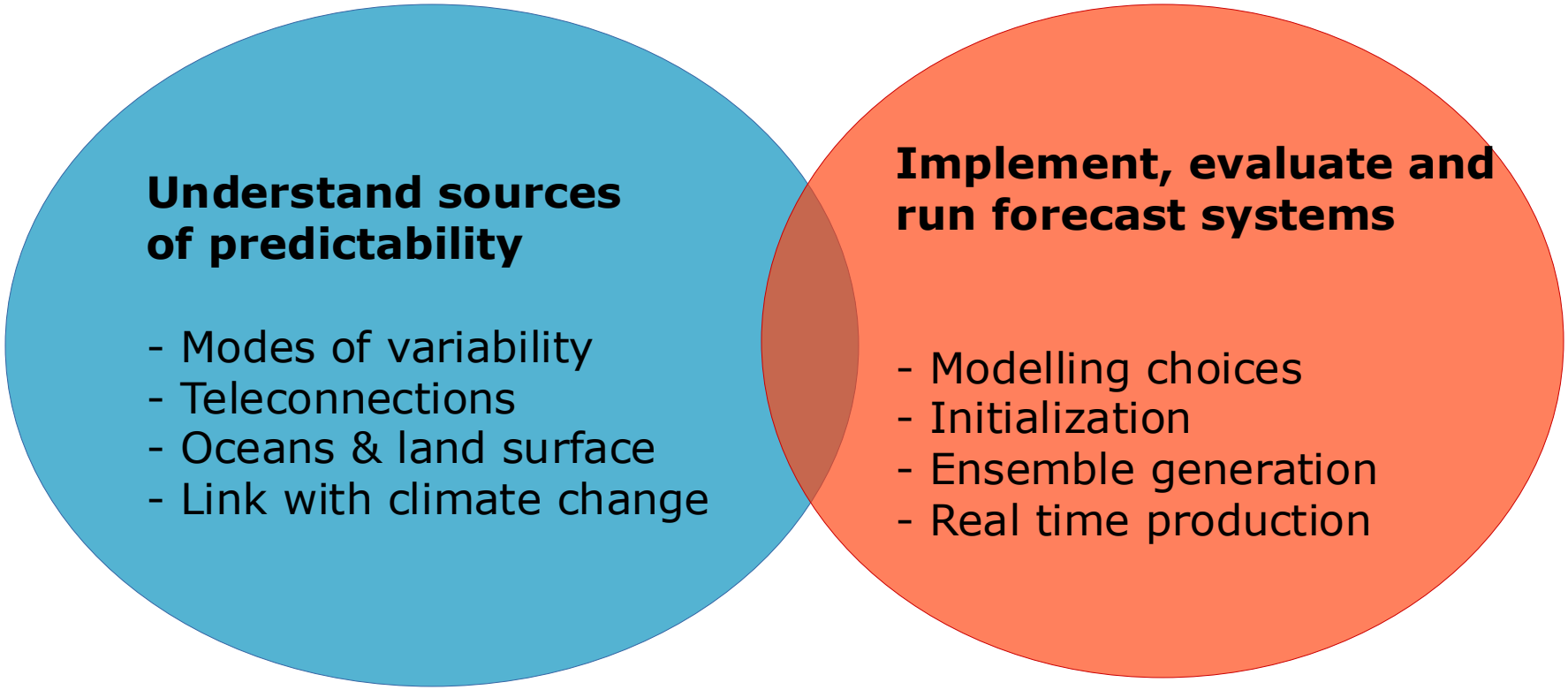
CNRM/Météo-France update

WGSIP – 5 Nov. 2024

Constantin Ardilouze

Scientific themes

- Predictability and prediction at the **seasonal** (2-6 months) and **subseasonal** (2 weeks – 2 months) leadtime
- Main tool : **Global climate model** + statistical approaches



