Please check our wiki for help on navigating the form.

Horizon 2020

Call: H2020-MSCA-IF-2018

(Marie Skłodowska-Curie Individual Fellowships)

Topic: MSCA-IF-2018

Type of action: MSCA-IF-EF-CAR

(Career Restart panel)

Proposal number: 844955

Proposal acronym: ArcIce4MedRain

Deadline Id: H2020-MSCA-IF-2018

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How to fill in the forms

The administrative forms must be filled in for each proposal using the templates available in the submission system. Some data fields in the administrative forms are pre-filled based on the steps in the submission wizard.

This proposal version was submitted by **Francisco J. DOBLAS-REYES** on **12/09/2018 15:12:39** Brussels Local Time. Issued by the Participant Portal Submission Service.

1 - General information

Topic	MSCA-IF-2018	Type of Action	MSCA-IF-EF-CAR
Call Identifier	H2020-MSCA-IF-2018	Deadline Id	H2020-MSCA-IF-2018

Acronym: ArcIce4MedRain

Proposal title: Investigating the impacts of future Arctic sea-ice loss on Mediterranean climate types

Note that for technical reasons, the following characters are not accepted in the Proposal Title and will be removed: < > " &

Duration in months: 24

Scientific Area: ENV - Environmental and Geosciences (ENV)

Please select up to 5 descriptors (and at least 3) that best characterise the subject of your proposal, in descending order of relevance.

Descriptor 1: Climatology and climate change

Descriptor 2: Meteorology, atmospheric physics and dynamics

Descriptor 3: Scientific Computing

Free keywords: *atmospheric dynamics, atmospheric teleconnections, Mediterranean climate types, Mediterranean precipitation, Arctic sea-ice loss*

Please choose the scientific area and descriptors carefully, and in order of importance, since this will guide the REA in the selection of experts for proposal evaluation and the allocation of proposals to experts. To help you select the most relevant area for your proposal, please consult the Guide for Applicants which provides a breakdown of each scientific area into a number of descriptors.

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Abstract

Despite substantial recent advances, state-of-the-art climate model simulations continue to disagree about both the magnitude and sign of future precipitation changes over the Mediterranean and California, hindering planning and adaptation efforts over these highly populated regions. Recent work has indicated that the erroneous representation of future sea-ice changes could affect the accuracy with which precipitation changes over the Mediterranean Basin and California are simulated. Addressing this knowledge gap has the potential to provide an important tool for decreasing the intermodel spread of future rainfall changes. This project will investigate the physical links between Arctic sea-ice loss and subtropical rainfall. It will utilize experiments from a hierarchy of climate model simulations, including the state-of-the-art perturbed sea-ice physics simulations previously developed by the applicant and multimodel simulations carried out within the context of the European H2020 projects that the host institution currently participates in. The physical mechanisms and teleconnections identified will subsequently be used to define a physically based framework for selection of the less reliable model projections within the ongoing Climate Model Intercomparison Project Phase 6. By defining such physical criteria, this project will seek to reduce the range of projected precipitation changes over the two study regions. In the final objective, the improved understanding of sea-ice induced atmospheric teleconnections will be utilized to improve decadal climate predictions. This project combines the applicant's expertize in atmospheric dynamics with the host institution's proficiency in climate prediction. The successful completion of the proposed work will help reduce the spread of future rainfall changes over the Mediterranean and California and help position the candidate and the host institution as leaders in investigating the remote drivers of Mediterranean rainfall.

Remaining characters 1

Has a similar proposal in terms of research objectives been submitted to a Horizon 2020 Marie Skłodowska-Curie Individual Fellowship call? ○ Yes ◉ No

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Declarations

1) The applicant (future beneficiary) declares to have the explicit consent of all partner organisations (if applicable) on their participation and on the content of this proposal.	☒
2) The information contained in this proposal is correct and complete.	☒
3) This proposal complies with ethical principles (including the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity — and including, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct).	☒

4) The applicant (future beneficiary) hereby declares:

- it is fully eligible in accordance with the criteria set out in the specific call for proposals; and	☒
- it has the financial and operational capacity to carry out the proposed action.	☒

The applicant (future beneficiary) is only responsible for the correctness of the information relating to his/her own organisation. Where the proposal to be retained for EU funding, the applicant (future beneficiary) will be required to present a formal declaration in this respect.

According to Article 131 of the Financial Regulation of 25 October 2012 on the financial rules applicable to the general budget of the Union (Official Journal L 298 of 26.10.2012, p. 1) and Article 145 of its Rules of Application (Official Journal L 362, 31.12.2012, p.1) applicants found guilty of misrepresentation may be subject to administrative and financial penalties under certain conditions.

Personal data protection

The assessment of your grant application will involve the collection and processing of personal data (such as your name, address and CV), which will be performed pursuant to Regulation (EC) No 45/2001 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data. Unless indicated otherwise, your replies to the questions in this form and any personal data requested are required to assess your grant application in accordance with the specifications of the call for proposals and will be processed solely for that purpose. Details concerning the purposes and means of the processing of your personal data as well as information on how to exercise your rights are available in the privacy statement. Applicants may lodge a complaint about the processing of their personal data with the European Data Protection Supervisor at any time.

Your personal data may be registered in the Early Detection and Exclusion system of the European Commission (EDES), the new system established by the Commission to reinforce the protection of the Union's financial interests and to ensure sound financial management, in accordance with the provisions of articles 105a and 108 of the revised EU Financial Regulation (FR) (Regulation (EU, EURATOM) 2015/1929 of the European Parliament and of the Council of 28 October 2015 amending Regulation (EU, EURATOM) No 966/2012) and articles 143 - 144 of the corresponding Rules of Application (RAP) (COMMISSION DELEGATED REGULATION (EU) 2015/2462 of 30 October 2015 amending Delegated Regulation (EU) No 1268/2012) for more information see the Privacy statement for the EDES Database.

2 - Participants & contacts

#	Participant Legal Name	Country	Action
1	BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SUPERCOMPUTACION	Spain	

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2 - Administrative data of participating organisations

Future Host Institution

PIC	***Legal name***
999655520	*BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SUPERCOMPUTACION*

Short name: BSC

Address of the organisation

Street Calle Jordi Girona 31

Town BARCELONA

Postcode 08034

Country Spain

Webpage www.bsc.es

Specific Legal Statuses

Research and Innovation legal statuses

Legal person ..... yes

Non-profit ..... yes

International organisation ..... no

International organisation of European interest ..... no

Secondary or Higher education establishment ..... no

Research organisation .....yes

Small and Medium-sized Enterprises (SMEs) .....no

Public body .....yes

Academic Sector ..... yes

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Department(s) carrying out the proposed work

Department 1

Department name: Earth Sciences ☐ not applicable

☐ Same as proposing organisation's address

Street: Jordi Girona, 29

Town: Barcelona

Postcode: 08034

Country: Spain

If the location of the Department carrying out the proposed work is not the same as the location of the Host Institute, please note that although the proposal submission system calculates the budget of the project based on the location of the Host Institute, the budget of the project for the grant agreement will be calculated by using the country coefficient of the location of the Department carrying out the proposed work.

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Researcher

The name and e-mail of the Researcher and Supervisor are read-only in the administrative form, only additional details can be edited here. To give access rights and contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Last Name*	Cvijanovic	Last Name at Birth	Cvijanovic
First Name(s)*	Ivana	Gender*	○ Male ◉ Female
Title	Dr.	Country of residence*	Serbia
Nationality*	Serbia	Nationality 2	
Date of Birth (DD/MM/YYYY)	04/11/1982	Country of Birth*	Serbia
		Place of Birth	Belgrade

Contact address

Current organisation name	N/A		
Current Department/Faculty/Institute/ Laboratory name	N/A		
☐ Same as organisation address			
Street	Vojvodjanska 38		
Postcode/Cedex	21000	Town	Novi Sad
Phone	+38162241453	Country	Serbia
Phone2 / Mobile	+xxx xxxxxxxxx		
E-Mail*	ivanacbegg@gmail.com		

ORCID ID: *If you have a ORCID number please enter it here (e.g. 9999-9999-9999-999X. where 9 represents numbers and X represents numbe*

Researcher ID: *The maximum length of the identifier is 11 characters (ZZZ-9999-2010) and the minimum length is 9 characters (A-1001-2010).*

Other ID	Scopus Author ID	35344689700

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Qualifications

Doctorate Date of (expected) award	Select the exact date (DD/MM/YYYY)	02/05/2012
Doctorate start date	Select the exact date (DD/MM/YYYY)	15/09/2008
University Degree giving access to PHD	Date of award (DD/MM/YYYY)	29/08/2008

Place of activity/place of residence (previous 5 years - most recent one first)

Indicate the period(s) and the country/countries in which you have legally resided and/or had your main activity (work, studies, etc) during the last 5 years up until the deadline for the submission of the proposal.

Please fill in this section without gaps. Short stays (as defined in the Guide for Applicants) shall not be listed in this box.

