*ANNEX DE LA SOL·LICITUD D’AJUTS BP 2017*

Aquest document només és vàlid per annexar-lo, **en format PDF**, al formulari de sol·licitud d’ajuts per a la incorporació de personal investigador postdoctoral al sistema de ciència i tecnologia català dins del programa Beatriu de Pinós (BP 2017).

*ANNEX TO APPLICATIONS FOR 2017 BP GRANTS*

This document is valid only when attached, **in PDF format**, to the application form for grants for incorporation of postdoctoral research staff into the Catalan science and research systems within the Beatriu de Pinós programme (BP 2017).

# Dades de la persona responsable de la sol·licitud / *Details of person responsible for the application*

**Nom / *Name:*** Francisco Javier Doblas Reyes

**Telèfon / *Telephone:*** 663495636

**Adreça electrònica / *Email:*** francisco.doblas-reyes@bsc.es

# Dades de la persona candidata / Details of the candidate

**Nom / *Name:*** Ivana Cvijanovic

**Telèfon / *Telephone:*** +1 510 290 3487

**Adreça electrònica / *Email:*** ivanacbegg@gmail.com

**ORCID:**      

**ResearcherID:**      

**Scopus Author ID:** 35344689700

**Google Scholar:** https://scholar.google.com/citations?user=MXF7WhQAAAAJ&hl=en

(En cas d’indicar qualsevol referència, cal tenir indexades totes les publicacions / *If any reference is indicated all publications must be indexed*)

**Altres pàgines web amb informació complementària / *Other web pages with complementary information*:**

**1.** **Currículum de la persona candidata / *Candidate’s curriculum vitae***

1.0 Indiqueu si des de l’obtenció del títol de doctor/a, heu complert algun dels supòsits d’interrupció de carrera previstos en la convocatòria. (2 línies màxim incloent supòsit i durada). / *Indicate whether any of the career break assumptions foreseen/contemplated in the call apply to the applicant since obtaining his/her doctoral qualification. (2 lines maximum including the assumption and duration / length).*

On maternity and caregiver’s leave from Sep 28 2016 till May 2018, except for the period from August 23 2017 to November 1st 2017.

1.1 Estudis i formació acadèmica / *Academic studies and training*

Academic:

05/2012 Ph.D. degree in Atmospheric Sciences

Niels Bohr Institute, University of Copenhagen

Copenhagen, Denmark

*Phd Dissertation* *Title*: Abrupt climate change and high to low

latitude teleconnections as simulated in climate models.

09/2008 M.Sc. in Applied Environmental Geosciences

Faculty of Geoscience, Eberhard-Karls University

Tuebingen, Germany

*M.Sc. Thesis* *Title*: The influence of shallow subsurface moisture and heat transport on the mass and energy balances at the land surface.

GPA: 1.2 (Excellent)

03/2006 Diploma in Physics, Meteorology and Environmental Modeling

Nature and Science Faculty, University of Novi Sad

Novi Sad, Serbia

GPA: 9.94 out of 10 (Excellent)

Training Courses (with ECTS points):

01/2009 Network for Ice and Climate Evolution (NICE) Winter School Course “Integrated Modelling of the past and future climate: the role of cryosphere” (5 ECTS)

06/2009 Alpine Summer School Course on Monsoon System (5 ECTS)

08/2009 University of Alaska Fairbanks Summer Fieldcourse on Arctic Ecosystems (7.5 ECTS)

07/2010 Advanced Climate Dynamics Course (ACDC) on “Ice-Ocean Interactions”(5 ECTS)

Fieldwork training:

07/2009 The North Greenland Eemian Ice Drilling (NEEM) Campaign: ice core processing (5 ECTS)

1.2 Experiència professional, incloses beques, ajuts i contractes de recerca postdoctorals (Copieu i enganxeu el format proposat tantes vegades com us sigui necessari) / *Professional experience, including postdoctoral grants, funding and research (copy and paste the proposed format as often as required)*

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| **Experiència professional** / ***Professional experience*** | |
| **Posició actual */ Current position*:** Postdoctoral Researcher | |
| **Centre / *Centre*:** Lawrence Livermore National Laboratory | |
| **Grup de recerca/departament / *Research group/department*:**  Atmospheric, Earth and Energy Division | |
| **Localitat / *Town/city*:** Livermore | **País / *Country*:** United States |
| **Durada (mesos) / *Duration (months):*** 20 (taking into account the absence due to maternity and caregiver’s leave) | **Dates d’inici i fi / *Start and end dates*:**  01/ 2015 - present |

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| **Experiència professional** / ***Professional experience*** | |
| **Posicions anteriors */ Previous positions*:** Postdoctoral Researcher | |
| **Centre / *Centre*:** Carenegie Institution for Science Stanford (in collaboration with University of Copenhagen, Denmark) | |
| **Grup de recerca/departament / *Research group/department*** Global Ecology | |
| **Localitat / *Town/city*:** Stanford | **País / *Country*:** United States |
| **Durada (mesos) / *Duration (months):*** 21 | **Dates d’inici i fi / *Start and end dates*:** 01/2013-08/2014 |

***Grants***

2016 Lawrence Livermore National Laboratory Exploratory Research Grant – LDRD 17-ERD-052 ($550.000 USD for fiscal year 2016/2017, PI: Ivana Cvijanovic)

(Comment: Shortly after the grant was awarded, the project’s PI, Ivana Cvijanovic, and her newborn son were hospitalized for several months. Due to this medical absence another PI was chosen as a replacement)

1.3 Experiència en recerca, incloent la participació en projectes de recerca, contractes i convenis. Indiqueu el càrrec o posició que ocupàveu, les tasques realitzades, la institució i la durada / *Research experience, including participation in research projects, contracts and agreements. Indicate office or position you held, the duties performed, the institution and duration.*

**Doctoral appointment – Niels Bohr Institute, University of Copenhagen, Denmark (09/2008-05/2012)**

During her doctoral appointment at the University of Copenhagen, the candidate investigated atmospheric teleconnections and abrupt atmospheric reorganizations behind the abrupt climate shifts inferred from the Greenland ice cores (Steffensen et al. 2008). The candidate studied the impacts of glacial and present day climate on low-to-high latitude atmospheric transport changes (Cvijanovic et al. 2010) and identified an atmospheric teleconnection linking Antarctic temperature shifts with Arctic wind and temperature changes (Cvijanovic et al. 2013).

During her stay abroad at the University of California, Berkeley, the candidate lead an investigation into the high- to low-latitude communication that resulted in a deeper understanding of the role of tropical sea surface temperature changes in conveying the signals of high-latitude cooling and inducing tropical precipitation shifts (Cvijanovic and Chiang 2013).

During the course of her PhD, Dr Cvijanovic also participated in an ice-core drilling campaign in northeast Greenland, getting hands on experience of ice-core research. This engagenment with ice-core science resulted in co-authorship in two highly cited studies (200+ citations): Dahl-Jensen et al. (2013), Nature and Rasmussen et al. (2014), Quaternary Science Reviews.

**Postdoctoral Researcher - Carnegie Institution for Science, Stanford (01/2013-08/2014)**

As a postdoctoral researcher at the Carnegie Institution for Science the candidate lead two studies aimed at investigating; i) the influence of global sea-ice changes on weather extremes; and ii) the climate impacts of ocean albedo geoengineering in the Arctic. For the purpose of these investigations, she designed and implemented several new modeling setups for the Community Earth System Model (CESM, Gent et al. 2011): a) a setup featuring active atmospheric and ocean components but prescribed sea-ice cover, b) a “zero ice” setup in which sea-ice formation is disabled, and c) an altered high latitude ocean albedo setup. These investigations resulted in several publications in high quality peer-reviewed journals (Cvijanovic and Caldeira (2015) Climate Dynamics, Caldeira and Cvijanovic (2014) Journal of Climate, and Cvijanovic et al. (2015) Environmental Research Letters).

In addition to the primary duties described above, the candidate also supervised a PhD student during their scientific visit to the Carnegie Instituion for Science. This resulted in another publication on regional impacts of Arctic sea ice loss (Pedersen et al. (2016), Journal of Climate).

Some of these publications received a substantial societal interest and were highlighted by the journal editors due to their potential for high scientific impact:

*Cvijanovic et al. (2015)* was Editor’s choice for the IOPselect collection and was reported on by The Independent, International Business Times, Daily Mail, Der Standard and several other major media outlets. According to altmetrics, this article is in the top 5% of all research outputs scored and in the 98th percentile compared to all existing articles of the same age (see <https://iop.altmetric.com/details/3949392> for more details).

*Pedersen et al. (2016)* was featured by Nature Climate Change as a research highlight.

**Postdoctoral Researcher - Lawrence Livermore National Laboratory (01/2015-09/2016)**

During her postdoctoral appointment at the Lawrence Livermore National Laboratory, the candidate has taken part in projects aimed at detection and attribution of climate change and quantification of current warming trends (Santer et al. (2017) Nature Geoscience, Santer et al. (2016) Journal of Climate, Santer et al. *submitted* and Cvijanovic et al. *in prep*). In parallel, she focused on understanding the drivers of California droughts and in particular, on Arctic sea-ice loss as a potential driver. For this purpose, the candidate employed a large ensemble of uncertainty quantification simulations and developed a new, state-of-the-art modeling framework for isolating the impacts of Arctic sea-ice loss that resulted in a highly visible\* study (Cvijanovic et al. (2017) Nature Communications). This study showed, for the first time, the pathway through which Arctic sea-ice changes can affect the climate of the western United States and indicated that Artcic sea-ice loss of the magnitude expected in the next few decades could lead to substantial decrease in California’s precipitation. The work performed in Cvijanovic et al. (2017) was the basis for a $550K funding grant by Lawrence Livermore National Laboratory awarded to the candidate.

During this time, Cvijanovic also contributed to other drought studies (Bonfils et al. 2017), co-organized and co-hosted series of climate and weather seminars and gave a number of science presentations aimed at a general audience (California Academy of Sciences, Lawrence Livermore National Laboratory).

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\*According to altmetrics, this article is in the 99th percentile compared to the all existing articles of the same age and has been reported on by a number of (100+) newspapers and media outlets including National Public Radio, New York Times, Washington Post, Los Angeles Times, San Francisco Chronicle, Guardian, NBC news, Voice of America. More details available at: <https://www.altmetric.com/details/30018421>.

1.4 Publicacions (Copieu i enganxeu el format proposat tantes vegades com us sigui necessari) */ Publications (copy and paste the proposed format as often as required)*

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| **Indicadors generals de recerca (cal especificar la base de dades (Web of Science, Scopus, etc..) utilitzada per calcular els valors / *General research indicators. You must specify the database (Web of Science, Scopus, etc.) used to calculate the values*** |
| **Base de dades / *Database*:** Scopus (and Google Scholar) |
| **Número total de cites / *Total number of citations*:** 618 (637) |
| **Número total d’articles / *Total number of articles*:** 15 |
| **Número total d’articles de Q1 / *Total number of Q1 articles*:** 15 |
| **Índex-h */ h-index:*** 7 (8) |