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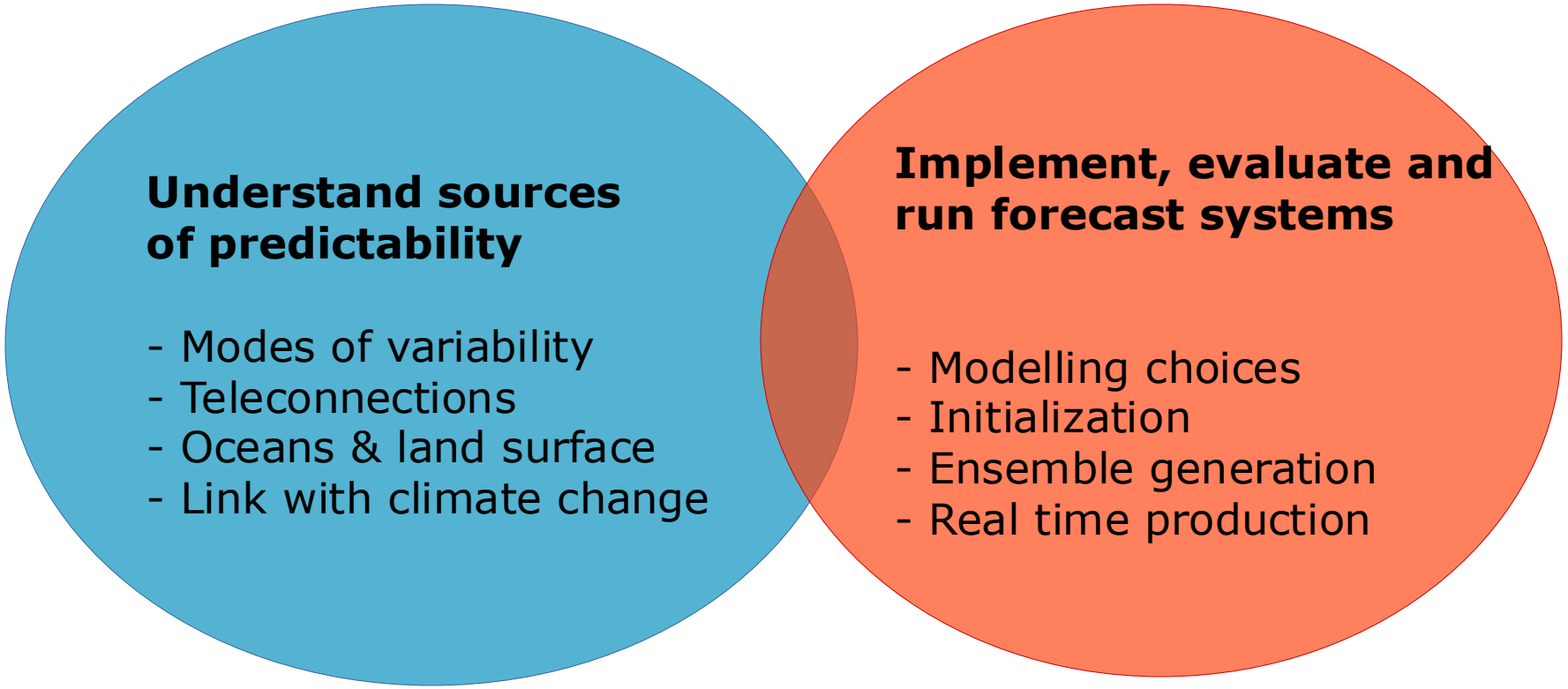

- Contribution to the Météo France GPC role by running operational seasonal forecasts
- Running S2S forecasts every week (pseudo-operational task)

Staff

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- Team working on S2S/S2D : 8 people.

Recent loss of experienced staff (L. Batté leaving academia + JF Gueremy retiring).