Period from	Period to	Duration (days)	Country
16/08/2018	12/09/2018	28	Serbia
22/11/2014	15/08/2018	1363	United States
31/08/2014	21/11/2014	83	Serbia
03/08/2014	30/08/2014	28	Denmark
24/04/2013	02/08/2014	466	United States
03/01/2013	23/04/2013	111	Denmark
	Total	2079	

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Proposal ID **844955** *Acronym* **ArcIce4MedRain** *Short name* **BSC**

Supervisor

The name and e-mail of the Researcher and Supervisor are read-only in the administrative form, only additional details can be edited here. To give access rights and contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof. Sex: (•) Male ( ) Female

First name* **Francisco** Last name* **Doblas-Reyes**

E-Mail* **francisco.doblas-reyes@bsc.es**

Position in org.: Earth Sciences Department Director

Department: Earth Sciences

☒ Same as organisation address

Street: Calle Jordi Girona 31

Town: BARCELONA Post code: 08034

Country: Spain

Website: https://www.bsc.es/doblas-reyes-francisco-j

Phone: +34934137719 Phone 2: *+xxx xxxxxxxxx* Fax: *+xxx xxxxxxxxx*

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Dorota	Chmielewska	dorota.chmielewska@bsc.es	*+34 934 134 082*

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3 - Budget

Is the Researcher eligible for family allowance? (•) Yes ( ) No

Participant Number	Organisation Short Name	Country	Country Coefficient	Number of Months	Researcher Unit Cost			Institutional Unit Cost		Total
					Living Allowance	Mobility Allowance	Family Allowance	Research, training and networking costs	Management and Overheads	
1	BSC	ES	0,954	24	111732,48	14400,00	12000,00	19200,00	15600,00	172932,48
Total					111732,48	14400,00	12000,00	19200,00	15600,00	172932,48

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4 - Ethics

1. HUMAN EMBRYOS/FOETUSES		Page
Does your research involve Human Embryonic Stem Cells (hESCs)?	○ Yes ◉ No	
Does your research involve the use of human embryos?	○ Yes ◉ No	
Does your research involve the use of human foetal tissues / cells?	○ Yes ◉ No	
2. HUMANS		**Page**
Does your research involve human participants?	○ Yes ◉ No	
Does your research involve physical interventions on the study participants?	○ Yes ◉ No	
3. HUMAN CELLS / TISSUES		**Page**
Does your research involve human cells or tissues (other than from Human Embryos/ Foetuses, i.e. section 1)?	○ Yes ◉ No	
4. PERSONAL DATA		**Page**
Does your research involve personal data collection and/or processing?	○ Yes ◉ No	
5. ANIMALS		**Page**
Does your research involve animals?	○ Yes ◉ No	
6. THIRD COUNTRIES		**Page**
In case non-EU countries are involved, do the research related activities undertaken in these countries raise potential ethics issues?	○ Yes ◉ No	
Do you plan to use local resources (e.g. animal and/or human tissue samples, genetic material, live animals, human remains, materials of historical value, endangered fauna or flora samples, etc.)?	○ Yes ◉ No	
Do you plan to import any material - including personal data - from non-EU countries into the EU?	○ Yes ◉ No	
Do you plan to export any material - including personal data - from the EU to non-EU countries?	○ Yes ◉ No	
In case your research involves low and/or lower middle income countries, are any benefits-sharing actions planned?	○ Yes ◉ No	
Could the situation in the country put the individuals taking part in the research at risk?	○ Yes ◉ No	
7. ENVIRONMENT & HEALTH and SAFETY		**Page**

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Does your research involve the use of elements that may cause harm to the environment, to animals or plants?	◯ Yes ◉ No	
Does your research deal with endangered fauna and/or flora and/or protected areas?	◯ Yes ◉ No	
Does your research involve the use of elements that may cause harm to humans, including research staff?	◯ Yes ◉ No	
8. DUAL USE		Page
Does your research involve dual-use items in the sense of Regulation 428/2009, or other items for which an authorisation is required?	◯ Yes ◉ No	
9. EXCLUSIVE FOCUS ON CIVIL APPLICATIONS		Page
Could your research raise concerns regarding the exclusive focus on civil applications?	◯ Yes ◉ No	
10. MISUSE		Page
Does your research have the potential for misuse of research results?	◯ Yes ◉ No	
11. OTHER ETHICS ISSUES		Page
Are there any other ethics issues that should be taken into consideration? Please specify	◯ Yes ◉ No	

I confirm that I have taken into account all ethics issues described above and that, if any ethics issues apply, I will complete the ethics self-assessment and attach the required documents. ☒

How to Complete your Ethics Self-Assessment

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5 - Call specific questions

Eligibility Researcher (future fellow)

1. Were you in the last 5 years in military service? ○ Yes ◉ No

2. Did you spend time on procedures for obtaining refugee status (according to the 1951 Geneva Refugee Convention and the 1967 Protocol) in a Member State or Associated Country? ○ Yes ◉ No

3. Were you out of research for a continuous period of at least 12 months within the 18 months prior to the deadline for submission of proposals? ◉ Yes ○ No

Period of inactivity in research:

From (DD/MM/YYYY) 21/09/2016 To (DD/MM/YYYY) 01/11/2018 Duration (days) 772

Nature of activities during this period in order to confirm research inactivity:

I was on medical, maternity and medical caregiver's leave from September 21 2016 to May 01 2018. I have terminated my employment on May 14 2018 and have been unemployed to the date of submission.

Other Questions

1. For communication purposes only, the European Commission REA asks for permission to publish the name of the researcher (future fellow) should the proposal be retained for funding. Does the researcher (future fellow) give this permission? ◉ Yes ○ No

2. Some national and regional public research funding authorities run schemes to fund MSCA applicants that score highly in the MSCA evaluation but which cannot be funded by the MSCA due to their limited budget. In case this proposal could not be selected for funding by the MSCA, do the researcher and supervisor consent to the European Commission disclosing to such authorities the results of its evaluation (score and ranking range) together with their names and contact details, non-confidential proposal title and abstract, proposal acronym, and host organisation? ◉ Yes ○ No

3. Is there a secondment in Member States or Associated Countries envisaged in Part B of this proposal? ○ Yes ◉ No

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Extended Open Research Data Pilot in Horizon 2020

If selected, applicants will by default participate in the Pilot on Open Research Data in Horizon 2020[1] , which aims to improve and maximise access to and re-use of research data generated by actions.

However, participation in the Pilot is flexible in the sense that it does not mean that all research data needs to be open. After the action has started, participants will formulate a Data Management Plan (DMP), which should address the relevant aspects of making data FAIR – findable, accessible, interoperable and re-usable, including what data the project will generate, whether and how it will be made accessible for verification and re-use, and how it will be curated and preserved. Through this DMP projects can define certain datasets to remain closed according to the principle "as open as possible, as closed as necessary". A Data Management Plan does not have to be submitted at the proposal stage.

Furthermore, applicants also have the possibility to opt out of this Pilot completely at any stage (before or after the grant signature). In this case, applicants must indicate a reason for this choice (see options below).

Please note that participation in this Pilot does not constitute part of the evaluation process. Proposals will not be penalised for opting out.

We wish to opt out of the Pilot on Open Research Data in Horizon 2020.	○ Yes	◉ No

Further guidance on open access and research data management is available on the participant portal: http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-dissemination_en.htm and in general annex L of the Work Programme.

[1] *According to article 43.2 of Regulation (EU) No 1290/2013 of the European Parliament and of the Council, of 11 December 2013, laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" and repealing Regulation (EC) No 1906/2006.*

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1. Excellence

1.1 Quality and credibility of the research/innovation project; level of novelty, appropriate consideration of inter/multidisciplinary and gender aspects

1.1.1 Introduction and problem background

According to the Köppen-Geiger climate classification scheme[1] the Mediterranean Basin and California represent the two largest 'Mediterranean climate' zones in the Northern hemisphere. Regions featuring the Mediterranean climate are defined by cool, wet winters and hot, dry summers, and are typically located underneath the poleward edges of the Hadley circulation in the subtropics, in zones of predominantly descending flow. The rainfall over these areas is influenced by both tropical and mid-latitude atmospheric circulation changes and, as such, is subject of large inter-model spread in projections of future precipitation changes[2-4]. Future planning and adaptation efforts over these highly populated regions in response to global climate change are hindered by the fact that the state-of-art model simulations disagree regarding the magnitude (and often even the sign) of future precipitation changes[4].

One possible cause of these inter-model discrepancies is that some climate models underestimate the magnitude of the Arctic sea-ice loss observed over the satellite era. The applicant's recent work has shown that the erroneous representation of future sea-ice changes in climate models could affect the accuracy with which subtropical precipitation changes are simulated[5]. However, this study investigated links between the Arctic and the western United States only, and while demonstrating that sea-ice loss also induces precipitation changes over the Mediterranean region, the physical processes behind that teleconnection have not been investigated and, in general, are not well understood.

This project will investigate the physical links between Arctic sea-ice loss and Mediterranean rainfall. It will employ the state-of-the-art sea-ice simulations developed by the applicant to investigate sea-ice induced drivers of California's rainfall, reinforced by a suite of multi-model simulations from a range of international projects the host institution participates in. The physical mechanisms and teleconnections identified in the first part of this project and in the study by Cvijanovic et al. (2017)[5], will further be used to define a physically based framework for selection of the less reliable model projections within the ongoing Climate Model Intercomparison Project Phase 6 (CMIP6)[6]. By defining these criteria, this project will reduce the range of projected precipitation changes over the two study regions. Finally, the improved understanding of sea-ice induced atmospheric teleconnections will be combined with the expertise in climate prediction within the host institution to improve decadal climate predictions.