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| **Articles a revistes amb avaluació externa / *Journal articles with peer review*** | |
| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** **I Cvijanovic**, BD Santer, C Bonfils, DD Lucas, JCH Chiang, S Zimmerman | |
| **Títol / *Title*:** [Future loss of Arctic sea-ice cover could drive a substantial decrease in California’s rainfall](javascript:void(0)) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Nature communications 8 (1) | |
| **Any / *Year*:** 2017 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 12.124 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI): -** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Altmetric score 946, in the top 5% of all research outputs scored by Altmetric (https://www.altmetric.com/details/30018421)  Among the highest-scoring outputs from this source.  High Attention Score compared to outputs of the same age (99th percentile)  High Attention Score compared to outputs of the same age and source (99th percentile) | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** Benjamin D Santer, John C Fyfe, Giuliana Pallotta, Gregory M Flato, Gerald A Meehl, Matthew H England, Ed Hawkins, Michael E Mann, Jeffrey F Painter, Céline Bonfils, **Ivana Cvijanovic**, Carl Mears, Frank J Wentz, Stephen Po-Chedley, Qiang Fu, Cheng-Zhi Zou | |
| **Títol / *Title*:** [Causes of differences in model and satellite tropospheric warming rates](https://www.nature.com/articles/ngeo2973) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Nature Geoscience 10 478–485 | |
| **Any / *Year*:** 2017 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 13.941 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI): 2** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Altmetric score of 509: in the top 5% of all research outputs scored by Altmetric  Among the highest-scoring outputs from this source (#33 of 2,106)  High Attention Score compared to outputs of the same age (99th percentile)  High Attention Score compared to outputs of the same age and source (95th percentile)  Google Scoolar citations: 4 | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** Benjamin D Santer, Susan Solomon, Giuliana Pallotta, Carl Mears, Stephen Po-Chedley, Qiang Fu, Frank Wentz, Cheng-Zhi Zou, Jeffrey Painter, **Ivana Cvijanovic**, Céline Bonfils | |
| **Títol / *Title*:** [Comparing tropospheric warming in climate models and satellite data](http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-16-0333.1) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Journal of Climate 30, 373-392 | |
| **Any / *Year*:** 2017 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** **4.355** | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI): 7** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** Céline Bonfils, Gemma Anderson, Benjamin D Santer, Thomas J Phillips, Karl E Taylor, Matthias Cuntz, Mark D Zelinka, Kate Marvel, Benjamin I Cook, **Ivana Cvijanovic**, Paul J Durack | |
| **Títol / *Title*:** [Competing influences of anthropogenic warming, ENSO, and plant physiology on future terrestrial aridity](javascript:void(0)) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Journal of Climate  30, 6883-6904 | |
| **Any / *Year*:** 2017 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** **4.355** | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI): -** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** Rasmus A Pedersen, **Ivana Cvijanovic**, Peter L Langen, Bo M Vinther | |
| **Títol / *Title*:** [The impact of regional Arctic sea ice loss on atmospheric circulation and the NAO](http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-15-0315.1) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Journal of Climate 29, 889-902 | |
| **Any / *Year*:** 2016 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 4.161 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI):Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI):21** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Google Scoolar citations: 29  This article was Nature Communications highlight | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** **Ivana Cvijanovic**, Ken Caldeira | |
| **Títol / *Title*:** [Atmospheric impacts of sea ice decline in CO2 induced global warming](https://link.springer.com/article/10.1007/s00382-015-2489-1) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Climate Dynamics 44, 1173-1186 | |
| **Any / *Year*:** 2015 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 4.146 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI):Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI): 8** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Google Scoolar citations: 15 | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** **Ivana Cvijanovic**, Ken Caldeira, Douglas G MacMartin | |
| **Títol / *Title*:** [Impacts of ocean albedo alteration on Arctic sea ice restoration and Northern Hemisphere climate](javascript:void(0)) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Environmental Research Letters 10 (044020) | |
| **Any / *Year*:** 2015 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI):Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI):5** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Altmetric score 113: in the top 5% of all research outputs scored by Altmetric  High Attention Score compared to outputs of the same age (98th percentile)  High Attention Score compared to outputs of the same age and source (93rd percentile)  Google scholar citations: 9 | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** Ken Caldeira, **Ivana Cvijanovic** | |
| **Títol / *Title*:** [Estimating the contribution of sea ice response to climate sensitivity in a climate model](http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-14-00042.1) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Journal of Climate 27,  8597-8607 | |
| **Any / *Year*:** 2014 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 4.825 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI): 6** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** Sune O Rasmussen, Matthias Bigler, Simon P Blockley, Thomas Blunier, Susanne L Buchardt, Henrik B Clausen, **Ivana Cvijanovic**, Dorthe Dahl-Jensen, Sigfus J Johnsen, Hubertus Fischer, Vasileios Gkinis, Myriam Guillevic, Wim Z Hoek, J John Lowe, Joel B Pedro, Trevor Popp, Inger K Seierstad, Jørgen Peder Steffensen, Anders M Svensson, Paul Vallelonga, Bo M Vinther, Mike JC Walker, Joe J Wheatley, Mai Winstrup | |
| Títol / *Title*: A stratigraphic framework for abrupt climatic changes during the Last Glacial period based on three synchronized Greenland ice-core records: refining and extending the INTIMATE event stratigraphy | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Quaternary Science Reviews 106, 14-28 | |
| **Any / *Year*:** 2014 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 4.571 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI):Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI):** 254 |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Google Scoolar citations: 354 | |

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| **Autors/res / *Authors (in signing order)*:** **Ivana Cvijanovic**, Peter L Langen, Eigil Kaas, Peter D Ditlevsen | |
| **Títol / *Title*:** Southward intertropical convergence zone shifts and implications for an atmospheric bipolar seesaw | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start-end page)*:** Journal of Climate 26, 4121-4137 | |
| **Any / *Year*:** 2013 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 5.001 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI):12** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Google Scoolar citations: 17 | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** Dorthe Dahl-Jensen, MR Albert, Ala Aldahan, N Azuma, D Balslev-Clausen, Matthias Baumgartner, A-M Berggren, Matthias Bigler, Thomas Binder, Thomas Blunier, JC Bourgeois, EJ Brook, SL Buchardt, C Buizert, E Capron, J Chappellaz, J Chung, HB Clausen, **I Cvijanovic**, SM Davies, P Ditlevsen, Olivier Eicher, Hubertus Fischer, DA Fisher, LG Fleet, Gideon Gfeller, V Gkinis, S Gogineni, K Goto-Azuma, A Grinsted, H Gudlaugsdottir, M Guillevic, SB Hansen, Margareta Hansson, M Hirabayashi, S Hong, SD Hur, P Huybrechts, CS Hvidberg, Yoshinori Iizuka, T Jenk, SJ Johnsen, TR Jones, Jean Jouzel, NB Karlsson, K Kawamura, K Keegan, E Kettner, Sepp Kipfstuhl, HA Kjær, M Koutnik, T Kuramoto, Peter Köhler, Thomas Laepple, A Landais, PL Langen, LB Larsen, D Leuenberger et al. | |
| **Títol / *Title*:** [Eemian interglacial reconstructed from a Greenland folded ice core](https://www.nature.com/articles/nature11789) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Nature 493, 489-494 | |
| **Any / *Year*:** 2013 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 40.137 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI):** 243 |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Altmetric attention score 243: in the top 5% of all research outputs scored by Altmetric  High Attention Score compared to outputs of the same age (99th percentile)  High Attention Score compared to outputs of the same age and source (89th percentile) | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** **Ivana Cvijanovic**, John CH Chiang | |
| Títol / *Title*: Global energy budget changes to high latitude North Atlantic cooling and the tropical ITCZ response | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Climate dynamics 40, 1435-1452 | |
| **Any / *Year*:** 2013 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 4.146 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI): 30** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Google Scoolar citations: 45 | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** **Ivana Cvijanovic**, Peter Lang Langen, Eigil Kaas | |
| **Títol / *Title*:** Weakened atmospheric energy transport feedback in cold glacial climates | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start and end page)*:** Climate of the Past 7 (1061) | |
| **Any / *Year*:** 2011 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 2.664 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI): 5** |  |
| **Altres índexs de qualitat / *Other quality indices (state database and impact factor)*:** | |

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| **Autors/res (per ordre de signatura) / *Authors (in signing order)*:** Stefan J Kollet, **Ivana Cvijanovic**, Dirk Schüttemeyer, Reed M Maxwell, Arnold F Moene, Peter Bayer | |
| **Títol/*Title*:** [The influence of rain sensible heat and subsurface energy transport on the energy balance at the land surface](https://dl.sciencesocieties.org/publications/vzj/abstracts/8/4/846) | |
| **Revista (títol, volum, pàgina inicial- final) / *Journal (title, volume, start- end page)*:** Vadose zone journal 8, 846-857 | |
| **Any / *Year*:** 2009 | **Clau (A: article, R: review) / *Key* *(A: article, R: review)*:** A |
| **Índex d’impacte / *Impact factor* (SCI/SSCI/AHC):** 2.29 | **Quartil i àrea / *Quartile and area* (SCI/SSCI/AHCI): Q1** |
| **Número de cites / *Number of citations (*SCI/SSCI/AHCI):25** |  |
| **Altres índexs de qualitat (consignar base de dades i índex d’impacte) / *Other quality indices (state database and impact factor)*:** Google Scoolar citations: 36 | |

Consigneu els índexs d’impacte corresponents a l’any de publicació de l’article/ Include impact factors for the article’s year of publication

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| **Altres publicacions (Articles a revistes no indexades, informes tècnics, estudis de casos, traduccions, etc.) / *Other publications (Articles in non-indexed publications, technical reports, case studies, translations, etc.)*** | |
| **Autors/es (per ordre de signatura) / *Authors (in signing order)*:** Laura Herraiz Borreguero, Ruth Mottram, **Ivana Cvijanovic** | |
| **Títol / *Title*:** [Discussing Progress in Understanding Ice Sheet—Ocean Interactions](http://onlinelibrary.wiley.com/doi/10.1029/2010EO450006/full) | **Any / *Year*:** 2010 |
| **Pàgines (inicial-final) / *Pages (start-end)*:** 419-419 | |
| **Editorial / *Publishing house*:** Eos | |
| **Institució / *Institution*:** American Geophysical Union | |

1.5 Estades de mobilitat de curta durada en altres centres i universitats (Copieu i enganxeu el format proposat tantes vegades com us sigui necessari) / *Short-term mobility stays at other centres and universities (copy and paste the proposed format as often as required)*

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| **Estades de mobilitat */* *Mobility stays*** | |
| **Centre / *Centre*:** University of California Berkeley | |
| **Investigador responsable / *Responsible researcher*:** John Chiang | |
| **Grup de recerca/departament receptor / *Host research group/department*:** Department of Geography | |
| **Localitat / *Town/city* :** Berkeley, California | **País / *Country*:** United States |
| **Durada (mesos) / *Duration (months):*** 6+3 | **Dates d’inici i fi / *Start and end dates*:** 10/2010 - 04/2011 and 07/2011-10/2011 |
| **Tema / *Subject*:** exploring the mechanisms of high to low latitude atmospheric teleconnections | |

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| **Estades de mobilitat */* *Mobility stays*** | |
| **Centre / *Centre*:** Carnegie Institution for Science Stanford | |
| **Investigador responsable / *Responsible researcher*:** Ken Caldeira | |
| **Grup de recerca/departament receptor / *Host research group/department*:** Department of Global Ecology | |
| **Localitat / *Town/city* :** Stanford, California | **País / *Country*:** United States |
| **Durada (mesos) / *Duration (months):*** 2 | **Dates d’inici i fi / *Start and end dates*:** 11/2012 - 01/2013 |
| **Tema / *Subject*:** studying the impacts of sea ice loss on climate sensitivity and climate extremes | |