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November 2024 :

Damien Specq
Constantin Ardilouze
Saïd Qasmi
Jonathan Beuvier (50 %)
Laurent Dorel (Engineer)
Gabriel Narvaez Campo (Postdoc)
Louis Ledoux—Xatard (PhD student)
Onaïa Savary (PhD student)


Damien


Constantin


Jonathan


Saïd


Laurent

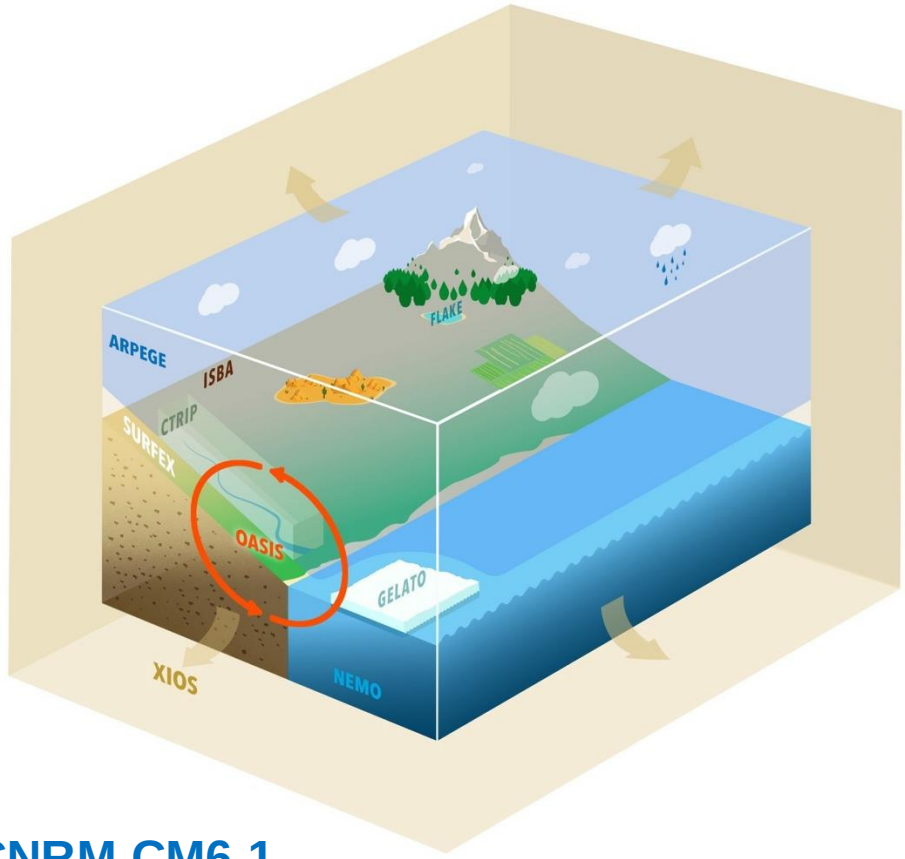

Gabriel


Louis


Onaïa

Seasonal prediction at Météo-France

Based on a **high-resolution version of the CNRM-CM6-1 coupled climate model** (Voldoire et al., 2019)



CNRM-CM6-1

-ARPEGE-Climat v6.4 (tl359l137r) + SURFEX / ISBA / CTRIP

-1-hour coupling using OASIS MCT with NEMO v3.6 / GELATO 6 (ORCA0.25°)

-Hindcast : fix, 25 members, 1993-2018

-Forecast : 51 members

- Coupled initialization strategy (constraining our initialization run towards ERA5/ERA5T and GLORYS12V1 / Mercator oper. analysis)