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. Ideally, model predictions of the conditions expected in the coming decades would be employed to plan infrastructure and policy methods of adaptation. However, large disagreements in the future projections of Mediterranean and Californian rainfall changes are delaying accurate assessments of climate change impacts over these areas. This project will provide a 'tighter' range of possible outcomes for densely populated regions such as the Mediterranean Basin and California - a result that is beneficial both scientifically and societally.

1.1.2. 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[7,8]. Between 1950 and 2004, total winter precipitation 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[9]. Prolonged dryness, in combination with high summer temperatures, increases the danger of wildfires[10], and is suspected to have contributed to the extreme wildfire seasons of 2016 and 2017 on the Iberian

1. Kottek, M et al (2006) Met. Zeitschr. 15 259-263. **2.** Knutti, R and Sedláček, J (2012) Nat. Clim. Change 3(4): 369–373. **3.** Neelin, JD, et al. (2013) J. Clim. 26, 6238–6256. **4.** Polade, SD, et al. (2017) Scientific Reports 7, 10783. **5.** Cvijanovic, I., et al., (2017) Nat. Comm. 1947, 10.1038/s41467-017-01907-4. **6.** Eyring, V, et al. (2016) Geosci. Model Dev., 9, 1937–1958. **7.** Giorgi, F (2006) Geophys. Res. Lett. 33 (L08): 707. **8.** Diffenbaugh, NS and Giorgi F (2012) Clim. Change 114: 813–822. **9.** Seager, R., et al. (2014) J. Clim. 27, 4655–4676. **10.** Turco, M, et al. (2017) Scientific Reports 7 (81).

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Peninsula. Model simulations of historical climate are unable to accurately capture the recent decline in winter precipitation over the Mediterranean (Fig. 1).

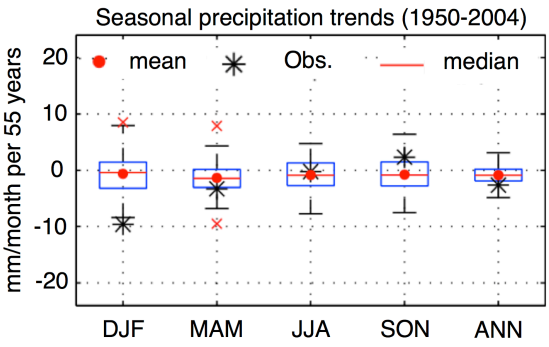

Fig. 1: Seasonal precipitation trends over the Mediterranean region (1950-2004): comparison of observed (Global Precipitation Climatology Centre) and simulated (23 model ensemble mean of historical simulations from Coupled Model Intercomparison Project Phase 5) values. The 25th and 75th percentiles of the model distributions are shown by the edges of the boxes, 0.35% and 99.65% range by whiskers (from Kelley et al. 2012)[11].

California's winter precipitation has also shown a decreasing trend over the last two decades[12] and between 2012 and 2016, California entered into one of the most severe droughts on record[13]. The recent California drought caused statewide emergency water restrictions, depletion of drinking water supplies, reduction in groundwater levels, and fallowing of thousands of acres of farmland resulting in significant loss of agricultural jobs and revenue[14]. Climatological assessment of the recent drought indices indicates that record high temperatures have magnified the effects of the lack of precipitation[15], suggesting that as the Earth warms through anthropogenic climate change, severe droughts are expected to become more common. Moreover, as was the case with the Mediterranean Basin, the present day winter precipitation decrease over California is not reproduced in coupled model simulations of historical climate[16].

The Mediterranean Basin and California both suffer from large inter-model disagreements in terms of the magnitude (and even the sign) of future precipitation changes (see Fig. 2). In general, model projections agree that the Mediterranean Basin will undergo further drying in the future, although the amount of projected drying largely varies between the models. Over California, the inter-model spread encompasses both positive and negative projections of future rainfall changes over the wet season. This results in a multi-model mean that is close to zero, and a large envelope of uncertainty.

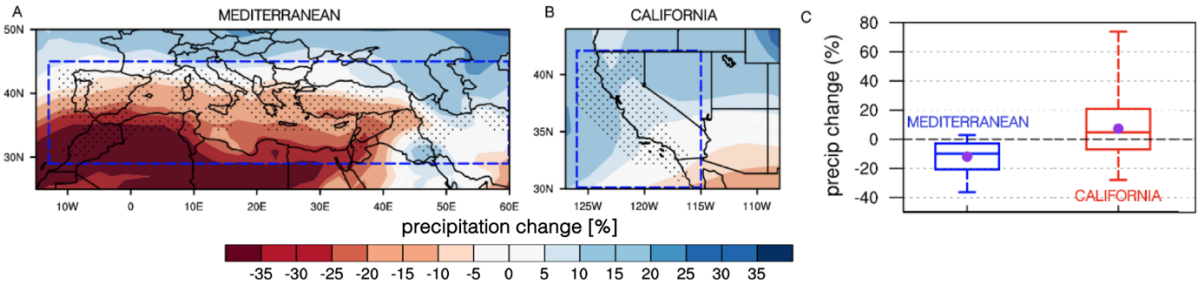

Fig. 2: Model projections of winter precipitation changes over Mediterranean and California under *business as usual* scenario (2060–2089 minus 1960–1989) using the 30-model ensemble. (**A**), (**B**) multi-model ensemble mean, (**C**) area average over the Mediterranean and Californian climate grids (stippled regions shown in A and B); circles - multi-model mean; horizontal line - median; box - the interquartile range; whiskers - 99% range (from Polade et al. 2017)[4].

The delicate balance between tropical and mid-latitude influences, makes future rainfall changes over the Mediterranean Basin and California very challenging to model. For example, with global warming, tropical circulation is expected to undergo several 'modes' of changes, all of which are capable of affecting rainfall in the subtropical regions. Hadley circulation has widened in recent decades[17] and is projected to continue to widen in the future due to the combined influence of global

11. Kelley, C, et al, (2012) Geophys. Res. Lett., 39, L21703. **12.** Lukovic et al. 2018 Geophys. Res. Abstracts 20, EGU2018-883: https://meetingorganizer.copernicus.org/EGU2018/EGU2018-883.pdf. **13.** Diffenbaugh, NS, et al. (2015) Proc. Natl Acad. Sci. USA 112, 3931–3936. **14.** Howitt, RE et al (2015) Economic Analysis of the 2015 Drought, University of California Davis, Davis, CA, 16 pp. **15.** Williams, AP, et al. (2015) Geophys. Res. Lett. 42(16): 6819–6828. **16.** Seager, R., et al. (2012) Nat. Clim. Change 3, 482–486. **17.** Hu, Y, and Fu, Q (2007) Atmos. Chem. Phys. 7, 5229-5236.

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warming and decreased temperature gradients between the tropics and mid-latitudes[18,19]. Hadley cell widening manifests itself over the Mediterranean Basin through increased subsidence and stronger anticyclonic conditions leading to a decrease in precipitation[20]. 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[21-23]. Changes in the atmospheric moisture content and moisture convergence are expected to intensify the amount of precipitation generated by the cyclones[9]. With warming temperatures, factors such as increased subsidence and stronger cyclones are expected to have opposing impacts that could, for example, manifest in a decreased number of cyclones but an increased amount of precipitation carried by each cyclone[24]. 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[25,26].

During the boreal winter, as the Hadley circulation weakens and shifts southward, the subsidence across the northern hemispheric subtropical regions decreases. This seasonal weakening of the subsidence strength clears the path for mid-latitude influences and arrival of the precipitation rich storms. In general, mid-latitude regions are expected to become wetter with global warming - a consequence of increased specific humidity and water vapour transport from the lower latitudes[27]. However at regional scales, mid-latitude precipitation is driven by other factors, such as troposphere-stratosphere interactions, sea surface temperature, sea-ice and storm track changes, that are all challenging to model[28]. Decreased temperature gradients between the northern mid-latitudes and the pole have been linked to increased westerly wind strengths[29-31] and have been suggested to result in a 'wavier' jet and/or more blocking events[5,29]. This type of scenario would result in mid-latitude changes that are not zonally uniform but show strong regional variability.

While the differences between simulated and observed precipitation changes over the Mediterranean Basin and California are likely at least in part a consequence of the different expression of internal or forced variability in the 'real' and 'model' worlds, recent work has revealed at least one factor contributing to the erroneous prediction of future precipitation changes in the subtropics: the incorrect representation of sea ice changes in climate models[5]. In their recent study, Cvijanovic et al. (2017)[5] demonstrated that Arctic sea-ice loss, 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. The high latitude sea-ice loss affects both high-to-low latitude temperature gradients as well as the interhemispheric temperature gradients. Moreover, several modeling studies have shown that sea ice changes also affect the amount of tropical warming in response to the greenhouse gas forcing[30,32]. As discussed above, all of these factors can contribute to changes in tropical and mid-latitude circulations thus affecting the precarious balance of their influences over subtropical regions. Inspired by this intricate web of atmospheric influences linking geographical regions that otherwise stand very far apart, this project will seek to disentangle some of the impacts arising from the dramatic loss in Arctic sea-ice cover and provide a new insights into the interconnectedness of our planet's changing climate.