1.6 Ponències a congressos i conferències */ Papers at congresses and conferences*

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| **Congressos i conferències / Congresses and conferences** | |
| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic**, C. Bonfils, D. D. Lucas, B. D. Santer, and J. C. H. Chiang | |
| Títol / Title: Seasonally ice-free Arctic favors dry California | |
| **Tipus de contribució / Contribution type:** talk | |
| **Congrés / Congress:** American Meteorological Society 96th Annual Meeting 2016 | |
| **Publicació / Publication:** https://ams.confex.com/ams/96Annual/webprogram/Paper289700.html | |
| **Lloc celebració / Venue:** New Orleans | **Data / Date:** **11 January 2016** |
| **Organisme/institució organitzadora / Organising body/institution:** American Meteorological Society | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** Rasmus Anker Pedersen, **Ivana Cvijanovic**, Peter Lang Langen, Bo Vinther | |
| **Títol / Title:** [The impact of regional Arctic sea ice loss on atmospheric circulation and the NAO](https://scholar.google.com/scholar?oi=bibs&cluster=10231521054786387683&btnI=1&hl=en) | |
| **Tipus de contribució / Contribution type:** talk | |
| **Congrés / Congress:** European Gesoscience Union General Assembly 2016 | |
| **Publicació / Publication:** http://adsabs.harvard.edu/abs/2016EGUGA..18.7437A | |
| **Lloc celebració / Venue:** Vienna | **Data / Date:** April 2016 |
| **Organisme/institució organitzadora / Organising body/institution:** European Gesoscience Union | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic** | |
| **Títol / Title:** Impacts of ocean albedo alteration on Arctic sea ice restoration and Northern Hemisphere climate | |
| **Tipus de contribució / Contribution type:** talk (invited) | |
| **Congrés / Congress:** American Geophysical Union Fall Meeting 2015 | |
| **Publicació / Publication:** https://agu.confex.com/agu/fm15/webprogram/Paper83164.html | |
| **Lloc celebració / Venue:** San Francisco | **Data / Date:** 14 December 2015 |
| **Organisme/institució organitzadora / Organising body/institution:** American Geophysical Union | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic**, C. Bonfils, D. D. Lucas, B. D. Santer, and J. C. H. Chiang | |
| **Títol / Title** Can large scale sea ice cover changes affect precipitation patterns over California? | |
| **Tipus de contribució / Contribution type:** talk | |
| **Congrés / Congress:** American Geophysical Union Fall Meeting 2015 | |
| **Publicació / Publication:** https://agu.confex.com/agu/fm15/webprogram/Paper73827.html | |
| **Lloc celebració / Venue:** San Francisco | **Data / Date:** 17 December 2015 |
| **Organisme/institució organitzadora / Organising body/institution:** American Geophysical Union | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic,** Ken Caldeira | |
| Títol / Title: Impacts of ocean albedo alteration in the Arctic | |
| **Tipus de contribució / Contribution type:** poster | |
| **Congrés / Congress:** American Geophysical Union Fall Meeting 2014 | |
| **Publicació / Publication:** http://abstractsearch.agu.org/meetings/2014/FM/GC11A-0537.html | |
| **Lloc celebració / Venue:** San Francisco | **Data / Date:** December 2014 |
| **Organisme/institució organitzadora / Organising body/institution:** American Geophysical Union | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** Ken Caldeira**, Ivana Cvijanovic** | |
| Títol / Title: Sea Ice Radiative Forcing, Sea Ice Area, and Climate Sensitivity | |
| **Tipus de contribució / Contribution type:** poster | |
| **Congrés / Congress:** American Geophysical Union Fall Meeting 2014 | |
| **Publicació / Publication:** http://abstractsearch.agu.org/meetings/2014/FM/A21H-3127.html | |
| **Lloc celebració / Venue:** San Francisco | **Data / Date:** December 2014 |
| **Organisme/institució organitzadora / Organising body/institution:** American Geophysical Union | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic,** Ken Caldeira | |
| Títol / Title: Atmospheric impacts of changing sea ice cover in CO2 induced global warming | |
| **Tipus de contribució / Contribution type:** talk | |
| **Congrés / Congress:** American Geophysical Union Fall Meeting 2013 | |
| **Publicació / Publication:** http://abstractsearch.agu.org/meetings/2013/FM/A44C-08.html | |
| **Lloc celebració / Venue:** San Francisco | **Data / Date:** December 2013 |
| **Organisme/institució organitzadora / Organising body/institution:** American Geophysical Union | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic,** Ken Caldeira | |
| *Títol / Title:* The effects of changing sea ice cover on global warming and climate consequences of sea ice geoengineering | |
| **Tipus de contribució / Contribution type:** talk | |
| **Congrés / Congress:** Blue Arctic White Arctic | |
| **Publicació / Publication:** - | |
| **Lloc celebració / Venue:** New York | **Data / Date:** April 2013 |
| **Organisme/institució organitzadora / Organising body/institution:** Columbia Climate Center, Columbia University | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order): Ivana Cvijanovic,** John CH Chiang | |
| **Títol / Title:** Global energy budget changes to high latitude North Atlantic cooling and the role of tropical SSTs | |
| **Tipus de contribució / Contribution type:** talk | |
| **Congrés / Congress:** INTIMATE WG3 workshop - The last deglaciation: towards model-data integration | |
| **Publicació / Publication:** - | |
| **Lloc celebració / Venue:** Copenhagen | Data / Date: 2012 |
| **Organisme/institució organitzadora / Organising body/institution:** INTIMATE Consortium and University of Copenhagen | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic**, John CH Chiang, Peter Langen, Eigil Kaas | |
| **Títol / Title:** [Global energy budget changes and the role of tropical SSTs in the southward ITCZ shifts](http://adsabs.harvard.edu/abs/2012EGUGA..1412610C) | |
| **Tipus de contribució / Contribution type:** poster | |
| **Congrés / Congress:** European Gesoscience Union General Assembly 2012 | |
| **Publicació / Publication:** http://adsabs.harvard.edu/abs/2012EGUGA..1412610C | |
| **Lloc celebració / Venue:** Vienna | **Data / Date:** April 2012 |
| **Organisme/institució organitzadora / Organising body/institution:** European Gesoscience Union | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic,** Peter Lang Langen, Eigil Kaas | |
| **Títol / Title:** Weakened atmospheric heat transport sensitivity in cold glacial climates | |
| **Tipus de contribució / Contribution type:** poster | |
| **Congrés / Congress:** Berkeley Atmospheric Science Center Symposium | |
| **Publicació / Publication:** - | |
| **Lloc celebració / Venue:** Berkeley | **Data / Date:** February 2011 |
| **Organisme/institució organitzadora / Organising body/institution:** University of California, Berkeley | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic,** John CH Chiang | |
| **Títol / Title:** Global energy flux changes to high latitude North Atlantic cooling and the tropical ITCZ response. | |
| **Tipus de contribució / Contribution type:** talk | |
| **Congrés / Congress:** American Geophysical Union Fall Meeting 2011 | |
| **Publicació / Publication:** http://abstractsearch.agu.org/meetings/2011/FM/PP14A-08.html | |
| **Lloc celebració / Venue:** San Francisco | **Data / Date:** December 2011 |
| **Organisme/institució organitzadora / Organising body/institution:** American Geophysical Union | |

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| **Autors/es (per ordre de signatura)/Authors (in signing order):** **Ivana Cvijanovic,** Peter Langen, Eigil Kaas, Peter Wang | |
| Títol / Title: Weakened atmospheric heat transport sensitivity in cold glacial climates | |
| **Tipus de contribució / Contribution type:** poster | |
| **Congrés / Congress:** American Geophysical Union Fall Meeting 2010 | |
| **Publicació / Publication:** http://abstractsearch.agu.org/meetings/2010/FM/A33A-0145.html | |
| **Lloc celebració / Venue:** San Francisco | **Data / Date:** December 2010 |
| **Organisme/institució organitzadora / Organising body/institution:** American Geophysical Union | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic**, Peter Langen, Eigil Kaas | |
| **Títol / Title:** Investigating the nonlinear atmospheric responses to hemispherically asymmetric surface temperature and Q-flux perturbations (is the oceanic tail wagging the meteorological dog?) | |
| **Tipus de contribució / Contribution type:** student talk | |
| **Congrés / Congress:** Advanced Climate Dynamics Course 2010 | |
| **Publicació / Publication:** - | |
| **Lloc celebració / Venue:** Lyngen, Norway | **Data / Date:** July 2010 |
| **Organisme/institució organitzadora / Organising body/institution:** MIT/Bjerknes Centre | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic**, Tim Brücher, Eigil Kaas, Peter Langen, Peter Wang | |
| **Títol / Title:** [Nonlinear atmospheric responses to hemispherically asymmetric surface temperature perturbations](http://adsabs.harvard.edu/abs/2010EGUGA..12.2792C) | |
| **Tipus de contribució / Contribution type:** poster | |
| **Congrés / Congress:** European Gesoscience Union General Assembly 2010 | |
| **Publicació / Publication:** http://adsabs.harvard.edu/abs/2010EGUGA..12.2792C | |
| **Lloc celebració / Venue:** Vienna | **Data / Date:** April 2010 |
| **Organisme/institució organitzadora / Organising body/institution:** European Gesoscience Union | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic**, Eigil Kaas, Peter Langen | |
| **Títol / Title:** AGCM simulations of the abrupt climate warming during the last glacial: Towards the possibility of the tropical tipping point | |
| **Tipus de contribució / Contribution type:** student talk | |
| **Congrés / Congress:** Alpine summer school on Monsoon Systems 2009 | |
| **Publicació / Publication:** - | |
| **Lloc celebració / Venue:** Valsevarenche, Italy | **Data / Date:** June 2009 |
| **Organisme/institució organitzadora / Organising body/institution:** Institute of Atmospheric Sciences and Climate (ISAC)/the Laboratoire de Météorologie Dynamique, École Normale Supérieure | |

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| **Autors/es (per ordre de signatura) / Authors (in signing order):** **Ivana Cvijanovic**, Stefan Kollet, Peter Bayer | |
| **Títol / Title:** The influence of shallow subsurface moisture and heat transport on the mass and energy balances at the land surface | |
| **Tipus de contribució / Contribution type:** talk | |
| **Congrés / Congress:** European Meteorological Society 8th Annual Meeting 2008 | |
| **Publicació / Publication:** https://meetings.copernicus.org/ems2008/crawl/abstracts/EMS2008/00381/EMS2008-A-00381.pdf | |
| **Lloc celebració / Venue:** Amsterdam | **Data / Date:** September 2008 |
| **Organisme/institució organitzadora / Organising body/institution:** European Meteorological Society | |

1.7 Experiència en projectes de col·laboració amb empreses i en transferència de tecnologia / *Experience in partnership projects with companies and in technology transfer*

1.8 Altres mèrits acadèmics i/o científics rellevants, incloent premis d’investigació, reconeixements, ensenyaments impartits, supervisió d’estudiants, activitats divulgatives, informes, desenvolupament de hardware i software, etc. */* *Other relevant academic and/or scientific merits, including research prizes, acknowledgements, teaching given, student supervision, dissemination activities, reports, hardware/software development, etc.*

**Prizes and acknowledgments:**

Lawrence Livermore National Laboratory SPOT Award for outreach efforts (2016)

Nature Communication research highlight for Pedersen et al. (2016)\*

IoPselect paper and Environmental Research Web highlight for Cvijanovic et al. (2015)\*\*

European Meteorological Society Young Scientist Award (2008)

German Academic Exchange Service (DAAD) scholarship award (2006-2008)

University of Novi Sad Excellence Awards: (2002-2005)

Kingdom of Norway Award for one of the 500 best students in Serbia (2005)

Nature and Science Universities of Serbia Annual Competitions: 3rd (2005) and 2nd (2004) places in physics

**Student supervision:**

PhD project co-supervision: University of Copenhagen/Carnegie Institution for Science 2014-2015.

BSc student co-supervision: University of Copenhagen, 2013.

**Teaching:**

Teaching assistant for Geophysics 3, University of Copenhagen, 09-12/2008.

Teaching assistant for Numerical methods, University of Copenhagen, 01-04/2009.

**Teaching (curriculum development):**

Development of a lesson plan on climate change and sustainable living for elementary school level English-as-a-foreign-language classes (in collaboration with J. Rakovic, Aarhus University, Denmark)

**Development of specialized configurations for Community Earth System Model:**

- aquaplanet setup (Cvijanovic et al. (2013), Journal of Climate)

- ‘hybrid’ data ocean/slab ocean configuration (e.g., tropical data ocean with extratropical slab ocean,

Cvijanovic et al. (2013), Climate Dynamics)

- prescribed and zero sea-ice setups (Caldeira and Cvijanovic (2014), Journal of Climate; Cvijanovic and

Caldeira (2015) Climate Dynamics; Pedersen et al. (2016) Journal of Climate)

- altered ocean albedo setup (Cvijanovic et al. (2015), Environmental Research Letters)

- perturbed sea-ice physics parameter simulations (Cvijanovic et al. (2017), Nature Communications)

**Reports:**

California Climate Change Assessment report 2018 – contributing author

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\* <https://doi.org/10.1175/JCLI-D-15-0315.1>

\*\* http://iopscience.iop.org/article/10.1088/1748-9326/10/4/044020/meta

**Reviewer:**

Journal of Climate (since 2011), Climate Dynamics (since 2011), Environmental Research Letters (since 2013), Geophysical Research Letters (since 2014), Nature Publishing Group (since 2014), AGU Journals of Geophysical Research (since 2015).

**Public Outreach:**

Climate and Weather Seminar Series organizer: Lawrence Livermore National Laboratory 01/2015-10/2016

California Academy of Sciences, Dark and Stormy Nightlife Event: presentations on the topic of California’s drought, San Francisco, 2016

Lawrence Livermore National Laboratory, Kids2work Day 2016: science presentations and experiments

Climate Central: commentaries regarding the links between Arctic warming/sea-ice loss and midlatitude weather pattern changes

Serbian newspapers “Dnevnik” and “Vojvodjanski Magazin”: interviews and commentaries on the topic of past climate change

University of Copenhagen, Culture Night Event 2009: public lectures on climate and ice core research

**Media and Editorial Highlights:**

Work reported by 100+ top newspapers, journals, radio and television stations, a brief selection is provided below. The candidate was a first author/co-author on several studies with very high attention score (>98th percential), according to Altmetrics.