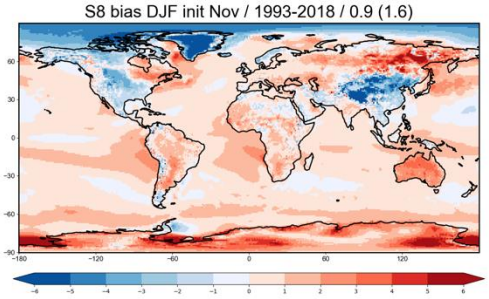
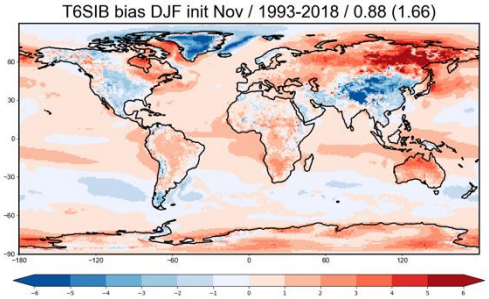
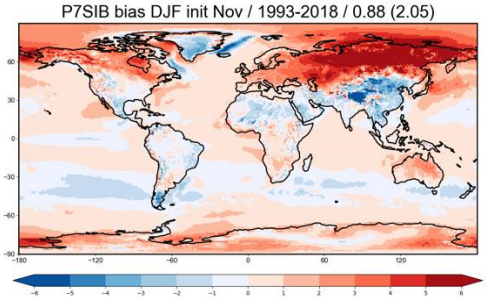
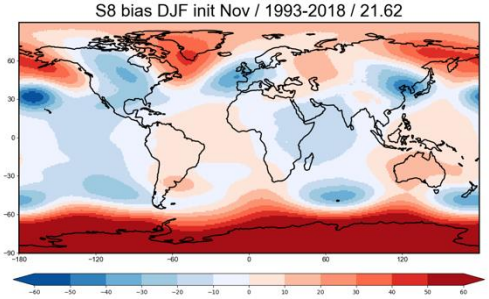
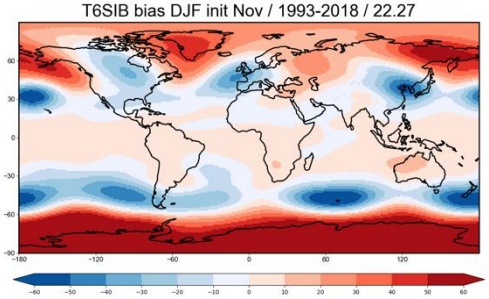
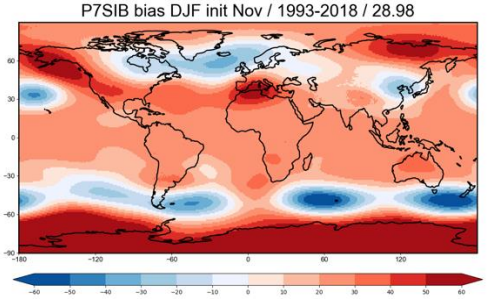
Data provided each month to the Copernicus Climate Change Service (C3S)
https://climate.copernicus.eu/seasonal-forecasts

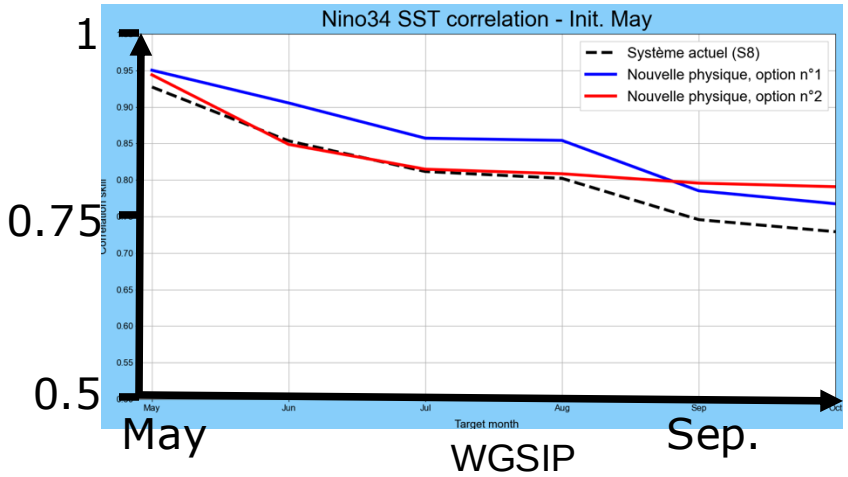
Climate Change Service
climate.copernicus.eu

Forecast system upgrade

Comparison of atmospheric physics

DJF Bias (November initialization)