1.1.3. Project Overview and Key Objectives

This project aims to improve understanding of sea-ice induced atmospheric teleconnections into the subtropics and to apply this knowledge to decrease the uncertainties in projections and predictions of rainfall changes. Current model limitations in simulating future precipitation changes over highly populated regions like the Mediterranean and California make the standard approach of

18. Lucas, C, et al. (2014) Wiley Interdiscip. Rev.: Clim. Change 5, 89-112. **19.** Adam, O., et al. (2014) J. Clim. 27, 7450–7461. **20.** Giorgi, F and Lionello, P (2008) Global Climate Change, 63, 90–104. **21.** Held, IM and Soden, BJ (2006) J. Clim., 19(21), 5686–5699. **22.** Seo, K-H, et al. (2014) Geophys. Res. Lett., 40, 5251–5258. **23.** Lau, WKM, Kim, K.-M (2015) Proc. Natl. Acad. Sci. USA 112, 3630–3653. **24.** Zappa, G, et al. (2015) Clim. Dyn. 45: 1727-1738. **25.** Chiang, JCH and Friedman, AR (2012) Annual Reviews of Earth and Planetary Sciences, 40, 383-412. **26.** Schneider, T et al. (2014) Nature 513, 45–53. **27.** Collins, M, et al. (2013) Climate Change 2013: The Physical Science Basis, T. F. Stocker et al., Eds., Cambridge University Press, 273–309. 28. Fereday, D, et al. (2018) J. Clim., 31,963–977. 29. Francis, J., and Vavrus, S., (2012) Geophys. Res. Lett. https://doi.org/10.1029/2012GL051000. **30.** Cvijanovic, I, Caldeira, K, (2015) Clim. Dyn., 44, 1173–1186. **31**. Pedersen , R., et al. (2016) J. Clim. 29, 889-902. **32.** Hall, A (2004) J. Clim. 17.1550–1568.

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treating every model equally disadvantageous, and an additional physical criteria for selecting and weighting the models is needed to minimize the model spread. Better understanding of the atmospheric linkages between the Arctic and the subtropics will allow us to define such physical criteria and select the 'best' model projections in order to narrow the range of projected changes. As a final goal, the inferred mechanisms will be employed towards improving multi-annual and decadal predictions of Mediterranean rainfall.

This project is organized into three complementary objectives:

1. *Understanding the links between high latitude sea-ice loss and Mediterranean rainfall:* 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.
2. *Decreasing the uncertainties in climate projections of future rainfall changes over the Mediterranean and California:* investigate whether the large intermodel spread in simulations of 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 the applicant's previous work[5].
3. *Determining the impact of 'sea-ice' on decadal and multi-annual predictions of Mediterranean rainfall:* analyze decadal and multi-annual climate predictions to explore whether a realistic initialization of sea-ice conditions and sea-ice driven atmospheric processes can help increase the predictive skill of precipitation changes over the Mediterranean region.

1.1.4. Methodology and approach

The project will rely on three Work Packages (WPs), each addressing one of the main objectives:

WP1. The baseline simulations used to accomplish Objective 1 in WP1 are the perturbed sea-ice physics parameter simulations (PSIPPS) described in Cvijanovic et al. (2017)[5] (**Task 1.1**). 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 sea-ice loss by imposing artificial energy flux anomalies in the high latitudes, the PSIPPS setup employs sea-ice physics parameter perturbations that allow for energy budget conservation. This ensures that the observed atmospheric response 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 *only within their respective expert-defined ranges,* in order to achieve the sea-ice loss in a manner that is in accordance with physical laws. Because the focus of PSIPPS simulations was the fast (decadal-scale) atmospheric response, and in order to allow for faster computation, this setup does not account for deep ocean dynamics. The PSIPPS simulations will be complemented by two additional sets of specialized simulations: multi-model altered sea-ice albedo simulations and nudged sea-ice simulations from the two H2020 projects, APPLICATE and PRIMAVERA, that the host institute, Barcelona Supercomputing Center (BSC) currently participates in (**Task 1.2**). While these simulations do not utilize as advanced methods for isolating the impacts of sea-ice loss (e.g. the imposed sea-ice albedo alterations are unphysical and do not allow isolation of the full spectrum of sea-ice impacts), they will allow for: a) a multi-model analysis; and b) investigation into the potential impacts of ocean dynamics and a better understanding of the timescales at which the sea-ice induced deep ocean response may affect the atmospheric response. **Tasks 1.1** and **1.2** will complement each other and allow for the robust assessment of propagation of Arctic changes into the Mediterranean region.

WP2. Investigations of sea-ice induced teleconnections (**Tasks 1.1 and 1.2**) will provide the foundation for WP2, aimed at narrowing the uncertainties in climate projections of future rainfall changes over the Mediterranean Basin and California. In order to determine how the representation of Arctic sea-ice cover and sea-ice-induced teleconnections affect the intermodel spread, WP2 will focus on the analysis of the simulations of historical climate and future projections from the CMIP6 initiative[6] and the high-resolution simulations from the H2020 PRIMAVERA project (following the HighResMIP protocol[33]). **Task 2.1** will employ a number of sea-ice indices describing the total and

33. Haarsma, RJ et al. (2016) Geosci. Model Dev. 9, 4185-4208.

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sectorial (e.g., Pacific vs. Atlantic) sea-ice cover loss to test how their intermodel spread is linked to the intermodel spread in Mediterranean and California rainfall (respectively). Following this, the same analysis will be repeated using the atmospheric indices describing sea-ice induced teleconnections (**Task 2.2**). For example, in case of California, these indices will include the atmospheric variables important for the two-step teleconnection described by Cvijanovic et al. (2017)[5]: tropical pacific outgoing longwave radiation changes, North Pacific geopotential anomalies and stream function anomalies over the Pacific sector. In **Task 2.3**, the identified teleconnections will be evaluated using the observational and reanalysis data from: ERA-Interim[34] and JRA-55[35], the Global Precipitation Climatology Project (GPCP)[36], and sea ice concentrations from the National Snow and Ice Data Centre (NSIDC)[37]. Newly compiled observational data sets of Mediterranean precipitation[12] will also be made available for the needs of this project through a collaboration the candidate will establish with the University of Belgrade. The model projections that perform the best at simulating both the sea-ice changes and the sea-ice induced teleconnections over the historical period will be selected. **Task 2.3** will then serve as a basis for further selection of the future projections (**Task 2.4**), that will be additionally constrained by the existing estimates of future sea-ice changes[38].

WP3. This final work package will assess the importance of accurate representation of sea-ice cover and sea-ice induced teleconnections on Mediterranean rainfall in a context of decadal and multi-annual climate predictions. An evaluation of the predictive skill of precipitation over the study region will be first performed with the EC-Earth model[39], by analyzing the experiments contributing to the Decadal Climate Prediction Project (DCPP) protocol A[40] and the equivalent but higher model resolution experiments performed within the context of the European H2020 project EUCP (that BSC is a part of) (**Task 3.1)**. The comparison between these two sets will determine if increased resolution improves the representation of sea-ice cover and the relevant teleconnection mechanisms and if this translates into an increased skill in Mediterranean rainfall prediction. To further isolate and confirm the role of representation of sea-ice cover and sea-ice induced atmospheric teleconnections on the predictability of the Mediterranean rainfall, the analysis will be extended with a new set of forecasts using initial conditions in which sea-ice concentrations are not assimilated (**Task 3.2)**. By employing different types of 'degraded' initial conditions for the sea-ice model, **Task 3.2** will improve understanding of the importance of accurate representation of sea-ice cover over different ocean basins. WP3 will benefit from the-long standing experience in climate prediction of the host institution (BSC). In particular, the diagnostics in **Tasks 3.1** and **3.2** will be carried out using the unique collection of statistical tools for climate prediction "s2dverification"[41] developed and maintained by the BSC's Earth System Services team.

1.1.5 Novelty

While the influence of Arctic sea-ice loss on mid-latitude weather has been widely discussed[42-44], evidence implicating sea-ice decline in shaping the weather and climate of the Mediterranean Basin is only beginning to emerge[5,45] and is not well understood. The state-of-the art perturbed sea-ice physics ensemble and the specialized multi-simulations from the APPLICATE and PRIMAVERA projects will provide a unique and comprehensive tool to investigate the remote impacts of Arctic sea-ice changes, providing insights into atmospheric linkages unrecognized thus far. Importantly, the project will consider impacts on multi-annual and decadal time scales, as opposed to the majority of existing literature focusing on the long-term (i.e., centennial) impacts of Arctic sea-ice loss, providing relevancy in terms of climate policy and adaptation. By successfully determining whether differences in model simulations of precipitation changes over California and the Mediterranean Basin can, in part, be explained by differences in representation of sea-ice loss and sea-ice induced teleconnections, the tools developed in this project have the potential to be a 'game-changer' for climate model

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34. Dee, DP, et al. (2011) Quart. J. Roy. Met. Soc.137: 553-597. **35.** Ebita, A, et al (2011) SOLA, 7, 149-152. **36.** Adler, RF, et al. (2003) J. Hydromet. 4,1147-1167. **37**. 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. **38.** Overland, JE and Wang, M (2013) Geophys. Res. Lett. 40, 2097–2101. **39**. Hazeleger, W., et al. (2011) Clim. Dyn. 39, 2611-2629. **40**. Boer, G J, et al. (2016) Geosci. Model Dev., 9, 3751-3777. **41.** Manubens N, et al. (2018) Environ. Model. Softw., doi:10.1016/j.envsoft.2018.01.018. **42.** Vihma, T (2014) Surv. Geophys., 35, 1175–1214. **43**. Koenigk, T, et al., (2015) Clim Dyn. 46, 317-337. **44**. García-Serrano J and Frankignoul C (2015) Clim Dyn. 47,1601-1612. **45.** Grassi B, et al. (2013) J Clim. 26:10101–10110.