*The Washington Post*

<https://www.washingtonpost.com/news/capital-weather-gang/wp/2017/12/06/thanks-to-climate-change-the-weather-pattern-burning-up-california-and-freezing-the-east-may-thrive/?utm_term=.091949cc2a8e>

*The New York Times*

<https://www.nytimes.com/2017/12/07/climate/california-fires-warming.html?_r=0>

*Los Angeles Times*

<http://beta.latimes.com/politics/la-na-pol-climate-california-20171205-htmlstory.html>

*San Francisco Chronicle*

<http://www.sfchronicle.com/bayarea/article/Arctic-ice-loss-could-spell-more-drought-for-12405285.php#photo-12686982>

*The Guardian*

<https://www.theguardian.com/environment/climate-consensus-97-per-cent/2017/dec/11/californias-hellish-fires-a-visit-from-the-ghost-of-christmas-future>

*National Public Radio (NPR)*

<https://www.npr.org/sections/thetwo-way/2017/12/12/570119468/arctics-temperature-continues-to-run-hot-latest-report-card-shows?ft=nprml&f>=

*Daily Californian*

<http://www.dailycal.org/2017/12/11/researchers-say-melting-arctic-sea-ice-may-exacerbate-future-california-droughts/>

*The Verge*

<https://www.theverge.com/2017/12/6/16742496/california-la-ventura-thomas-rye-creek-fires-drought-water-climate>

*Zeit Online*

<http://www.zeit.de/wissen/umwelt/2017-12/kalifornien-waldbraende-los-angeles-klimawandel>

*Environmental Research Web*

<http://environmentalresearchweb.org/cws/article/news/61045>

*MIT Review*

[*https://www.technologyreview.com/s/609974/how-nuclear-weapons-research-revealed-new-climate-threats/*](https://www.technologyreview.com/s/609974/how-nuclear-weapons-research-revealed-new-climate-threats/)

*NBC News*

[*https://www.nbcnews.com/news/us-news/disappearing-arctic-ice-could-make-california-droughts-worse-n826461*](https://www.nbcnews.com/news/us-news/disappearing-arctic-ice-could-make-california-droughts-worse-n826461)

*The Independent*

<http://www.independent.co.uk/news/science/artificially-manipulating-arctic-climate-by-whitening-surface-of-ocean-to-reflect-sunlight-back-into-10210896.html>

*The Guardian*

<https://www.theguardian.com/environment/climate-consensus-97-per-cent/2015/dec/21/the-best-of-climate-science-and-humanity-come-together-at-agu>

*New York Post*

[*https://nypost.com/2017/12/06/california-droughts-could-get-worse-from-melting-arctic-ice/*](https://nypost.com/2017/12/06/california-droughts-could-get-worse-from-melting-arctic-ice/)

*Der Standard*

<http://derstandard.at/2000015059031/Forscher-gegen-die-Idee-die-Arktis-weiss-zu-faerben>

*Cienciaplus*

<http://www.europapress.es/ciencia/habitat-y-clima/noticia-tenir-blanco-artico-puede-ayudar-hielo-no-clima-20150429104251.html>

*La Repubblica*

<http://www.repubblica.it/ambiente/2015/05/03/news/artico_imbiancare-113438645/?ref=search>

*Spektrum.de*

<http://www.spektrum.de/news/kalifornien-brennt-eine-katastrophe-von-menschenhand/1528513>

*Il Sole 24 Ore*

<http://nova.ilsole24ore.com/progetti/limportanza-degli-estremi-in-un-mondo-surriscaldato/>

*Al Jazeera*

<http://www.aljazeera.com/news/2017/12/california-wildfires-stay-171208080521885.html>

**2. Entitat i grup de recerca receptor (màxim 8 fulls) / *Host research group and entity (maximum 8 sheets)***

2.1 Breu descripció del grup de recerca receptor i del seu impacte científic internacional incloent les principals publicacions i els projectes de recerca finançats en els darrers cinc anys / *Brief description of the host research group and its scientific/academic impact, including main publications and research projects funded in the last five years*

The Barcelona Supercomputing Center (BSC) is the national supercomputing facility of Spain. It hosts the MareNostrum, one of the most powerful supercomputers in Europe and its mission is to develop and manage information technology in order to facilitate scientific and technological progress. BSC has more than 500 researchers and students, from more than 40 different countries and is recognised as a first-class research centre in supercomputing and in scientific fields that demand it, such as life and earth sciences. This multi-disciplinary approach, with world-leading researchers, HPC experts and state-of-the-art HPC resources makes BSC a unique research institution.

The BSC is one of eight Spanish research centers recognized as Severo Ochoa Centre of Excellence by the Minesterio de Ciencia e Inovacion (MICINN). BSC holds a twofold identity as it is at the same time an excellence research center and serves as the national supercomputing facility offering supercomputational services to several entities across Spain and Europe. BSC strives to be a first-class research centre in supercomputing and in scientific fields that demand high performance computing resources. Following this approach, BSC has brought together a critical mass of first-rate researchers, high performance computing experts and cutting-edge supercomputing technologies in order to foster multidisciplinary scientific collaborations and innovations.

Within the BSC, the Earth Sciences (ES) department, in which the candidate will conduct her research, conducts multi-faceted research in Earth system modelling. Established in 2006, the initial core activity was focused on atmospheric composition modelling. The nomination of Prof. Francisco J. Doblas-Reyes as director of the ES-BSC in 2014 initiated the merging of the ES-BSC with the Climate Forecast Unit of the Institut Català de Ciències del Clima (IC3-CFU), which he had been leading since 2009 and which had become a main European actor in the development of climate predictions and climate services. ES department activities include research on atmospheric emissions, air quality, mineral dust transport, computational efficiency of air quality and climate codes, data storage, analysis and dissemination, and global and regional climate modelling and prediction.

The BSC-ES is composed of four distinct but highly integrated groups:

**Computational Earth Sciences (CES)** group is a multidisciplinary team with different profiles that interacts closely with all the other groups at the BSC. The group provides expertise and guidance to the other scientists on technical issues and coordinates the high performance computing applications to Earth System Models.

**Climate Prediction (CP)** group undertakes advanced research to forecast climate variations from one month to several years into the future, with special emphasis on high-impact climate events such as the persistent winds, floods, droughts and temperature extremes.

**Earth System Services (ESS)** group aims to bridge the gap between climate information and end users in key sectors of society (energy, urban development, infrastructure, transport, health and agriculture).

**Atmospheric Composition (AC)** group investigates the spatiotemporal variations of atmospheric pollutants and their effects upon air quality, weather and climate. The group develops and maintains the Multiscale Online Non-hydrostatic AtmospheRe CHemistry model (MONARCH), whose dust component is running operationally at the first WMO Regional Specialized Meteorological Center for Atmospheric Sand and Dust Forecast.

The ES department has more than 70 employees, including technical and support staff. It is a highly productive scientific entity that has published more than 160 research articles in peer-reviewed journals over the last 5 years, including 6 in prestigious high-impact journals. It also has a very dense international collaborative network counting at least 50 institutes worldwide. During the same period, the ES department was granted 9 EU H2020 projects, 5 EU FP7 projects, 5 EU Copernicus projects, 10 projects funded by the Ministerio de Economía y Competitividad (now MICINN), 4 projects funded by the European Space Agency, and participated in a project funded by the French Ministry of Sciences and another by the Flanders Research Foundation. To meet his computing need, the department has also  obtained additional computing hours through 21 Red Española de Supercomputación (RES) and 4 Partnership for Advanced Computing in Europe (PRACE) projects. Finally, the department hosts a new AXA Chair on Sand and Dust Storms. This is an ambitious, comprehensive and long-term programme that combines fundamental research, operational forecasting and impact research, with the much needed development of user oriented products, services and capabilities.

**Selected list of publications from the Earth Sciences Department (in the last 5 years):**

1. Thornalley D., D. Oppo, P. Ortega, J. Robson, C. Brierley, R. Davis, I. Hall, L. Keigwin, P. Moffa- Sanchez, N. Rose, P. Spooner and I. Yashayaev “Anomalously weak Labrador Sea convection and Atlantic overturning during the past 150 years", **Nature** (Accepted).
2. Caron, L.-P., L. Hermanson, A. Dobbin, J. Imbers, L. Lledó and G.A. Vecchi (2017). How skilful are the multi-annual forecasts of Atlantic hurricane activity? **Bulletin of the American Meteorological Society** (Published Online), doi:10.1175/BAMS-D-17-0025.1.
3. Massonnet, F., O. Bellprat, V. Guemas and F. J. Doblas-Reyes (2016). Using climate models to estimate the quality of global observational data sets. **Science**, 6311, 452-455, doi: 10.1126/science.aaf6369 (7 citations in Scopus; Q1, Multidisciplinary sciences)
4. Bellprat, O. and F.J. Doblas-Reyes (2016). Attribution of extreme weather and climate events overestimated by unreliable climate simulations. **Geophysical Research Letters**, 43, 2158-2164, doi: 10.1002/2015GL067189 (14 citations in Scopus; Q1, Geosciences)
5. Jung, T., N.D. Gordon, P. Bauer, D.H. Bromwich, M. Chevallier, J.J. Day, J. Dawson, F.J. Doblas-Reyes, C. Fairall, H.F. Goessling, M. Holland, J. Inoue, T. Iversen, S. Klebe, P. Lemke, M. Losch, A. Makshtas, B. Mills, P. Nurmi, D. Perovich, P. Reid, I.A. Renfrew, G. Smith, G. Svensson, M. Tolstykh and Q. Yang (2016). Advancing polar prediction capabilities on daily to seasonal time scales. **Bulletin of the American Meteorological Society**, 97, 1631-1647, doi: 10.1175/BAMS-D-14-00246.1 (15 citations in Scopus; Q1, Meteorology and atmospheric sciences)
6. Caron, L.-P., L. Hermanson and F.J. Doblas-Reyes (2015). Multi-annual forecasts of Atlantic U.S. tropical cyclone wind damage potential. **Geophysical Research Letters**, 42, 2417-2425, doi: 10.1002/2015GL063303 (6 citations in Scopus; Q1, Geosciences)
7. Doblas-Reyes, F.J., J. García‐Serrano, F. Lienert, A. Pintó Biescas and L.R.L. Rodrigues (2013). Seasonal climate predictability and forecasting: status and prospects. **WIREs Climate Change**, 4, 245-268, doi: 10.1002/wcc.217 (81 citations in Scopus; Q1, Meteorology and atmospheric sciences)
8. Guemas, V., F.J. Doblas-Reyes, I. Andreu-Burillo and M. Asif (2013). Retrospective prediction of the global warming slowdown in the past decade. **Nature Climate Change**, 3, 649-653, doi: 10.1038/nclimate1863 (104 citations in Scopus; Q1, Meteorology and atmospheric sciences)
9. Doblas-Reyes, F.J., I. Andreu-Burillo, Y. Chikamoto, J. García-Serrano, V. Guemas, M. Kimoto, T. Mochizuki, L.R.L. Rodrigues and G.J. van Oldenborgh (2013). Initialized near-term regional climate change prediction. **Nature Communications**, 4, 1715, doi: 10.1038/ncomms2704 (102 citations in Scopus; Q1, Multidisciplinary sciences)
10. Kirtman, B., S. Power, J.A. Adedoyin, G.J. Boer, R. Bojariu, I. Camilloni, F.J. Doblas-Reyes, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schär, R. Sutton, G.J. van Oldenborgh, G. Vecchi and H.J. Wang (2013). Near-term climate change: Projections and predictability. Climate Change 2013: The Physical Science Basis. **Contribution of Working Group I to the Fifth Assessment Report of the IPCC**, edited by Stocker, T.F., et al., Cambridge University Press, Cambridge, United Kingdom and New York, USA, 953-1028.

**Selected list of research projects from the ES Department  (in the last 5 years):**

1. **IS-ENES2** (Infrastructure for the European Network of Earth System Modelling) is an EU FP7 project (start date: 04/2013; duration 3 months; funding: 7,999,941€) supported by 23 European partners. IS-ENES2 is the second phase project of the distributed e-infrastructure of models, model data and metadata of the European Network for Earth System Modelling.
2. **ESiWACE** (Centre of Excellence in Simulation of Weather and Climate in Europe) is an EU H2020 project (start date: 09/2015; duration 21 months; funding: 4,951,048€) supported by 16 European partners. ESiWACE is aimed to substantially improve efficiency and productivity of numerical weather and climate simulation on HPC platforms by supporting the end-to-end workflow of global Earth system modelling in HPC environment.
3. **QA4Seas** (Quality Assurance for Multi-model Seasonal Forecast Products) is a Copernicus Climate Change Service project (start date: 07/2016; duration 15 months; funding: 1.681.759€). It aims at developing a strategy for the evaluation and quality control of the multi-model seasonal forecasts provided by the Copernicus Climate Change Service to respond to the needs identified among a wide range of stakeholders. The BSC coordinates this project.
4. **SPECS** (Seasonal-to-decadal climate Prediction for the improvement of European Climate Services) is an EU FP7 project (start date: 11/2012; duration 39 months; funding: 11.766.236€) supported by 19 European institutions and a Brazilian institution and is coordinated by BSC-ES. The main scientific objective of SPECS was to deliver a new generation of European climate forecast systems and efficient regionalisation tools. The project was coordinated by IC3 and Francisco Doblas-Reyes, the applicant’s designated supervisor and the PI on this fellowship application.
5. **PRIMAVERA** (Process-based climate siMulation: AdVances in high resolution modelling and European climate Risk Assessment) is an EU H2020 project (start date: 11/2015; duration 48 months; funding: 14.967.969€). The goal of PRIMAVERA is to deliver novel, advanced and well-evaluated high-resolution global climate models capable of simulating and predicting regional climate with unprecedented fidelity, out to 2050.
6. **IMPREX** (Improving Predictions and management of hydrological EXtremes) is an EU H2020 project (start date: 10/2015; duration 36 months; funding: 7.996.848€) with 23 research centers across Europe, whose main objective is to improve forecast skill of meteorological and hydrological extremes in Europe and their impacts by applying dynamic model ensembles, process studies, new data assimilation techniques and high resolution modelling.
7. **PREFACE** (enhancing PREdiction oF tropical Atlantic ClimatE and its impacts) was an EU FP7 project (start date: 11/2013; duration 4 years; funding: 12.170.344€) which  involved 28 institutional partners across 18 countries in Europe and Africa and aimed to reduce uncertainties in our knowledge of the dynamics of Tropical Atlantic climate.
8. **APPLICATE** (Advanced Prediction in Polar regions and beyond: Modelling, observing system design and LInkages associated with a Changing Arctic climaTE) is an EU H2020 project (start date: 11/2016; duration 34 months; funding: 8.715.066€). Its main objective is to improve the understanding of processes involved in polar climate variability and teleconnections with the mid-latitudes.
9. **EUCP** (European Climate Prediction system) is an EU H2020 project (start date: 12/2017; duration 48 months; funding 12.999.515€ ) whose main goal is to develop an innovative European regional ensemble climate prediction system based on a new generation of improved and typically higher-resolution climate models.
10. **INTAROS** (Integrated Arctic observation system) is an EU H2020 project (start date: 11/2016, duration 48 months, funding 15.490.141€). Its main objective is to gather an integrated network of new observational data from the Arctic, to assess the added-value of these novel observations in a wide range of applications, including polar climate forecasting.