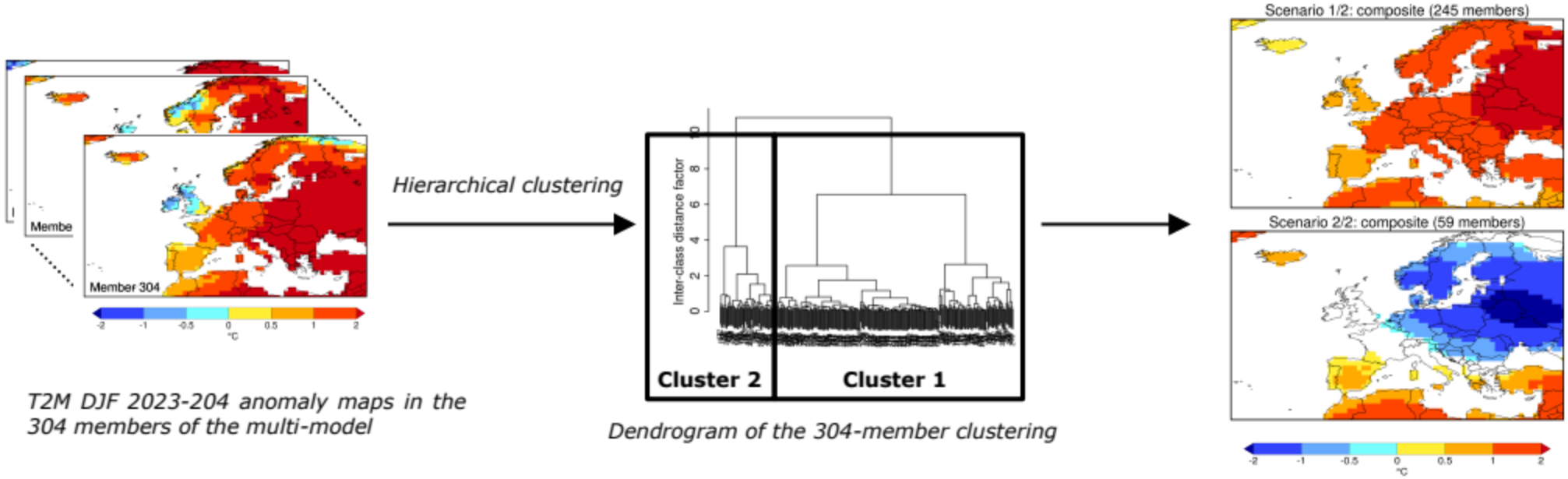
	MF System 8	Atm. Physics option #1	Atm. Physics option #2
T2m (vs ERA5)			
Z500 (vs ERA5)			



WGSIP

Defining scenarios for seasonal climate over Europe

- Clustering of the full range of C3S ensemble members
- Based on a dissimilarity index between 2 members $d_{i,j} = 1 - ACC(i,j)$