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analysis and development. Finally, improving the real-time decadal forecasts through the novel approach proposed in this project could mark a first step towards a multi-annual forecast of Mediterranean rainfall – a longstanding and highly desired outcome, both scientifically and societally.

1.1.6 Interdisciplinary aspects

The proposed project combines the applicant's expertise in atmospheric dynamics and teleconnections with those of the host group in climate prediction and seasonal forecasting. Successful completion of the project will directly benefit the efforts of strengthening the climate resiliency of the study regions, leading to multiple interdisciplinary exit strategies within the socio-economic sector. For example, the proposed analysis could potentially be extended to assess the predictability of additional societally important variables (e.g. water supply and crop safety) through integrative modelling. This could be accomplished in collaboration with BSC's Earth System Services team. Deeper understanding of the role of sea-ice induced atmospheric changes will provide invaluable information for global climate model development. This would lead to further collaborations with the BSC's Computation Earth Science group in developing and tuning the EC-Earth model.

1.2 Quality and appropriateness of the training and of the two way transfer of knowledge between the researcher and the host

The candidate's research curriculum will be enriched by BSC's proficiency in seasonal and decadal climate predictions. This will help increase her scientific versatility and provide exciting new avenues in which to apply her existing expertise. In order to help the candidate transition into an expert in climate prediction, BSC will provide her with the training and guidance needed to employ the in-house set of statistical tools for climate prediction[40], developed and maintained by the Earth Sciences department. Moreover, in close collaboration with the Earth System Services team, BSC will provide support for developing additional diagnostic tools for the identification of sea-ice induced teleconnections.

The candidate will benefit from BSC's strong network of European partners and research projects. For the needs of proposed project, the applicant will be provided with the simulations from BSC's H2020 partner projects: APPLICATE, PRIMAVERA and EUCP. The multi-model analysis envisioned by the project will require substantial storage capacities while several proposed tasks (e.g., atmospheric indices diagnostics in WP1 and EC-Earth model simulations in WP3) are expected to be computationally expensive. BSC's supercomputing resources and expertize will be made available to fully support these needs. Finally, the candidate's modeling skills will also be strengthened through the opportunity to employ the EC-Earth climate model (as opposed to the National Center for Atmospheric Research's models she has used thus far).

The candidate's expertize in atmospheric dynamics and remote impacts of Arctic sea-ice changes is complementary to the current scientific goals and targets of the host institution: BSC's Climate Prediction Group is expanding to investigate the impacts of sea-ice loss. The proposed project will not only strengthen this initiative but also position BSC as one of the leaders in the field. A number of high-impact publications are expected to result from this work, leading to an increased scientific versatility and visibility for both the candidate and the host institution.

Through her ongoing collaboration with Lawrence Livermore National Laboratory, the candidate will bring to BSC a set of state-of-the-art perturbed sea-ice physics simulations[5] that will allow exploration of sea-ice induced teleconnections in a unique setup that is both physical and energy conserving (see Section 1.1.4). Importantly, this setup, initially developed for the Community Earth System Model (CESM), has the potential to be re-developed for use with the EC-Earth climate model thus expanding the methods for isolation of sea-ice impacts available at BSC. The candidate will also foster other collaborations of benefit to BSC. In particular, collaboration with prof. John Chiang at the University of California, Berkeley will provide additional expertize in atmospheric dynamics and collaboration with Dr. Jelena Lukovic at the University of Belgrade will provide access to new, comprehensive datasets of the observed and modeled rainfall over the Mediterranean region.

Since the candidate already has an established network of US based collaborators who will support this project through their expertize in climate model intercomparison and climate dynamics, shorter research visits to other institutions (instead of secondments) are suggested. This will allow the candidate to maximize her exposure to BSC's climate prediction expertize. However, it also affords the opportunity to expand her scientific network by interacting closely with BSC's European

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collaborators while maintaining her existing relationships.

1.3 Quality of the supervision and of the integration in the team/institution

The candidate will work under the direct supervision of Prof. Francisco Doblas-Reyes, head of the Earth Science (ES) department at BSC. Prof. Doblas-Reyes is an expert in seasonal-to-decadal climate predictions – a field that is highly relevant for this project proposal. He has more than 20 years of experience in weather and climate modelling, climate prediction and development of climate services, and over 100 peer-reviewed publications. He is currently member of several international scientific committees, including the Working Group on Seasonal-to-Interannual Prediction, the Decadal Climate Prediction Panel of the World Climate Research Program, and the European Network for Earth System Modelling. He was the lead author of Chapter 11 of the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), and is designated Coordinating lead author of Chapter 10 in the 6th Assessment Report. For his work in seasonal forecasting at the European Center for Medium-Range Weather Forecasts (ECMWF), Prof. Doblas-Reyes was awarded the Norbert Gerbier-Mumm Award by the World Meteorological Organization. Prof. Doblas-Reyes has supervised numerous post-doctoral fellows since becoming head of the department and is currently supervising 4 Marie Skoldowska-Curie Individual Fellowship holders (DPETNA (655339), INCLIDA (275505), CLIM4CROP (740073) and SPFireSD (748750). He also currently participates in a number of FP7 and H2020 projects (SPECS, EUCP, PRIMAVERA), C3S contracts as well as several national projects.

The candidate will carry out her work within the ES department's **Climate Prediction group** and in collaboration with the **Earth System Services** group. The Climate Prediction group carries out advanced research in regional and global scale seasonal-to-decadal climate forecasting. It is a highly productive scientific environment that has published more than 150 peer-reviewed research articles over the last 5 years. The Earth System Services (ESS) group aims to provide relevant climate information to end users in key societal sectors, including energy, urban development, infrastructure, and transportation. Due to the high level of alignment between the goals of the ESS and the proposed project deliverables (e.g. improved climate projections and predictions of Mediterranean rainfall), multiple exit strategies involving the ESS group are expected.

The project supervisor will help the candidate develop an individual career plan, tailoring it to ensure she transitions into an independent researcher by the end of the fellowship. Scientific progress will be discussed via organized weekly meetings, with review and planning meetings occurring on a quarterly basis. Opportunities for participation in specialized workshops and those covering topics such as intellectual property, scientific communication, and proposal writing will be offered throughout the course of fellowship. Other training activities available at BSC include: methods for data assimilation, initialization, bias correction and calibration; efficient data post-processing and visualization; statistical programming and high performance computing; and project management.

Additional supervision and expertize in climate prediction from Dr. Pablo Ortega and Dr. Markus Donat, the leaders of the Climate Prediction group, will also be made available to the candidate. The applicant will benefit from the highly collaborative environment in the department through their regular group, and monthly departmental, meetings as well as through various internal scientific seminars. The candidate will be encouraged to present her work at the internal seminars in order to foster her integration into the research team and improve her visibility within the department.
Hosting arrangements: The applicant will be provided access to a personal workstation, personal computer and high performance computing facilities and other infrastructure available to BSC's employees. The candidate will benefit from the projects that BSC is involved in and will be exposed to many networking opportunities. In particular, BSC's participation in MEDSCOPE and MEDCOF projects aimed at improving climate forecasts over the Mediterranean regions will be utilized to further disseminate the project results. Other opportunities for collaboration and dissemination at the international level will include BSC's H2020 APPLICATE and PRIMAVERA projects.

1.4 Potential of the researcher to reach or re-enforce professional maturity/independence during the fellowship

After accumulating almost 4 years of postdoctoral experience in the US in 2016, and being awarded a 3-year research grant (~0.5 million USD/year) at Lawrence Livermore National Laboratory (LLNL), the candidate was primed to make the transition into a successful independent researcher.

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However, the applicant experienced a sudden and unexpected career break that involved a combination of medical, maternity and medical-caregiver's leave. The chance to join BSC as a Marie Skłodowska-Curie fellow will provide the candidate with an excellent opportunity to resume her original career path. Over the course of the fellowship, she will strengthen her professional, personal and leadership skills both through specialized courses and hands-on experience. The candidate will build on her previously established expertize in climate dynamics and impacts of Arctic sea-ice loss while also developing new competencies in climate prediction, resulting in a new research avenue at BSC. She will be encouraged and supported in maintaining her existing research collaborations at the University of California Berkeley and LLNL and introduced into a network of European research centers through a number of European projects (APPLICATE, PRIMAVERA, EUCP, MEDSCOPE). She will also be offered the opportunity to supervise PhD and MSc students in order to further strengthen her teaching skills. The candidate has so far authored and co-authored 16 publications that have resulted in over 800 citations and extensive media coverage; the proposed research project is expected to result in several high impact publications that will help her both re-establish and further enhance her international research presence.