2.2 Infraestructures i instal·lacions de les que es disposarà per desenvolupar les activitats de recerca previstes / *Installations and facilities to be made available for the carrying out of the planned research activities*

The BSC (www.bsc.es) serves as the National Supercomputing Facility in Spain. The BSC-CNS has hosted outstanding high performance computing facilities since its inception in 2006. All the computational resources that the center has are going to be available to the candidate to carry out the research plan. The available supercomputing facilities are essential to fulfill the demanding high-performance computing requirements of the proposed research. Currently, BSC has the following supercomputing infrastructures:

* MareNostrum: currently, the BSC is housing the fourth version of this supercomputer. MareNostrum IV is among the fastest supercomputers in the world, composed of 165,888 processors, and 13.7 Petaflops of peak performance, has 14 Petabytes of disk storageand is connected to the Big Data infrastructures of BSC, which have a total capacity of 24.6 Petabytes. Like its predecessors, MareNostrum4 will also be connected to the network of European research centres and universities through the RedIris and Geant networks.
* The Nord III cluster (current Peak Performance of 28 Gigaflops, 1,344 number of processors and 10.5 TB of main memory), which hosts and maintains the previous versions of the Eearth System Model EC-Earth (still used for many studies within the ES department due to their cheap computational cost).
* A Big Data storage infrastructure, which has a total capacity of 24.6 Petabytes.

Furthermore, BSC is one of the six hosting members of the Partnership for Advanced Computing in Europe (PRACE) supercomputing network. PRACE provides competitive computing time on world-class supercomputers to researchers in the 25 European member countries. It is also an active participant in HiPEAC, the ETP4HPC and other international forums such as BDEC. The center develops technologies for Exascale within the BSC-led Mont-Blanc project, DEEP and DEEP-ER projects and the Human Brain Flagship project. BSC has established joint research centers on Exascale with Intel and IBM.

BSC is located on a campus of the Technical University of Catalonia (Universitat Politècnica de Catalunya - UPC) and has an agreement with the UPC to use university facilities and services. Furthermore, many of the group leaders at BSC are also university professors with broad knowledge and experience in advance research and teaching, i.e., the BSC substantially contributes to and benefits from UPC’s higher educational environment.

BSC collaborates with industry, and has projects with companies such as ARM, Bull and Airbus as well as numerous SMEs. BSC has joint research centers with Microsoft, NVIDIA and Repsol. The center has participated in 80+ European Commision research projects.

2.3 Mitjans previstos per a la incorporació, coordinació i seguiment de la persona candidata / *Planned resources for the incorporation, coordination and oversight of candidate*

The Project Management Office at BSC will support the fellowship with regard to financial and administrative matters and will ensure that the grant agreement follows the Beatriu de Pinós 2017 contractual rules and the Spanish fiscal and social security laws. The researcher will also have access to support by BSC’s Technology Transfer Manager (orientation/help with science exploitation, development of contracts, agreements, and seeking new opportunities), Communications Team (support with outreach activities, organization of events and press releases), Legal Assessment (BSC has an agreement with an external office that gives advice on legal issues), and Education and Training (BSC has a dedicated unit and is committed to provide researchers with high-quality training in scientific, technical, and other skills). The candidate will be employed as a full-time researcher with a standard 2-year contract in full accordance with the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers. This will provide the salary and all other benefits made available by the Beatriu del Pinós Fellowship, in conformity with the H2020 framework program. It will also cover full access to the Spanish Social Security system, including comprehensive health care and pension provisions. Secretarial staff at the host institute will provide local support for financial administration and logistical organization.

The candidate will work under supervision of Dr Francisco Doblas-Reyes (ES department director) and Dr Pablo Ortega (co-leader of the Climate Prediction group), who will provide an individual career plan, which draws upon the experience of the BSC and the needs of the candidate. The scientific objectives will be monitored and updated regularly in meetings with the supervisors, by discussing research progress and identifying potential difficulties and ways of overcoming them. The candidate will benefit from the highly collaborative environment in the department, which stimulates the regular interactions among the different researchers, both in terms of their scientific and technical tasks. In particular, matters relevant to the entire ES department are coordinated and discussed monthly at departmental meetings, specific issues of the individual groups are discussed in monthly group meetings, and scientific seminars are organised every other week. Particular research activities of great relevance to the project, such as seasonal/decadal prediction, ocean and atmospheric dynamics, and sea-ice interactions will be discussed on a monthly basis.

2.4. Activitats per a la formació, especialització i desenvolupament de la carrera investigadora de les persones candidates. Capacitat de l’investigador o investigadora responsable de l’ajut de proporcionar formació i seguiment a la persona candidata per tal de facilitar la seva integració laboral posterior / *Activities for candidates’ training, specialisation and research career development. Capacity of the responsable researcher to provide training and oversight of the candidate in order to facilitate the candidate's subsequent joining of the labour force.*

**Training and career development**

The BSC has a significant record in participation and coordination of training activities with a dedicated unit of “education and training” that is in charge of organization of specialized training sessions. The BSC is also the main beneficiary of Marie Skoldowska-Curie Action COFUND program for postdoctoral fellows, which foresees the implementation of a number of training programs (STARS; H2020-MSCA-COFUND-754433). Thanks to the national excellence grant of Severo Ochoa, regular seminars will be offered to the fellow. Additional training sessions and courses will be available to the candidate through the projects the BSC is involved, including: Red Española de Supercomputación RES (RES training sessions), NVIDIA CUDA/GPU excellence center (Programing and Tuning Massively Parallel Systems (PUMPS) summer school), Partnership for Advanced Computing in Europe (PRACE) (PRACE Advanced Training Center), etc.

After accumulating more than 4 years of postdoctoral experience in the US, the candidate is ready to transition towards being an independent researcher. The Beatriu del Pinós Fellowship will provide the perfect conditions to achieve this goal, allowing the candidate to take a lead in a research project under the supervision of a highly active and respected research group. The coordination and oversight of the candidate progress described in Section 2.3, will ensure that the candidate will develop and/or reinforce the necessary skills (e.g. scientific, organizational and managerial) to succeed as an independent investigator. The development plan will also include opportunities for participation in additional workshops covering topics such as intellectual property and ethical issues, proposal writing, and advanced programming techniques. Likewise, the candidate will have the opportunity to present her work at relevant international events, and to participate in the weekly group meetings, where progress of the group research projects is evaluated and new research lines and opportunities are defined.

**Capacity of the responsible researcher**

Prof. Doblas-Reyes has experience managing research groups of more than 25 people since 2009, and has been able to provide researchers under his supervision with exceptional training support and conditions for their scientific growth, steering improvements in their scientific and management skills alike. He has mentored at least 15 postdocs and Ph.D students since 2009. Former postdocs and Ph.D. students hosted at the department hold positions in several well-known scientific institutions and energy companies around the globe, such as the School of Geography and Environment at the University of Oxford in UK (Dr Karsten Haustein) and EnBW Energie Baden-Württemberg AG in Germany (Dr Matthias Piot).

Prof. Doblas-Reyes is an expert in the development of seasonal-to-decadal climate prediction systems – a field that is highly relevant for this Beatriu de Pinos project proposal. He has more than 20 years of experience in weather and climate modelling, climate prediction and development of climate services and over 90 peer-reviewed publications with high citation impact. He is currently member of several international scientific committees, including the Working Group on Seasonal-to-Interannual Prediction (WGSIP) and the Decadal Climate Prediction Panel (DCPP) of the World Climate Research Programme (WCRP), and the European Network for Earth System Modelling (ENES) High-Performance Computing Task Force. He was also the lead author of Chapter 11 of the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), and has just been designated Coordinating lead author of Chapter 10 in the upcoming 6th Assessment Report. For his work in seasonal forecasting at European Center for Medium-Range Weather Forecasts (ECMWF), Prof. Doblas-Reyes was awarded the Norbert Gerbier-Mumm Award by the World Meteorological Organization (WMO) in 2006.

**3. Projecte o activitats de recerca (màxim 8 fulls) / *Research project or activities (maximum 8 sheets)***

3.1 Descripció del projecte o de les activitats de recerca que es volen desenvolupar, fent especial referència a l’estat de la qüestió, a la novetat i la originalitat de la recerca proposada. Descripció dels objectius, de l’enfocament metodològic i del pla de treball / *Description of the intended research project or activities, with special reference to the state of the art, and the innovative nature and originality of the proposed research. Description of goals, methodological focus and work plan.*

**Project Title and Acronym:**

Reducing uncertainties in future rainfall changes by constraining the impacts of Arctic sea-ice loss: casestudies of the Mediterranean and California (*ArcIce4MedRain*)

**Brief description**

Accurate prediction of future precipitation changes and drought risks is a key factor in planning and adapting water supply to ensure food and water security and protect natural resources. Resource managers, including municipal, agricultural, and ecological managers, rely on model predictions of the conditions expected in the coming decades to plan infrastructure and policy methods of adaptation. Despite substantial advances, over certain geographical regions climate models have still not been successful in simulating recent precipitation changes. These same locations suffer from large inter-model disagreements in the projections of future changes. In particular, regions located right below the ascending branch of the Hadley cell (e.g., Mediterranean Basin, California), whose climate is influenced both by tropical and mid-latitude atmospheric circulation changes, suffer from considerable uncertainties in model projections of twenty-first century precipitation changes (Kelley et al. 2012, Knutti and Sedláček 2012, Neelin et al. 2013). Future planning and adaptation efforts over these highly populated regions are hindered by the fact that the state-of-art model simulations disagree regarding themagnitude (and often even the sign) of the future precipitation changes (Seager et al. 2012, Kelley et al. 2012).

One possible cause of these inter-model discrepancies is that some climate models underestimate the magnitude of observed Arctic sea-ice loss over the satellite era. Our recent work has shown that the erroneous representation of future sea-ice changes in climate models could be affecting the prediction of future precipitation changes in the subtropics (Cvijanovic et al. 2017; hereafter CV17)*.* This study focused exclusively on the climate of the western United States and demonstrated that Arctic sea-ice loss, of the magnitude expected in the next few decades, could lead to a significant drying over California. The same study also indicated that other regions (including large parts of the Mediterranean Basin) are influenced by changes in Arctic sea-ice cover. However, the atmospheric teleconnections linking the Arctic changes and the climate of the Mediterranean Basin have not been explored by this study, and in general, are not well understood.

The first goal of this project is to investigate the physical mechanism through which Arctic sea-ice loss drives precipitation changes over the Mediterranean region. For this purpose, we will utilize experiments from a hierarchy of climate model configurations, specifically tailored to isolate the climate impacts of sea-ice loss. This will include the perturbed sea-ice physics parameter simulations described in CV17 and several other idealized simulations carried out within the context of the European H2020 APPLICATE and PRIMAVERA projects. The physical mechanisms and teleconnections identified will then be used to define a physically based framework for identification of the less reliable model projections within the ongoing Climate Model Intercomparison Project Phase 6 (CMIP6, Eyring et al. 2016). Model projections that more reliably simulate the sea-ice changes and the sea-ice induced atmospheric teleconnections important for the prediction of Mediterranean and Californian rainfall changes will be selected. This will allow us to reduce the range of projected precipitation changes over these regions. In the final objective of our project, we will further apply the knowledge on sea-ice induced atmospheric teleconnections to explore the prospects of improving decadal climate predictions.

Large disagreements in the model projections of Mediterranean Basin and Californian future precipitation changes are delaying the assessment of climate change impacts. Narrowing down the uncertainties related to future rainfall changes is of considerable importance for climate resiliency and adaptation efforts. This project will provide a ‘tighter’ range of possible outcomes for highly populated regions such as the Mediterranean Basin and California, a result that is beneficial both scientifically and societally.

**Problem background and the state-of-the-art**

Previous work has identified the Mediterranean Basin as a possible climate “hot-spot”: a highly populated region that may experience greater aridification than any other area in the world (Cubash et al. 2001, Giorgi 2006, Diffenbaugh and Giorgi 2012). Between 1950 and 2004, total winter precipitation has decreased by more than 15% while the recent drought of 2008 has demonstrated the extreme fragility of the eastern parts of the Iberian peninsula with regards to continued replenishment of its natural water resources by winter storms (Seager et al. 2014). Prolonged dryness, in combination with high summer temperatures, increases the danger of wildfires (Turco et al. 2017), and is suspected to have contributed to the extreme wildfire seasons of 2016 and 2017 on the Iberian Peninsula.