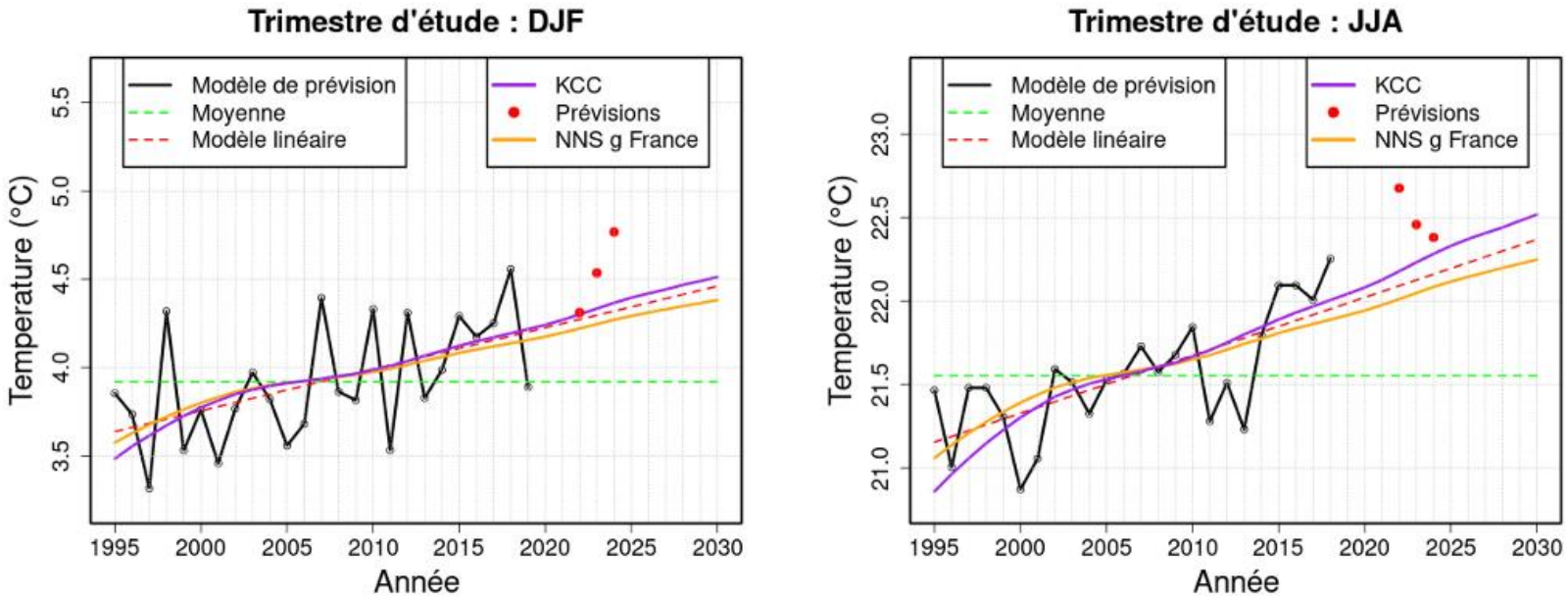
T2M DJF 2023-204 anomaly maps in the 304 members of the multi-model

Dendrogram of the 304-member clustering

- Help to identify where the forecast is more confident and where it is more uncertain

Understanding sources of predictability

Master thesis : contribution of climate change to seasonal forecast anomalies



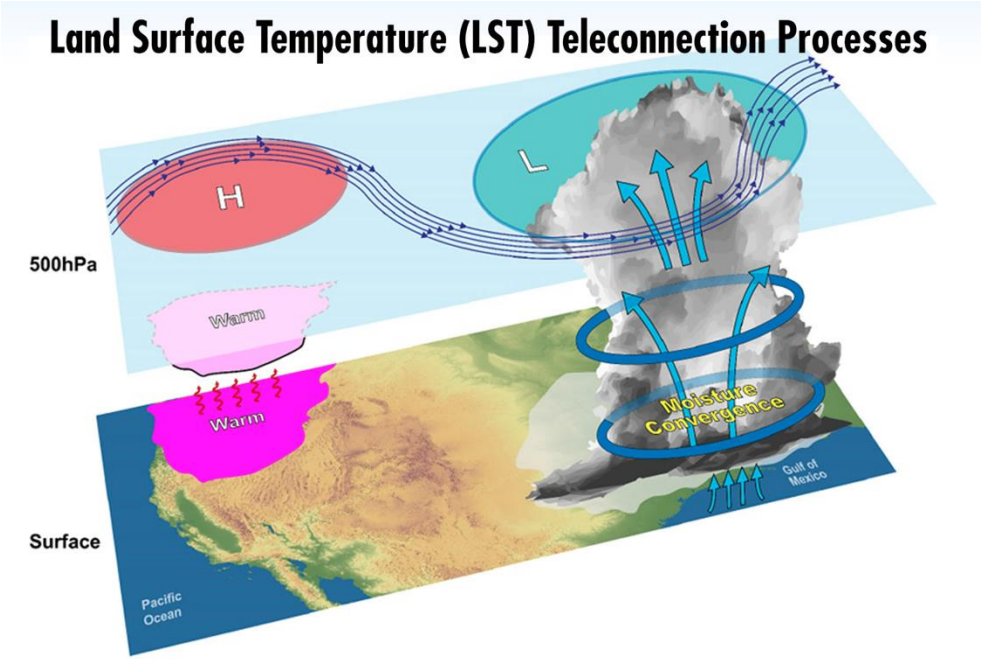
Seasonal hindcast of T2m averaged over France between 1995 and 2024 + different estimates of the climate change contribution