2. Impact

2.1 Enhancing the future career prospects of the researcher after the fellowship

Through the expected publications and international collaborations, the proposed project will help Dr. Cvijanovic re-establish herself as an internationally recognized researcher. In conjunction with the high prestige of the fellowship, this will put her in an excellent position to apply for national and international research grants, allowing her to start to build her own research group towards the end of the project. Mentoring and supervision of MSc and PhD level students will enhance her academic prospects, allowing her to consider professorships at universities as well as positions in research institutions.

The successful completion of the proposed project will result in multiple societal applications. Improved prediction of precipitation changes on annual and decadal scales is a highly desirable outcome for developing climate services and forecasts to relevant government and private entities, as well as improving understanding of the societal impacts of climate change. As such, this project will not only help increase the candidate's scientific versatility, but also place her at the forefront of the application of these new methods towards climate adaption and climate risk assessment. Likewise, since the project deliverables represent actionable climate information that is significant for public stakeholders and decision makers, this will allow the candidate to expand her professional network within the public sector too.

2.2 Quality of the proposed measures to exploit and disseminate the project results

The proposed project is expected to result in several high impact publications. The successful completion of WP1 will result in a paper describing the remote drivers of precipitation changes over the Mediterranean Basin. The analysis in WP2 and WP3, will provide a physically based framework for reducing the uncertainties in global climate model projections of future precipitation changes over the Mediterranean and California (two papers) and improving the skill in climate predictions of rainfall over the same regions (one paper), respectively.

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 and CLIVAR meetings and workshops.

Since the outcomes of the proposed project are of substantial relevance to APPLICATE, PRIMAVERA and MEDSCOPE projects, their dissemination resources will be utilized in order to maximize public impacts. These projects feature work packages dedicated to user engagement activities (including regular meetings with representatives from the main stakeholder groups) and provide support for the material production, communication and dissemination.

2.3. Quality of the proposed measures to communicate the project activities to different target audiences

Arctic sea-ice cover is currently undergoing unprecedented changes, and is a highly discussed topic within the climate community. At the same time, both the Mediterranean and California represent 'uncertainty hotspots' in terms of future climate projections of rainfall. By linking these two

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research topics, the project outcomes are expected to be of wide societal interest. The candidate has substantial experience in communicating research results to journalists, scientific writers, and educational programs and will continue to share published research within this established network and beyond. With each scientific publication, the candidate will prepare press releases, fact sheets for journalists and simple figures that are accessible to the general public. BSC's Project Dissemination Unit will further assist the candidate in communicating the project results and producing visualization material. The material will be made available on the BSC website and shared using its official social media platforms. All publications will be deposited in UPCommons in order to guarantee their long-term preservation and free accessibility. The project results will also be disseminated to the Sea Ice Action Network (aimed at communicating and advancing public awareness on the consequences of Arctic sea-ice loss) that the candidate is a member of.

Upon joining the BSC, the candidate will start participating in 'MareNostrum Open Days' aimed at communicating science to a general audience. In addition, given previous successful public outreach activities at the California Academy of Sciences, in San Francisco, amongst others, the candidate will seek to collaborate with similar public entities focused on biological conservation (e.g., Barcelona Natural History Museum, Barcelona Aquarium and Zoo) to organize public lectures that would introduce the concepts of climate change in the Arctic and its global consequences. These lectures are expected to commence in the second year of the project.

3. Quality and Efficiency of the Implementation

3.1 Coherence and effectiveness of the work plan, including appropriateness of the allocation of tasks and resources

Work Packages (WP):
WP1: Understanding the links between high latitude sea-ice loss and Mediterranean rainfall
WP2: Decreasing the uncertainties in climate projections of future rainfall changes
WP3: Determining the impacts of accurate representation of sea-ice cover on decadal and multi-annual predictions of Mediterranean rainfall

month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
WP1	Task 1.1: PSIPPS analysis						Task 1.2: multimodel analysis				WP1 write up													
WP2									Task 2.1: intermodel spread analysis: sea-ice indices				Task 2.2: intermodel spread analysis: atmospheric indices			Task 2.3: Obs. analysis & historical simulations selection			Task 2.4: Future projections selection			WP2 write up		
WP3																	Task 3.1: Impacts of model resolution				Task 3.2: Impacts of sea-ice model initialization			
Milestones	0 1.1					1.2			2.1	1.3		2.2			2.3		3.1	2.4		3.2	2.5			3.3
Deliverable												0.1	1.1								2.1		2.2	3.1 0.2
Research Visits											R1+R2					R3								

Deliverables (D): D0.1: First year project report; **D1.1**: Manuscript draft on the influence of Arctic sea-ice loss on Mediterranean rainfall; **D2.1, D2.2**: Manuscripts drafts on how the representation of Arctic sea-ice cover and sea-ice-induced teleconnections affect the intermodel spread of rainfall over California (**D2.1**) and Mediterranean Basin (**D2.2**); **D3.1**: Assessment of the role of representation of sea-ice changes and sea-ice induced teleconnections on the skill with which the Mediterranean rainfall is predicted; **D0.2**: Second year project report.

Milestones (M): M0: Career Development Plan drafted; **M1.1**: PSIPPS, APPLICATE and PRIMAVERA experiments downloaded; **M1.2**: PSIPPS analysis completed; **M1.3**: APPLICATE and PRIMAVERA experiments analysis completed. **M2.1**: selected variables from CMIP6 downloaded, available observational and reanalysis data gathered; **M2.2**: analysis of sea-ice indices completed; **M2.3**: analysis of atmospheric indices of sea-ice induced teleconnections completed; **M2.4-2.5**: selection of 'best performing' historical simulations (**M2.4**) and future projections (**M2.5**); **M3.1**: EC-Earth experiments downloaded; **M3.2**: analysis of the two sets of experiments that differ in model

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resolution; **M3.3**: analysis of the impacts of sea-ice model initialization and 'degraded' sea-ice conditions completed.

Research Visits (R): Three short research visits (< 1 month) are planned during the course of the project. The tasks within WP1 will be carried out in collaboration with prof. John Chiang, University of California, Berkeley who will provide additional expertize in climate dynamics. The analysis of intermodel spread in WP2 will be carried out in collaboration with Dr. Benjamin Santer at LLNL who will provide expertize in model analysis and intercomparison. These two research visits (**R1, R2**) will be carried out together towards the end of year 1. A third research visit (**R3**) at the University of Belgrade, Serbia will be carried out in the first half of year 2 with Dr. Jelena Lukovic. The purpose of this visit is to obtain a new comprehensive dataset of Mediterranean precipitation.

3.2 Appropriateness of the management structure and procedures, including risk management

3.2.1 Management structure and procedures

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 both Marie Skłodowska-Curie contractual rules and Spanish fiscal and social security laws. The candidate will have access to BSC's Technology Transfer Manager (orientation/help with science exploitation, proposal writing, seeking new opportunities), Communications Team (support with outreach activities, organization of events, and press releases), Legal Assessment unit and Education and Training unit (high-quality training in scientific, technical, and general 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 MSC Fellowship, in conformity with the H2020 framework program. It will provide 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.

3.2.2 Anticipated challenges and risk management

1. The identification of the sea-ice induced teleconnection in model simulations may be hindered by large internal climate variability. If encountered, this issue can be resolved by employing large ensemble simulations and/or sub-sampling relevant periods with a large forcing.
2. In case the production of EUCP experiments for WP3 is substantially delayed (expected to start in the second half of 2018), the analysis would be complemented by the CMIP5 decadal hindcasts, and other sets of analogous experiments from the FP7 SPECS project, all of which are already available.
3. While WP2 and WP3 are dependent on successful completion of WP1, it is highly reassuring that the candidates' previous work and several other studies[5,44,45] have indicated Arctic sea-ice loss as a factor affecting rainfall over the Mediterranean Basin and California.

3.3 Appropriateness of the institutional environment (infrastructure)

The BSC serves as the National Supercomputing Facility in Spain, hosting one of the fastest supercomputers in the world, the MareNostrum4, composed of 165,888 processors, 13.7 Petaflops of peak performance and 14 Petabytes of disk storage, connected to the network of European research centers. BSC also maintains two additional supercomputing infrastructures: i) The Nord III cluster (peak performance of 28 Gigaflops, 1,344 processors and 10.5 TB of main memory), which hosts and maintains several versions of the Earth System Model EC-Earth; and ii) A Big Data storage infrastructure, which has a total capacity of 24.6 Petabytes and is linked to MareNostrum4, providing additional long term storage. With all the computational resources described above readily available to the candidate, the BSC computational infrastructure will fully cover the project needs. The BSC also fosters a highly skilled team of technicians able to provide advice and support in high performance computing. By developing tools for automatizing the running of climate prediction experiments, their post-processing, and code optimization strategies, the Computational Earth Sciences group provides powerful support to researchers throughout BSC that the candidate will strongly benefit from. Outstanding supercomputing facilities, high quality user support and experience in hosting fellows will provide the candidate with a very strong basis for a successful completion of the proposed project.