California’s winter precipitation has also been decreasing over the last two decades, and between 2012 and 2016 California entered into one of the most severe droughts on record (Diffenbaugh et al. 2015). The recent California drought caused statewide emergency water restrictions, depletion of drinking water for some communities, reduction in groundwater levels and fallowing of thousands of acres of farmland, resulting in significant loss of agricultural jobs and revenue (Howitt et al. 2015). Tree-ring records indicate that periods of low precipitation have endured for multiple decades in the past over both the Mediterranean and the United States southwest (Seager et al. 2007, Cook et al. 2015), leading to complex societal challenges and even warfare (Benson et al. 2007). Climatological assessment of the recent drought indices indicates that record high temperatures have magnified the effects of the lack of precipitation (Williams et al. 2015), indicating that as the Earth warms through anthropogenic climate change, severe droughts are expected to become more common.

The Mediterranean Basin and California represent the two largest ‘Mediterranean climate’ zones in the Northern hemisphere (Köppen-Geiger climate classification scheme, see Kottek et al. (2006) and also Fig. 1). Regions featuring the Mediterranean climate are defined by wet cool winters and dry hot summers, and are typically located underneath the poleward edges of the northern and southern Hadley cells (between 30° - 45° latitude) in the zones of predominantly descending flow. Future precipitation changes over these subtropical regions are linked to both tropical and midlatitude circulation changes and as such are a subject to many uncertainties (Seager et al. 2012, Seager et al. 2014, CV17, Polade et al. 2017).

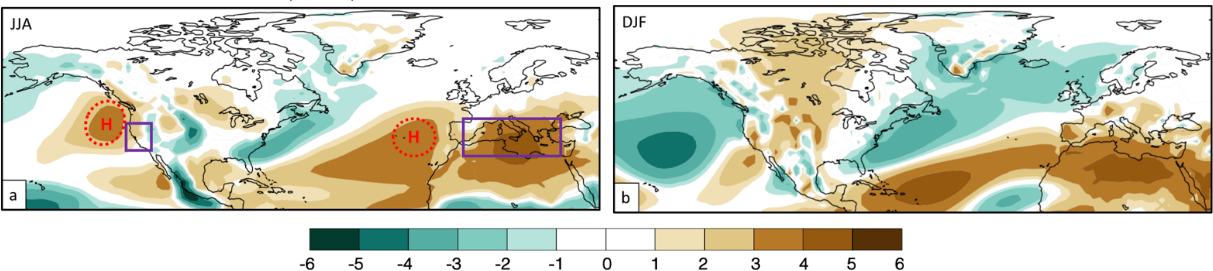


Fig. 1: Summer (JJA) and winter (DJF) vertical (omega) velocity climatology (positive regions indicate subsidence, negative uplift). During the boreal summer, the circulation associated with the northern Hadley cell is at its peak strength and has its furthest northward extent (Fig. 1 a). This results in a strong Azorean and North Pacific highs and dry conditions over the Mediterranean Basin and California. During the boreal winter (Fig. 1 b), the northern Hadley cell weakens and shifts southward, resulting in decreased subsidence over these regions. This  seasonal weakening of the subsidence strength clears the path for mid-latitude influences and arrival of the precipitation rich storms. The majority of precipitation is deposited through a couple of large frontal storms (as opposed to the frequent weaker events) making the yearly water resources highly dependent on the arrival of these storms (Dettinger et al. 2014). Visualization based on model simulations by CV17.

In the future, tropical circulation is expected to undergo several kinds of changes, all of which are capable of affecting the rainfall in the subtropics. Hadley circulation has widened in recent decades (Hu and Fu 2007), and is projected to continue to widen in the future due to the combined influence of global warming and decreased temperature gradients between the tropics and midlatitudes (Lucas et al. 2014, Adam et al. 2014). Although observational data are still unable to fully confirm this (Lau and Kim 2015), Hadley circulation is also expected to weaken in warmer climates, as a result of weakened meridional temperature gradients and changes in static stability and moisture convergence (Held and Soden 2006, Seo et al. 2014). Finally, changes in the interhemispheric temperature gradient have also been implicated in affecting the dynamics of Hadley circulation. By affecting the position of the “energy equator” and the Intertropical Convergence Zone, differential warming in one hemisphere relative to another can lead to latitudinal shifts of the Hadley circulation (Chiang and Friedman 2012, Schneider et al. 2014).

During the winter, as Hadley circulation weakens, subtropical regions become more affected by the midlatitude weather. In general, many midlatitude regions are expected to become wetter with global warming - a consequence of increased specific humidity and water vapour transport from the lower latitudes (Collins et al. 2013). However at regional scales, midlatitude precipitation is driven by many conjoint influences such as troposphere-stratosphere interactions and/or sea surface temperature, sea ice and storm track changes, that are all challenging to model (Fereday et al. 2017). It comes as no surprise then that the delicate balance between tropical and midlatitude influences, and the expected future changes, makes regions like the Mediterranean Basin and California, areas with the highest uncertainties in future climate projections.

The Mediterranean Basin is anticipated to undergo further drying in the future, as a result of increased subsidence and stronger anticyclonic conditions (Giorgi and Lionello 2008) that is a manifestation of widening of the Hadley circulation. However, subsidence changes are not the only factor shaping the future trends in Mediterranean Basin climate: changes in the atmospheric moisture content and moisture convergence (Trenberth 2011) are expected to intensify the amount of precipitation generated by cyclones (Seager et al. 2014). With warming temperatures, these two factors are expected to have opposing impacts (Zappa et al. 2015). This could, for example, manifest in a decreased number of cyclones but an increased amount of precipitation carried by each cyclone.  Model projections are unable to accurately capture the recent decline in winter precipitation over the Mediterranean Basin (Fig. 2). The present day precipitation decreases and the associated circulation anomalies over California are also not evident from coupled model simulations of historical climate (Seager et al. 2012).

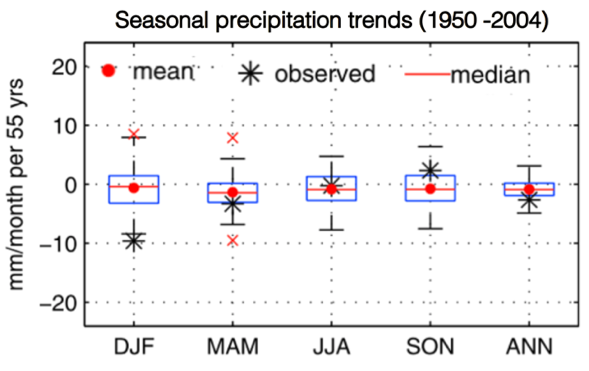


Fig. 2: Seasonal precipitation trends over the Mediterranean region from 1950 to 2004: comparison of observed (Global Precipitation Climatology Centre, GPCP) and simulated (23 model ensemble mean of historical simulations from phase 5 of the Coupled Model Intercomparison Project) values. The 25th and 75th percentiles of the model distributions are shown by the edges of the boxes, and the whiskers as the range of .35% and 99.65% (from Kelley et al. 2012).

Over the Mediterranean Basin and California, model projections also disagree about the magnitude (and in some instances even the sign) of the future precipitation changes. This results in a multi-model mean that is often close to zero, and a large envelope of uncertainties (see Fig. 3c). The differences between simulated and observed precipitation changes may in part be a consequence of the different expression of internal or forced variability in the ‘real’ and ‘model’ worlds. However, recent work has revealed that at least one factor contributing to the erroneous prediction of future precipitation changes in the subtropics is the incorrect representation of sea ice changes in climate models (CV17). In their recent study, CV17 demonstrated that decreases in Arctic sea-ice changes, of the magnitude expected in the coming decades, could lead to reorganization of tropical convection, triggering an anticyclonic response over the North Pacific that results in a significant drying over California. The same study indicated that the sea-ice loss drives precipitation changes across other subtropical regions, including the Mediterranean Basin, but did not explore the physical mechanisms behind those linkages.

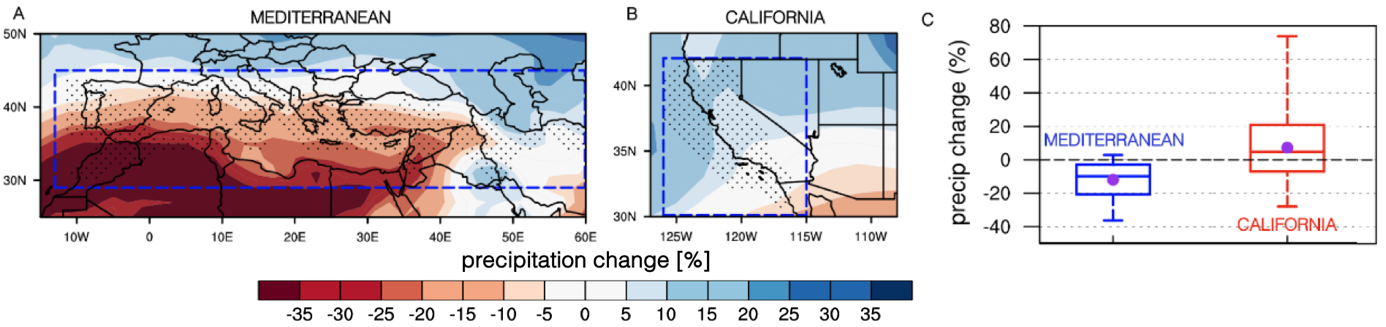


Fig. 3: Model projections of winter precipitation changes over Mediterranean and California under *business as usual* scenario for 2060–2089 minus 1960–1989 using the 30 model ensemble from the phase 5 of the Coupled Model Intercomparison Project. (**a**),(**b**) multi-model ensemble mean, (**c**) area average over the Mediterranean and Californian climate grids (stippled regions shown in a and b); multi-model ensemble average is shown by the circle, the median is indicated by the horizontal line, the box represents the interquartile range, and whiskers the range containing 99% of projections (from Polade et al. 2017).

The substantial loss of high latitude sea ice cover affects both high-to-low latitude temperature gradients as well as the interhemispheric temperature gradients (Francis and Vavrus 2012, Cvijanovic and Caldeira 2015). Moreover, several modeling studies have shown that the sea ice feedbacks also affect the amount of tropical warming in response to greenhouse gas forcing (Hall et al. 2004, Cvijanovic and Caldeira 2015). As discussed above, all of these factors can contribute to changes in tropical and midlatitude circulations thus affecting the precarious balance of their influences over the subtropical regions. While the influence of Arctic sea-ice loss on midlatitude weather has been widely discussed (Vihma et al. 2014, Koenigk et al. 2015, Garcia-Serrano et al. 2015), the evidence implicating sea-ice decline in shaping the weather and climate of the Mediterranean Basin is only beginning to emerge (Grassi et al. 2013, CV17, Cheung et al. 2018).

Better understanding of the sea-ice induced atmospheric teleconnections affecting the Mediterranean climate and application of this knowledge towards decreasing the uncertainties in projections of future precipitation changes represents the core of this proposal. Current model limitations in simulating future precipitation changes over the Mediterranean and California make the standard approach of treating every model equally disadvantageous, and an additional criteria for selecting and weighting the models is needed in order to minimize the model spread. We will use a variety of global climate models and specialized setups to disentangle the role of Arctic sea-ice loss in Mediterranean rainfall changes. Understanding these physical linkages will allow us to define the physical criteria used to select the best model projections and will narrow the range of projected precipitation changes. Finally, we will use the observational data to test the realism of the mechanisms inferred from the model world, as well as to assess the ability of current decadal predictions systems to represent them, with a particular emphasis on determining if the accurate representation of identified physical mechanisms translates into an increase in skill of Mediterranean rainfall prediction.

**Key Objectives**

**1.   Understanding the links between high latitude sea-ice loss and Mediterranean rainfall**

We will quantify the impacts of future sea-ice loss on Mediterranean rainfall and elucidate the physical mechanisms by which high latitude changes propagate into the Mediterranean region. In order to isolate the impacts of sea-ice loss alone, we will employ specialized model simulations designed to treat the sea-ice changes as a forcing. This will be achieved by comparing two sets of simulations that differ only in the amount of Arctic sea-ice cover. In order to eliminate the possibility that the investigated teleconnections are an artifact of the method or model used, we will employ several different approaches for isolating the impacts of sea ice loss and sample a variety of models and model configurations (see Methods for further details).

**2.   Decreasing the uncertainties in climate projections of future rainfall changes over the Mediterranean and California**

We will investigate whether the large intermodel spread in simulating Mediterranean and Californian precipitation changes can, at least in part, be explained by different representations of: i) high latitude sea-ice cover; and ii) sea-ice-induced teleconnections (explored in Objective 1 and in our previous work (CV17). Based on this, we will define several physically based frameworks for selecting model projections. Using observational and reanalysis data as well as future predictions of sea-ice changes based on other approaches (Overland and Wang 2013), these frameworks will first be evaluated in the context of historical climate, and then used to provide new projections of rainfall changes over the Mediterranean and California.

