

PRIMAVERA model evaluation aims and plan

Virginie Guemas (BSC), Malcolm Roberts (Reading),
Pier Luigi Vidale (MetOffice), Torben Koenigk (SMHI),
Martin Evaldsson (SMHI), Ramon Fuentes Franco
(SMHI), Benoit Vanniere (Reading), Jeremy Grist
(NERC), Adrian New (NERC), Simon Josey (NERC)

Model evaluation aims (1)

- Model fidelity is central to PRIMAVERA
- Focus on recent past to near future
- Process understanding to identify the impacts of climate change and disentangle them from fingerprints of internal variability
- Quantify uncertainties in projection
- Focus on the North Atlantic Ocean, Arctic, Tropics and their impact on Europe

Model evaluation aims (2)

- Assess the added-value of high-resolution
- Explain how resolution impacts the representation of climate variability and change at the process level
- Process-based model evaluation



Up to extreme high resolution

Example of Ec-Earth3 climate simulation spinup with the ORAC12-T1279 resolution (about 8km globally)

<https://www.youtube.com/watch?v=JT4ZQAQf5yI>

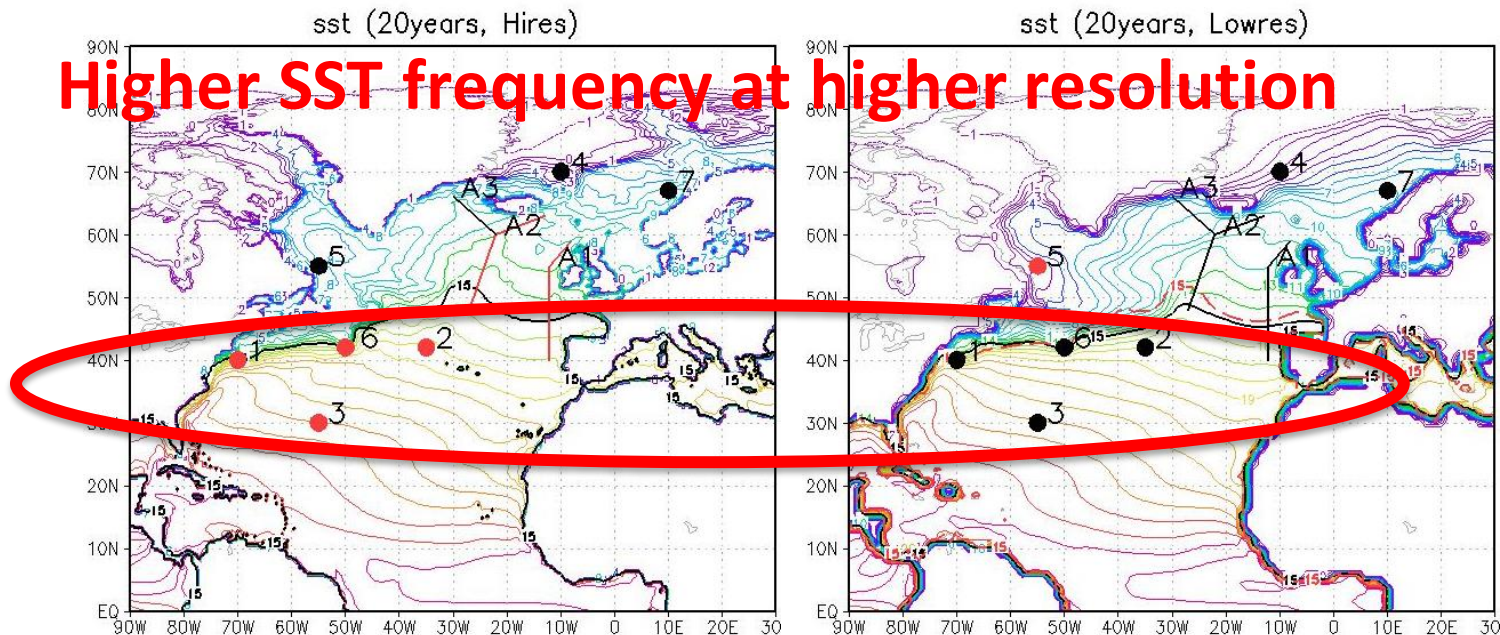


Examples of processes of interest

- AMO variability -> African Easterly wave interactions -> Sahel rainfall + tropical cyclone activity -> mid-latitude storms
- Gulf Stream variability -> mid-latitude jet variability / storm tracks -> heat and moisture transport toward Arctic & Europe
- Interactions between ice and polar storms
- Northward ocean heat transport (response to external forcing) -> sea ice

Gulf Stream variability (SMHI)

- EC-Earth HR (T511-ORCA025) vs LR (T255-ORCA1) 1990-2009 : stronger SST gradient – wavier Gulf stream – higher frequency variability in HR