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Part B-2 Section 4: CV of the experienced researcher

Curriculum Vitae for Ivana Cvijanovic, PhD

Email: ivanacbegg@gmail.com

Professional Experience:

12/01/2015 – 15/05/2018	Postdoctoral Researcher Atmospheric, Earth and Energy Division Lawrence Livermore National Laboratory, Livermore, CA *(on medical, maternity and medical caregivers leave from 21/09/2016 to 01/05/2018)*
03/01/2013 – 01/09/2014	Postdoctoral Researcher Carnegie Institution for Science, Stanford, CA and Niels Bohr Institute, University of Copenhagen, Denmark
05/11/2012 – 31/12/2013	Visiting Research Scholar Department of Global Ecology Carnegie Institution for Science, Stanford, California
01/06/2007 – 01/08/2008	Summer Research Assistant in Groundwater Modeling Centre for Applied Geoscience Eberhard-Karls University Tuebingen, Germany

Education:

15/09/2008 – 02/05/2012	Ph.D. in Atmospheric Sciences Niels Bohr Institute, University of Copenhagen Copenhagen, Denmark Ph.D. Dissertation Title: Abrupt climate change and high to low latitude teleconnections as simulated in climate models.
01/08/2006 – 29/08/2008	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)
01/09/2001 – 17/03/2006	Diploma in Physics, Meteorology and Env. Modeling Nature and Science Faculty, University of Novi Sad Novi Sad, Serbia. GPA: 9.94 out of 10 (Excellent)

Career Break:

21/09/2016 – 01/05/2018	Medical, maternity and medical-caregivers leave[1]
15/05/2018 – 01/11/2018	Unemployed

Ph.D. Mobility Stays:

Geography Department, University of California Berkeley, United States
Duration: 9 months, 10/2010 - 04/2011 and 07/2011-10/2011
Research topic: the mechanisms of high to low latitude atmospheric teleconnections

[1] In October 2017, I prepared revisions and article proofs for Cvijanovic et al. (2017) Nature Communications.

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Publications:

(1) Santer, B.D., Po-Chedley, S., Zelinka,M. D., **Cvijanovic, I.**, Bonfils, C., Durack, P., Fu, Q., Kiehl, J., Mears, J., Painter, J., Pallotta, G., Solomon, S., Wentz, F.J., and Z. Cheng-Zhi Zou (2018): Human Influence on the Seasonal Cycle of Tropospheric Temperature. *Science* 361, 6399. Citations[2]: 2.

(2) Cvijanovic, I., Bonfils, C., Santer, B. D., Lucas, D. D., Chiang, J.C.H and S. Zimmerman (2017): Future loss of Arctic sea-ice cover could drive a substantial decrease in California's rainfall. *Nature Communications* 8, doi:10.1038/s41467-017-01907-4. Citations: 10.

(3) Bonfils, C., Anderson, G., Santer, B.D., Phillips, T.J., Taylor, K.E., Cuntz, M., Zelinka, M.D., Marvel, K., Cook, B.I., **Cvijanovic, I.** and P.J. Durack (2017): Competing Influences of Anthropogenic Warming, ENSO, and Plant Physiology on Future Terrestrial Aridity. *Journal of Climate,* 30, 6883–6904. Citations: 1.

(4) Santer, B. D., Fyfe, J. C., Pallotta, G., Flato, G. M., Meehl, G. A., England, M. H., Hawkins, E., Mann, M. E., Painter, J. F., Bonfils, D., **Cvijanovic, I.**, Mears, C., Wentz, F. J., Po-Chedley, S., Fu, Q. and C-Z Zou (2017): Causes of differences in model and satellite tropospheric warming rates, *Nature Geoscience* 10, 478-485. Citations: 10.

(5) Santer, B. D., Solomon, S., Pallotta, G., Mears, C., Po-Chedley, S., Fu, Q., Wentz, F., Zou, C-Z., Painter, J., **Cvijanovic, I.** and C. Bonfils (2016): Comparing Tropospheric Warming In Climate Models and Satellite Data. *Journal of Climate* 30, 373-392. Citations: 10.

(6) Pedersen, R.A, **Cvijanovic, I.**, Langen, P.L. and B. M. Vinther (2016): The Impact of Regional Arctic Sea Ice Loss on Atmospheric Circulation and the NAO. *Journal of Climate* 29, 889–902. Citations: 34.

(7) Cvijanovic, I., Caldeira, K. and D. MacMartin (2015): Impacts of ocean albedo alteration on Arctic sea ice restoration and Northern Hemisphere climate. *Environmental Research Letters* 10, 044020. Citations: 10.

(8) Cvijanovic, I. and K. Caldeira (2015): Atmospheric impacts of sea ice decline in CO_2 induced global warming. *Climate Dynamics* 44,1173-1186. Citations: 18.

(9) Caldeira, K. and **I. Cvijanovic** (2014): Sea ice radiative forcing, sea ice area, and climate sensitivity. *Journal of Climate* 27, 8597–8607. Citations: 6.

(10) Rasmussen et al. (2014): A framework for robust naming and correlation of past abrupt climatic changes during the recent glacial period based on three synchronized Greenland ice cores. *Quaternary Science Reviews* 106, 14–28. Citations: 451.

(11) NEEM community members (2013): Eemian interglacial reconstructed from Greenland folded NEEM ice core strata, *Nature* 493, 489-94. Citations: 148.

(12) Cvijanovic, I., Langen, P.L., Kaas, E. and P.D. Ditlevsen (2013): Southward Intertropical Convergence Zone shifts and implications for an atmospheric bipolar seesaw, *Journal of Climate* 12, 4121-4137. Citations: 20.

(13) Cvijanovic, I. and J.C.H. Chiang (2013): Global energy budget changes to high latitude North Atlantic cooling and the tropical ITCZ response, *Climate Dynamics* 40, 1435-1452. Citations: 51.

(14) Cvijanovic, I., Langen, P.L. and E. Kaas (2011): Weakened atmospheric energy transport feedback in cold glacial climates, *Climate of the Past* 7. Citations: 5

(15) Borreguero, L.H., Mottram, R. and **I. Cvijanovic** (2010): Discussing Progress in Understanding Ice Sheet-Ocean Interactions: Advanced Climate Dynamics Course 2010, *Eos, Transactions American Geophysical Union*. Citations: 1.

(16) Kollet, S.J., **Cvijanovic, I.**, Schüttemeyer, D., Maxwell, R.M., Moene, A.F., and P. Bayer (2009): The influence of rain sensible heat and subsurface energy transport on the energy balance at the land surface, *Vadose Zone Journal* 8, 846-857. Citations: 39.

[2] All citations in this section are taken from Google Scholar on 09/09/2018.

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Governmental Reports:

California's Fourth Climate Change Assessment Report 2018 – contributing author.

Selected Talks:

American Meteorological Society 96th Annual Meeting 2016, New Orleans, Louisiana: *Seasonally ice-free Arctic favors dry California*.

American Geophysical Union Meeting 2015, San Francisco, California: *Impacts of ocean albedo alteration on Arctic sea ice restoration and Northern Hemisphere climate*. (*invited*)

American Geophysical Union Meeting 2015, San Francisco, California: *Can large scale sea ice cover changes affect precipitation patterns over California?*

Lawrence Livermore National Laboratory, Atmospheric, Earth and Energy division, Livermore, California, 2014: *Climate impacts of changing sea ice cover in CO_2 induced global warming.* (*invited*)

Columbia Climate Center, Earth Institute, Columbia University, 2013: *The effects of changing sea ice cover on global warming and climate consequences of sea ice geoengineering.*

American Geophysical Union Meeting 2013, San Francisco, California: *Atmospheric impacts of changing sea ice cover in CO_2 induced global warming.*

Department of Global Ecology Seminar Series, Carnegie Institution for Science, Stanford, 2012: *Abrupt climate change and high to low latitude teleconnections.* (*invited*)

INTIMATE WG3 workshop 2012 - The last deglaciation: towards model-data integration, Copenhagen, Denmark: *Global energy budget changes to high latitude North Atlantic cooling and the role of tropical SSTs*. (*invited*)

American Geophysical Union Meeting 2011, San Francisco, California: *Global energy flux changes to high latitude North Atlantic cooling and the tropical ITCZ response*.

European Meteorological Society Meeting 2008, Amsterdam, Netherlands: *The influence of shallow subsurface moisture and heat transport on the mass and energy balances at the land surface.* (student award talk)

Grants:

2016 Lawrence Livermore National Laboratory Exploratory Research Grant – LDRD 17-ERD-052, Principal Investigator: Ivana Cvijanovic (3-year funding grant, ~$550.000 USD for each fiscal year).

Prizes and acknowledgments:

Lawrence Livermore National Laboratory 2018 Physical and Life Science directorate Outstanding Paper Award for Cvijanovic et al. (2017)

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

Nature Climate Change research highlight for Pedersen et al. (2016)

IoPselect paper and Environmental Research Web highlight for Cvijanovic et al. (2015) http://iopscience.iop.org/article/10.1088/1748-9326/10/4/044020/meta

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 place in physics (2005), 2nd place in physics (2004)

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Teaching and supervision:

Teaching:

Teaching assistant for Geophysics 3, University of Copenhagen, 09-12/2008.
Teaching assistant for Numerical methods, University of Copenhagen, 01-04/2009.
Guest Lectures: PhD courses "Weather in a tank" (2011) and "California Hydrology" (2016), University of California, Berkeley.

Supervision:

PhD project supervision: University of Copenhagen and Carnegie Institution for Science, Stanford, 2014-2015.
BSc student supervision: University of Copenhagen, 2013.