**3.   Assessing the skill of decadal prediction systems in Mediterranean precipitation changes**

As a final goal of this project, we will analyse a set of state-of-the-art decadal climate predictions  to explore whether a realistic initialization of sea-ice conditions, and a well-constrained estimation of radiative forcing changes, can help increase the predictive skill of precipitation changes over the Mediterranean region. A number of studies found a link between Arctic sea ice and winter climate conditions over Europe at seasonal to interannual timescales (Scaife et al 2014, Koegnig et al 2015, García-Serrano et al 2015). The envisaged analysis proposes to bridge the gap between these short-term impacts, and those of the long-term sea-ice decline analysed in Work package 1 and 2. This will be done by consistently assessing the skill across a large set of decadal predictions, and by a subsequent use of the skillful systems to investigate the underlying mechanisms.

**Methodology and approach**

The project will rely on three work packages, each of them addressing one of the main objectives.

Work Package 1. The baseline simulations that will used to accomplish the Objective 1 are the perturbed sea-ice physics parameter simulations, PSIPPS, described in CV17. These state-of-the-art simulations were specially tailored to isolate the impacts of sea-ice loss, without imposing artificial energy fluxes in the high latitudes. In contrast to recent studies that achieve the sea-ice loss by imposing artificial energy flux anomalies in the high latitudes, PSIPPS setup employes the sea-ice physics parameter perturbations that allow for energy budget conservation. In this manner it is ensured that the observed atmospheric response really originates from the sea-ice changes and that it is not altered by spurious energy flux perturbations. Under the PSIPPS protocol, the three sea-ice physics parameters that have the strongest impact on the sea-ice extent are selected (the snow grain radius tuning parameter, thermal conductivity of snow, and snow melt maximum radius) and their values are varied *within their respective expert-defined ranges,* in order to achieve the sea-ice loss. Comparison of the low-ice simulations and control simulations representative of the sea-ice conditions at the end of the twentieth century, allows to isolate the atmospheric response that is solely associated with the sea-ice loss.

In order to capture the atmosphere–surface ocean interactions and sea surface temperature (SST) changes necessary for propagation of high-to-low latitude atmospheric teleconnections (Chiang and Bitz 2005, Cvijanovic and Chiang 2013) neither the SSTs nor the sea-ice cover were prescribed in the PSIPPS setup. The importance of using the interactive SSTs when investigating the remote impacts of high latitude forcing was described in Cvijanovic and Chiang (2013) and is also illustrated in Fig. 4. Simulations with tropical SSTs prescribed to the control values cannot capture the tropical precipitation and circulation changes due to high latitude forcing. This in turn inhibits the propagation of any other teleconnections that would otherwise arise from the sea-ice-induced tropical circulation changes. As shown CV17, these ‘secondary’ teleconnections can play a very important role in shaping the subtropical response.

PSIPPS simulations will further be complemented with two other sets of specialized simulations: altered sea-ice albedo simulations from APPLICATE and nudged sea-ice simulations from PRIMAVERA (see Section 2.1 for more details on both projects). The complementary nature of the three simulation sets arises from the fact that while PSIPPS simulations feature the state-of-the-art method for isolating the impacts of sea-ice loss, fully coupled simulations from PRIMAVERA and APPLICATE will allow investigating the impacts of ocean dynamics. By comparing the outcomes from both approaches, we will be able to evaluate if the impacts over the Mediterranean region and the driving mechanisms are robust, and better understand the timescales at which the sea-ice induced deep ocean response may affect the atmospheric response downstream.

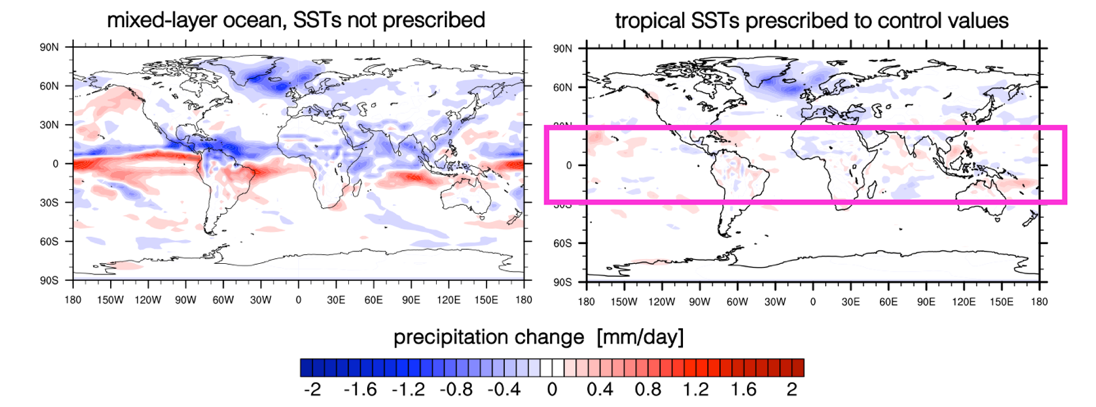


Figure 4: Annual mean precipitation response to idealized North Atlantic cooling. Substantial tropical precipitation changes are indicated in simulations with active SSTs (left panel), in contrast to no precipitation changes in simulations with SSTs prescribed to their respective control values (right panel). (Adapted from Cvijanovic and Chiang 2013).

Work Package 2. Investigation of the sea-ice induced  teleconnections described in Work Package 1 will provide the foundation for the second objective of this project, aimed at narrowing the uncertainties in climate projections of future rainfall changes over the Mediterranean Basin and California. To accomplish this, we will analyze the model projections of historical and future climates from the CMIP6 project (Eyring 2016) and the high resolution simulations from H2020 PRIMAVERA project (following the HighResMIP protocol**,** Haarsma et al 2016) and investigate how the representation of Arctic sea-ice cover and sea-ice-induced teleconnections affect the intermodel spread. Firstly, we will seek to determine whether the large differences in model projections of historical and future precipitation changes over the Mediterranean and California can be explained by their respective differences in representation of high latitude sea-ice loss. Following this, we will focus on the sea-ice induced teleconnections. For example, CV17 describes a two step teleconnection through which Arctic sea-ice changes affect Californian precipitation. The high latitude changes first propagate into the tropical Pacific resulting in tropical convection and precipitation changes there. This tropical response then drives a northward propagating Rossby wavetrain that results in drying over California. This sequence of events illustrates that for a given model to simulate the precipitation decline over California in response to the sea-ice loss, it needs to capture adequately both the sea-ice induced convection changes in the tropical Pacific, and the tropical convection induced  precipitation changes over California. We will thus explore how the intermodel spread  relates to the representation of the each of these stages, and produce a similar analysis for the key drivers of the sea-ice induced Mediterranean rainfall changes (as previously identified in Work Package 1).

The investigated atmospheric linkages from the model world will further be tested using the re-analysis data (ERA-Interim (Dee et al. 2011) and JRA-55 (Ebita et al. 2011)), and several other observational datasets and assimilation products (e.g., precipitation data from the Global Precipitation Climatology Project (GPCP, Adler et al. 2003); sea ice concentrations from the National Snow and Ice Data Centre (NSIDC, Cavalieri et al. 1996), etc.). This will allow us to select the model projections that perform best at simulating the sea-ice changes and the sea sea-ice induced teleconnections over the historical period. Chosen projections will in turn serve as a basis for the selection of the future projections that will be further constrained by other existing estimates of the future sea-ice changes; see Overland and Wang (2013).

Work Package 3. We will focus on the experiments contributing to the CMIP6 initiative following the Decadal Climate Prediction Project (DCPP) protocol A (Boer et al. 2016), as well as the experiments performed within the context of the European H2020 project EUCP\*, and perfrom a comprehensive assessment of the skill in predicting the Mediterranean rainfall changes. Once the models with predictive skill have been identified, they will be used to investigate the associated sea-ice teleconnections, with a special emphasis on determining the similarities and differences with the mechanisms highlighted in Work Package 1.

This workpackage will benefit from the large experience on climate prediction of the host institute (BSC). All diagnostics will rely on the use of the R-package “[s2dverification](https://www.bsc.es/research-and-development/software-and-apps/software-list/s2dverification)” (Manubens et al. 2018), a comprehensive collection of sophisticated statistical tools for climate prediction, developed and maintained by the BSC’s Earth Sciences Department (ESD). In close collaboration with the Earth System Services team from the ESD, we will extend our analysis to assess the predictability of tailored variables of special relevance for different socio-economical sectors. In case the production of some or most of these experiments is substantially delayed (they are expected to start in the second half of 2018), the analysis would be complemented with the CMIP5 decadal hindcasts, and other sets of analogous experiments from the H2020 project SPECS\*, all of them already available.

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\*described in Section 2.1

**Anticipated challenges**

The identification of the sea-ice induced teleconnection in model simulations may be hindered by large internal climate variability. However, this risk is inherent to any climate study and can be resolved by employing large ensemble simulations and/or sub-sampling the periods with large forcing. Such an approach proved successful in our previous investigations (CV17) and it is also highly reassuring that our previous work and several other studies (Grassi et al. 2013; Cheung et al. 2018) have indicated the Arctic sea-ice loss as a factor affecting the projections of Mediterranean and Californian climate.

Prior to data-model integration, we will assess the factors that could affect the propagation of the sea-ice induced teleconnections of interest (model limitations in reproducing the observed modes of internal variability, tropical convection, stratospheric processes, etc.). Having these limitations in mind, we may for example, decide to use the information on the sign and relative magnitude of sea-ice induced tropical convection changes rather than their exact location.

**Work plan**

The proposed timeline for the start and the completion of project tasks is provided in Table 1. During the first quartile we will analyze the PSIPPS simulations (these are already available, see Objective 1 for more details). Altered albedo and nudged sea-ice simulations from APPLICATE and PRIMAVERA projects will be made available for our use during the second quartile. During the second quartile we will also perform the analysis of CMIP6 and high resolution PRIMAVERA simulations (Objective 2) and investigate the observational constraints based on the observational and reanalysis data. Selection of future model projections will be the focus of the third quartile. The final quartile will be dedicated to investigating the prospects of improving decadal climate predictions based on the improved representations of high latitude sea-ice changes and sea-ice induced atmospheric teleconnections.

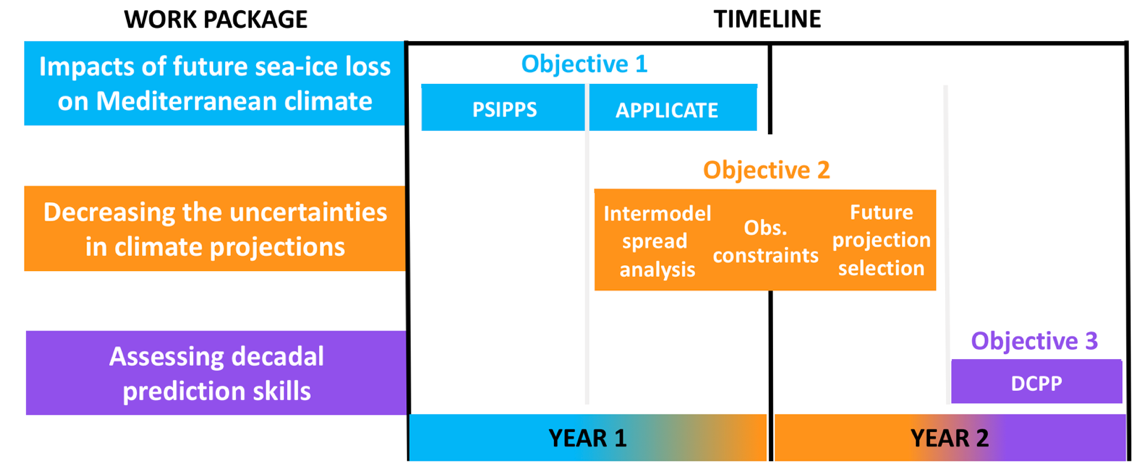


Table 1: Chronogram of the project.

**References:**

Adam, O, T Schneider, and N Harnik (2014) J. Climate, 27, 7450–7461.

Adler, RF, et al. (2003) J. Hydromet. 4,1147-1167.

Benson, LV, et al. (2007) Quat. Sci. Rev. 26,336-350.

Boer, G J, et al. (2016) Geosci. Model Dev., 9, 3751-3777.

Cavalieri, DJ et al. (1996) Sea Ice Concentrations from Nimbus-7 SMMR and DMSP SSM/I-SSMIS Passive Microwave Data, NASA DAAC at the National Snow and Ice Data Center, Boulder, Colorado, USA.

# Cheung, HHN, et al. (2018) Adv. Atmos. Sci.35, 38-51.

Chiang, JCH and Bitz, CM (2005) Clim. Dyn., 25, 477–496.

Chiang, JCH and Friedman, AR (2012) Annual Reviews of Earth and Planetary Sciences, 40, 383-412.

Cook, ER, et al. (2015) Science Advances 1/10, e1500561, 10.1126/sciadv.1500561

Cubasch, U, et al. (2001) Projections of future climate change. Climate Change 2001: The Scientific Basis, J. T. Houghton et al., Eds., Cambridge University Press, 525– 582.