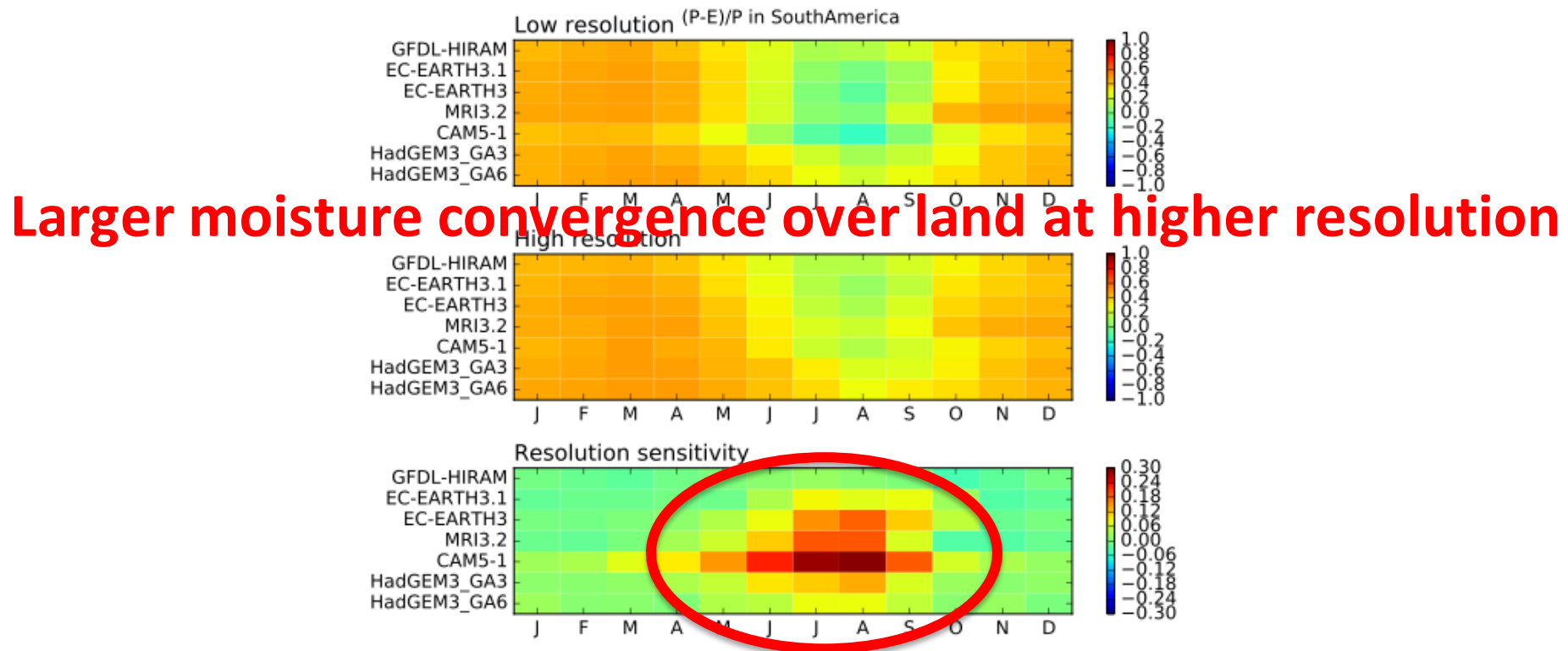


● High frequency (about 10 years)

● Low frequency (about 5 years)

Moisture transport to lands (UREAD)

- $(P-E)/P$ over land represents the fraction of local precipitation due to moisture convergence



Ocean heat transport (NERC)

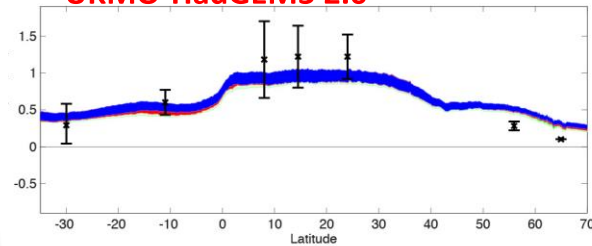
Resolution dependence of zonal Atlantic heat transport in pre-Primavera runs

No significant change with atmos resolution

Significant increase with ocean resolution

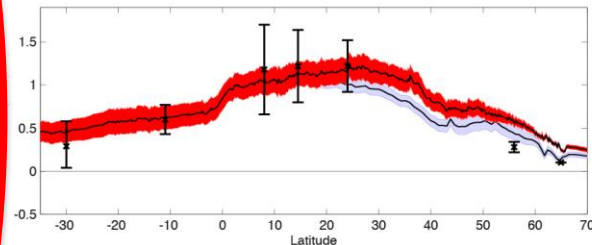
Large increase when ocean & atmospheric resolution increase

UKMO-HadGEM3 2.0



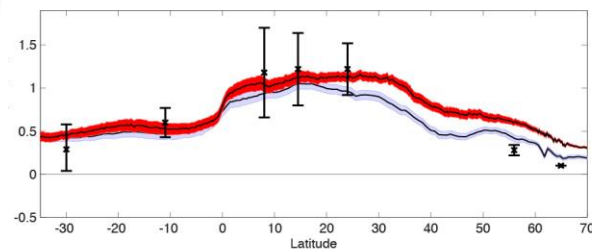
N96 ORCA025
N216 ORCA025
N512 ORCA025

CMCC-CM2



192x288 ORCA1
192x288 ORCA025

(SMHI) EC-EARTH3.1



T255 ORCA1
T511 ORCA025

Error bars: observations

Model evaluation plans

- Coordinated sets of experiments to be described in session 6
- Development of process-based metrics to be incorporated in ESMValTool : for single model components and coupled processes ; covering North Atlantic ocean, Arctic, Tropics and impacts on Europe ; to be detailed in session 3