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)

Fieldwork training and participation:

The North Greenland Eemian Ice Drilling (NEEM) Campaign: ice core processing (July 2009)

Development of specialized climate model configurations

(1) aquaplanet setup (Cvijanovic et al. (2013), J. Clim.)
(2) 'hybrid' data ocean/slab ocean configuration (e.g., tropical data ocean with extratropical slab ocean, Cvijanovic et al. (2013), Clim. Dyn.)
(3) prescribed and zero sea-ice setups (Caldeira and Cvijanovic (2014), J. Clim., Cvijanovic and Caldeira (2015) Clim. Dyn., Pedersen et al. (2016) J. Clim.)
(4) altered ocean albedo setup (Cvijanovic et al. (2015), Env. Res. Lett.)
(5) perturbed sea-ice physics parameter simulations (Cvijanovic et al. (2017), Nat. Com.)

Public Outreach:

Climate and Weather Seminar Series organizing committee: 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

Global Ecology Seminar Series organizer: Carnegie Institution for Science, Stanford 09/2013-09/2014

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

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).

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Media and Editorial Highlights:

Climate Central, CBC News, Voice of America: interviews and commentaries on the topic of climate change. Work reported by 100+ newspapers, radio and television stations, a brief selection provided below.

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

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=

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

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

MIT Review
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

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/

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

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

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Section 5: Capacity of the Participating Organizations

Participating Organizations	Legal Entity Short Name	Country	Supervisor/ Responsible Person(s)	Role of Partner Organization
Beneficiary				
Barcelona Supercomputing Center	BSC	Spain	Prof. Francisco Doblas-Reyes	N/A (Host organization)
Collaboration Organizations[3]				
University of Belgrade	UB	Serbia	Dr. Jelena Lukovic	Scientific collaboration: providing observational data sets and hosting a short research stay
University of California Berkeley	UCB	USA	Prof. John Chiang	Scientific collaboration: providing expertize in atmospheric dynamics and hosting a short research stay
Lawrence Livermore National Laboratory	LLNL	USA	Dr. Benjamin Santer and Dr. Donald Lucas	Scientific collaboration: providing expertize in climate model projections and perturbed physics ensemble simulations

[3] Since according to the MSCA guidelines, collaboration organization is not considered a 'partner organization' these are only listed here but will not be described in the reminder of the section.

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Barcelona Supercomputing Center - Centro Nacional de Supercomputación (BSC), Spain	
General Description	**The Barcelona Supercomputing Center (BSC)** is the national supercomputing facility of Spain, hosting the MareNostrum, one of the most powerful supercomputers in the world. It employs over 500 researchers focusing on a multidisciplinary research in Earth and Life Sciences and Scientific Computing. The BSC is one of the first research institutions in Spain recognized as a Severo Ochoa Centre of Excellence by the Spanish Ministry of Science and Innovation (Ministerio de Ciencia e Innovación MICINN). This award is given by the Spanish Government to recognize internationally renowned research institutions in Spain. The fellow will be hosted at the **Earth Sciences (ES) Department,** within the **Climate Prediction Group**. This group carries out advanced research in seasonal-to-decadal climate forecasting. It is one of the world leaders in the field of climate prediction with more than 150 peer-reviewed research articles published over the last 5 years. The candidate will be supervised by Prof. Francisco Doblas-Reyes, head of the Earth Sciences Department and co-supervised by Dr. Pablo Ortega and Dr. Markus Donat, leaders of the Climate Prediction Group.
Academic Organization	Yes. In addition, the BSC closely collaborates with Universidad Politècnica de Catalunya (UPC) running a joint MSc degree programme in Environmental Engineering.
Role and Profile of Key Persons (Supervisor)	ICREA Research **Prof. Francisco Doblas-Reyes** is the director of the Earth Science Department at the BSC. He is a world expert in the development of "s2d" climate prediction systems and has more than 20 years of experience in weather and climate modelling, climate prediction and development of climate services. He has authored and co-authored 100+ peer-reviewed publications. He was the PI on 1 FP7 project, is currently involved in 4 Horizon 2020 collaborative projects, leading 2 C3S contracts and has supervised (including current fellows) 4 MSCA-IF researchers (DPETNA (655339), INCLIDA (275505), CLIM4CROP (740073) and SPFireSD (748750). His expertize in seasonal-to-decadal climate predictions is essential to this Marie Skłodowska-Curie project proposal.
Dept./Division / Laboratory	The project will be hosted by the Climate Prediction Group within the Earth Sciences (ES) Department.
Key Research Facilities, Infrastructure and Equipment	The BSC hosts outstanding high performance computing facilities including MareNostrum IV, one of the fastest supercomputers in the world (composed of 165,888 processors and 14 Petabytes of disk storage. It also manages the Nord III cluster (1,344 processors and 10.5 TB of main memory) and a Big Data storage infrastructure, with a total capacity of 24.6 Petabytes.
Independent research premises?	All BSC's departments have their own research premises. The infrastructure, equipment and key research facilities will be available for the fellow during the entire duration of the project.
Previous and current involvement in Research and Training Programmes	The **BSC-ES Department** is a highly productive scientific institution that has been granted 24 EU Horizon 2020 projects, 6 EU FP7 projects, 10 Copernicus contracts, 11 national projects and 4 European Space Agency projects in the last five years. The most important projects for this MSC proposal that the Climate Prediction Group currently participates in, are H2020 projects **APPLICATE** (H2020-BG-2016-2017-727862; providing multi-model simulations for WP1), **PRIMAVERA** (H2020-SC5-01-2014-641727; high resolution simulations for WP1&WP2), **EUCP** (H2020-SC5-2016-2017-776613; high resolution simulations for WP3) and **SPECS** (FP7-ENV-2012-308378; finished, but will provide backup simulations for WP3 in case the ones from the EUCP are not ready in time). The BSC is also the beneficiary of Marie Skłodowska-Curie Action COFUND program for postdoctoral fellows (**STARS**; H2020-MSCA-COFUND-754433). The BSC-ES is currently awarded 6 early stage postdoctoral fellowships (5 Juan de la Cierva and 1 Beatriu de Pinos), 5 senior research grants (4 Ramon y Cajal and 1 ICREA) and hosts 7 MSCA-IF research projects: NeTNPPAO, ACRoNNim, SPFireSD, DUST.ES, PROTECT, INADEC, CLIM4CROP.
Relevant Publications and/or research/innovation products	Selected list of 5 publications by Prof. Doblas-Reyes most relevant for this proposal: **1.** Lledó, L. et al., (2018): Investigating the effects of Pacific sea surface temperatures on the wind drought of 2015 over the United States. **Journal of Geophysical Research: Atmospheres**, 123 (10), 4837-4849. **2.** Massonnet, F., et al., (2016): Using climate models to estimate the quality of global observational data sets. **Science**, 6311, 452-455. **3**. Guemas V.,et al (2016). Impact of sea ice initialization on sea ice and atmosphere prediction skill on seasonal timescales. **Geophysical Research Letters**, 43, 3889-3896. **4.** Doblas-Reyes, F.J., et al. (2013): Seasonal climate predictability and forecasting: status and prospects. **WIREs Climate Change**, 4, 245-268. **5.** Doblas-Reyes, F.J., et al., (2013): Initialized near-term regional climate change prediction. **Nature Communications**, 4, 1715.

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Section 6 - Ethical Issues

There are no ethical issues flagged in the Ethics Issues Table, this proposal meets the EU and national legal and ethics requirements.

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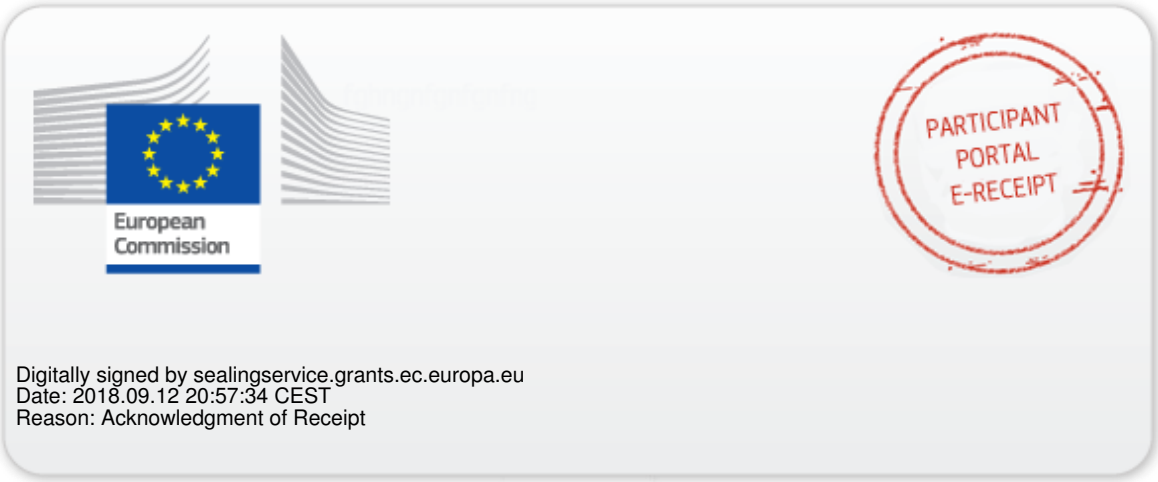

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