→ Is the linear model a valid estimate of the warming trend ?
→ PhD about to start : new methods to disentangle the trend from interannual variability in the forecast anomalies

Initialization and sources of predictability

Efforts on **land initialization**

- Contribution of initial land (sub-)surface temperature of high altitude regions on downstream S2S atmospheric variability and predictability (GEWEX/GASS Project LS4P)

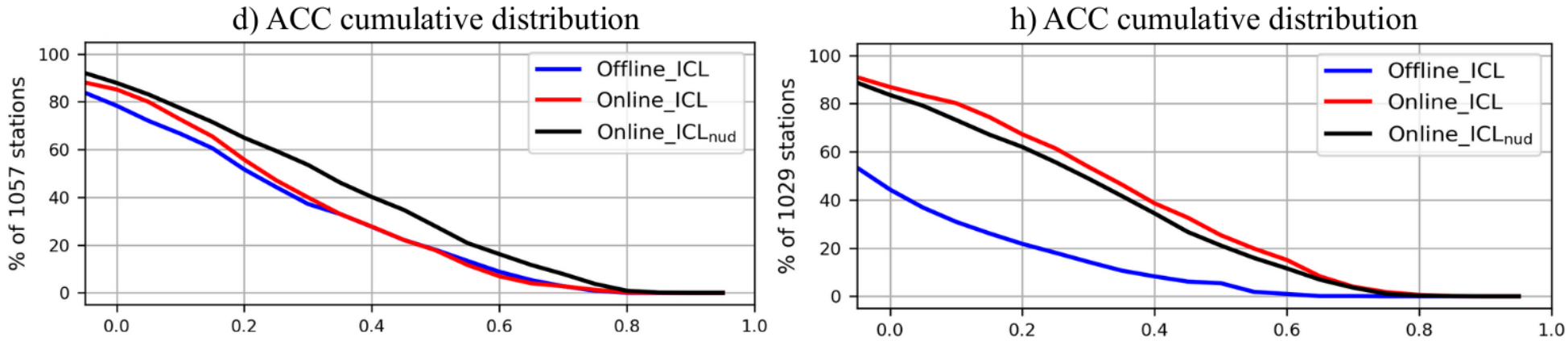


- Impact of land data assimilation on initial conditions/reanalyses and seasonal forecasts initialized thereof (European project CERISE)

Predictability of Earth system components

Evaluation of global streamflow forecasts directly derived from GCM output (CERISE projects)

JJA **DJF**



Blue line : Benchmark forecast (Ensemble offline streamflow prediction : Land/river model forced by atmospheric reanalysis)
Red line : Météo-France operational forecast Sys8
Black line : Météo-France Sys8 with improved land initialisation (soil moisture reconstruction))

→ Coupled hydrological seasonal forecasts outperform the offline forecast used as a benchmark, especially in boreal winter
→ Improved soil moisture initial conditions considerably increase the forecast skill in JJA

Some of our future plans

- **Causality in S2S forecasts**
  - Investigation of causal relationships between predictors and predictand in the context of a S2S windows of opportunity (See Angel presentation on Thursday)
- **Mid-latitude teleconnexions**
  - Year-round North-Atlantic weather regimes and European droughts
  - Impact of the 2023 NE Atlantic marine heatwave on seasonal forecasts over Europe
- **Seasonal forecasts with AI** (national project in preparation)
- **Extreme events in seasonal forecasts** by *ensemble boosting*
- **Upgrade of the CNRM S2S system** in 2025

Any questions ?