Collins, M, et al. (2013) Climate Change 2013: The Physical Science Basis, T. F. Stocker et al., Eds., Cambridge University Press, 273–309.

Cvijanovic, I, Chiang, JCH (2013) Clim. Dyn., 40, 1435–1452.

Cvijanovic, I, Caldeira, K, (2015) Clim. Dyn., 44, 1173–1186.

Cvijanovic, I., et al., 2017:. Nature Communications 1947 doi:10.1038/s41467-017-01907-4.

Dee, DP, et al. (2011) Quart. J. Roy. Met. Soc.137: 553-597.

Dettinger, MD, Cayan, DR (2014) San Francisco Estuary and Watershed Science. 12(2).

Diffenbaugh, NS and Giorgi F (2012) Clim Chang 114:813–822.

Diffenbaugh, NS, et al. (2015) Proc. Natl Acad. Sci. USA 112, 3931–3936.

[Ebita, A, et al (2011) SOLA, 7, 149-152.](https://www.jstage.jst.go.jp/article/sola/7/0/7_0_149/_article" \t "_blank)

Eyring, V, et al. (2016) Geosci. Model Dev., 9, 1937–1958.

Fereday, D, et al. (2018)  J. Clim., 31,963–977.

García-Serrano J and Frankignoul C (2015) Clim Dyn. 47,1601-1612.

Gent, PR, et al. (2011) J. Clim., 24, 4973–4991.

Giorgi, F (2006) Geophys. Res. Lett. 33 (L08):707

Giorgi, F and Lionello, P (2008) Global Climate Change, 63, 90–104.

Grassi B, et al. (2013) J Clim. 26:10101–10110.

Hall, A (2004) J. Clim. 17.1550–1568.

Haarsma, RJ et al. (2016) [Geosci. Model Dev. 9, 4185-4208.](http://www.geosci-model-dev.net/9/4185/2016/)

Held, IM and Soden, BJ (2006)  J. Clim., 19(21), 5686–5699.

Howitt, RE et al (2015) Economic Analysis of the 2015 Drought for California Agriculture. Center for Watershed Sciences, University of California- Davis, Davis, CA, 16 pp.

Hu, Y, and Fu, Q (2007) Atmos. Chem. Phys. 7, 5229-5236.

Kelley, C, et al, (2012)  Geophys. Res. Lett., 39, L21703.

Knutti, R and Sedláček, J (2012) Nat. Clim. Change 3(4):369–373.

Koenigk, T, et al., (2015) Clim Dyn. 46, 317-337.

Kottek, M et al (2006) Met. Zeitschr.15,259-263.

Lau, WKM, Kim, K.-M (2015) Proc. Natl. Acad. Sci. USA 112, 3630–3653.

Lucas, C, et al. (2014) Wiley Interdiscip. Rev.: Clim. Change 5, 89-112.

Manubens N, et al. (2018) Environ. Model. Softw*.*, doi:10.1016/j.envsoft.2018.01.018

Neelin, JD, et al. (2013) J. Clim. 26, 6238–6256.

Overland, JE and Wang, M (2013) Geophys. Res. Lett. 40, 2097–2101.

Polade, SD, et al. (2017) Scientific Reports 7, 10783. doi:10.1038/s41598-017-11285-y

Scaife, AA, et al. (2014) Geophys Res Lett 41:2514–2519

Schneider, T et al. (2014) Nature 513, 45–53.

Seager, R et al. (2007) Quat. Sci. Rev.26, 2322-2336.

Seager, R., et al. (2012) Nat. Clim. Change 3, 482–486.

Seager, R., et al. (2014) J. Clim. 27, 4655–4676.

Seo, K-H, et al. (2014) Geophys. Res. Lett., 40, 5251–5258.

Trenberth, KE (2011) Clim Res 47(1):123–138

Turco, M, et al. (2017) Scientific Reports 7 (81). doi: 10.1038/s41598-017-00116-9

Vihma, T (2014) Surv. Geophys., 35, 1175–1214.

Williams, AP, et al. (2015) Geophys. Res. Lett. 42(16):6819–6828.

# Zappa, G, et al. (2015) Clim. Dyn. 45: 1727-1738.

3.2 Impacte previst dels resultats del projecte en el camp d’investigació i en la de la seva aplicació en el desenvolupament de nous coneixements, productes o processos / *Forecast impact of project’s results in the field of research and in its application in the development of new knowledge, products or processes.*

Polar climate is currently undergoing unprecedented changes, and is one of the ‘hottest’ topics within the climate community. At the same time, the Mediterranean remains the ‘uncertainty hotspot’ in terms of future rainfall changes. By linking these two research topics, this project is expected to produce a number of high impact publications, and stir the media attention.

The successful completion of the proposed work will provide a better understanding of the remote drivers of precipitation changes over the Mediterranean Basin and California. This outcome will allow to better constrain future drought risks over these regions.

The overall analysis will provide a physically based framework for: i) reducing the uncertainties in global climate model projections of future precipitation changes, and ii) improving the skill in decadal climate predictions of hydroclimatic events. As such, the proposed project can strengthen several societally important aspects:

a) It will deliver important information for defining better adaptation and mitigation strategies over the Mediterranean region (and beyond), significant for ***public stakeholders and decision makers.***

b) The project outcomes will help strengthen current operational forecast systems and boost the skill of the ***operational predictions*.**

c) Project deliverables represent actionable climate information important for different***socio-economic sectors***, including water management, agriculture and food safety, forestry, etc.

The experimental protocol to be developed by this Beatriu de Pinos project could be exploited to analyse other potentially sensitive areas, like for example the tropics, and/ other relevant climate variables (e.g. extreme precipitation events). This guarantees multiple potential applications and pathways to follow up the proposed research. The project has a potential to establish BSC as a timely leader in investigating the remote drivers of Mediterranean climate, the outcome that will enhance BSC’s reputation for world-class climate science.

3.3 Activitats de difusió i de divulgació de la recerca previstes en el marc del projecte de recerca: disseminació dels resultats del projecte, explotació de resultats, comunicació i estratègia de compromís públic de l'acció / *Planned research dissemination activities within the framework of the research project: dissemination of project results, exploitation of results, communication and public commitment to action.*

Major results from the project, and in particular the aspects of greater impact on society described previously in Section 3, will be communicated with help of BSC’s Project Dissemination Unit (PDU). With every achieved milestone, we will prepare press releases, fact sheets and visualizations describing our research in a manner that is accessible to the general public. This material will be made available on the BSC website and shared using official social media platforms. According to the Open Access policies in Horizon 2020 and Ley de la Ciencia, la Tecnología y la Innovación (2011), and other recommendations for getting wider dissemination and maximizing visibility and impact of the research results of the fellowship, all the publications will be deposited in UPCommons, the institutional repository used by the BSC (<https://upcommons.upc.edu/handle/2117/23714>) in order to guarantee their long-term preservation and their free accessibility. In addition, the results of this project will be disseminated to relevant organizations through the Mediterranean Climate Outlook Forum (MedCOF) network in which the BSC is an active participant.

Other opportunities for dissemination at the international level will be exploited too. In particular, since the outcomes of this Beatriu de Pinos project are of great relevance to H2020 APPLICATE and PRIMAVERA projects, we will also utilize their dissemination options in order to maximize project’s public impact. APPLICATE and PRIMAVERA projects both feature an entire work package dedicated to user engagement activities (including regular meetings with representatives from the main project stakeholder groups) and provide support for the material production, communication and dissemination. Similarly, we will share the project outcomes with the Sea Ice Action Network (aimed at communicating and advancing public awareness regarding the consequences of Arctic sea-ice loss).

The candidate has substantial experience in communicating the research results to journalists, scientific writers, educational radio and television program hosts and we plan to continue sharing our published research within this previously established network. The candidate will also engage in a series of public lectures upon joining BSC.

Finally, the results will be presented at international scientific conferences and meetings, including European Geosciences Union General Assembly, American Geophysical Union Fall Meeting, European Meteorological Society Meetings, CLIVAR workshops, etc.

**4. Aspectes ètics del projecte de recerca previst / *Ethical aspects of the planned research project***

4.1 Indiqueu si la recerca que es vol desenvolupar inclou algun d’aquests aspectes / *Indicate whether the intended research work includes any of the following aspects*:

|  |  |  |
| --- | --- | --- |
| Investigació sobre embrions humans/Fetus  *Research on human embryos /foetuses* | SI / YES | NO |
| La investigació proposada implica embrions humans?  *Does the proposed research involve human embryos?* |  |  |
| La investigació proposada implica teixits o cèl·lules fetals humanes?  *Does the proposed research involve human foetal tissue or cells?* |  |  |
| La investigació proposada implica cèl·lules mare embrionàries humanes?  *Does the proposed research involve human embryo stem cells?* |  |  |
| La proposta d'investigació amb cèl·lules mare embrionàries humanes implica cultiu cel·lular o l’obtenció de cèl·lules a partir d’embrions?  *Does the proposed research with human embryo stem cells involve cell cultures or the obtaining of cells from embryos?* |  |  |

|  |  |  |
| --- | --- | --- |
| Investigació sobre éssers humans  *Research on human beings* | SI / YES | NO |
| La investigació proposada implica la participació de nens?  *Does the proposed research involve the participation of children?* |  |  |
| La investigació proposada implica la participació de pacients?  *Does the proposed research involve the participation of patients?* |  |  |
| La investigació proposada implica la participació de persones incapacitades per donar el seu consentiment?  *Does the proposed research involve the participation of persons incapable of giving their consent?* |  |  |
| La investigació proposada implica voluntaris adults sans?  *Does the proposed research involve healthy adult volunteers?* |  |  |
| La investigació proposada implica material genètic humà o mostres biològiques humanes?  *Does the proposed research involve human genetic material or human biological specimens?* |  |  |
| La investigació proposada implica la recopilació de dades personals?  *Does the proposed research involve the gathering of personal data?* |  |  |

|  |  |  |
| --- | --- | --- |
| Privacitat  *Privacy* | SI / YES | NO |
| La investigació proposada implica el processament de la informació genètica o de les dades personals (per exemple, salut, vida sexual, origen ètnic, les opinions polítiques, les conviccions religioses o filosòfiques)?  *Does the proposed research involve the processing of genetic information or personal data (for example, health, sex life, ethnic origin, political opinions, religious or philosophical convictions)?* |  |  |
| La investigació proposada implica el seguiment de la ubicació o de l'observació de les persones?  *Does the proposed research involve the monitoring of the location or the observation of persons?* |  |  |

|  |  |  |
| --- | --- | --- |
| Investigació amb animals  *Research with animals* | SI / YES | NO |
| La investigació proposada implica la investigació amb animals?  *Does the proposed research involve research with animals?* |  |  |
| Aquests animals són petits animals transgènics de laboratori?  *Are these animals transgenic small laboratory animals?* |  |  |
| Aquests animals són animals de granja transgènics o clonats?  *Are these animals transgenic or cloned farm animals?* |  |  |
| Aquests animals són primats no humans?  *Are these animals non-human primates?* |  |  |

|  |  |  |
| --- | --- | --- |
| Investigació amb els Països en Desenvolupament  *Research with developing countries* | SI / YES | NO |
| La investigació proposada implica l'ús de recursos locals (genètics, animals, vegetals, etc)?  *Does the proposed research involve the use of local resources (genetic, animal, plant, etc.)?* |  |  |
| És la investigació proposada en benefici de les comunitats locals (per exemple, la creació de capacitats, accés a la salut, l'educació, etc?  *Does the proposed research benefit local communities (for example, skills creation, access to health, education, etc.?* |  |  |

|  |  |  |
| --- | --- | --- |
| Doble us  *Dual use* | SI / YES | NO |
| La investigació proposada té un ús militar directe?  *Does the proposed research have a direct military use?* |  |  |
| La investigació té un potencial ús terrorista?  *Does the research have a potential terrorist use?* |  |  |

4.2 Si el projecte de recerca que es vol desenvolupar inclou algun tipus d'estudi amb dades personals o genètiques, algun tipus d’experimentació amb éssers humans, la utilització de mostres biològiques d'origen humà o algun tipus d’experimentació amb animals, expliqueu-ne breument els motius. Indiqueu també si el projecte ja compta amb l’aprovació del comitè d’ètica del propi centre. / *If the intended research project includes some kind of study with personal or genetic data, some kind of experiment with human beings, the use of biological samples of human origin or some kind of experiment with animals, briefly explain the reasons. Also indicate whether the project has already been approved by the centre’s own ethics committee.*

Not applicable.

4.3 En els casos en que el projecte presentat inclogui algun tipus d'estudi amb dades personals o genètiques o algun tipus d’experimentació amb éssers humans, també caldrà especificar si existeix algun tipus de remuneració o de compensació per als subjectes participants i, en el moment de presentar la sol·licitud, també caldrà adjuntar el model d’informació i de consentiment que rebran els participants / *In cases in which the submitted project includes some kind of study with personal or genetic data or some kind of experiment with human beings, you must also specify whether there is any kind of remuneration or compensation for participating subjects and, at the time of submitting the application, the information and consent form to be received by participants must also be attached.*

Not applicable.