S2S Activities at CNRM/Météo-France

System set-up and some case studies

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Presented by A. Boone

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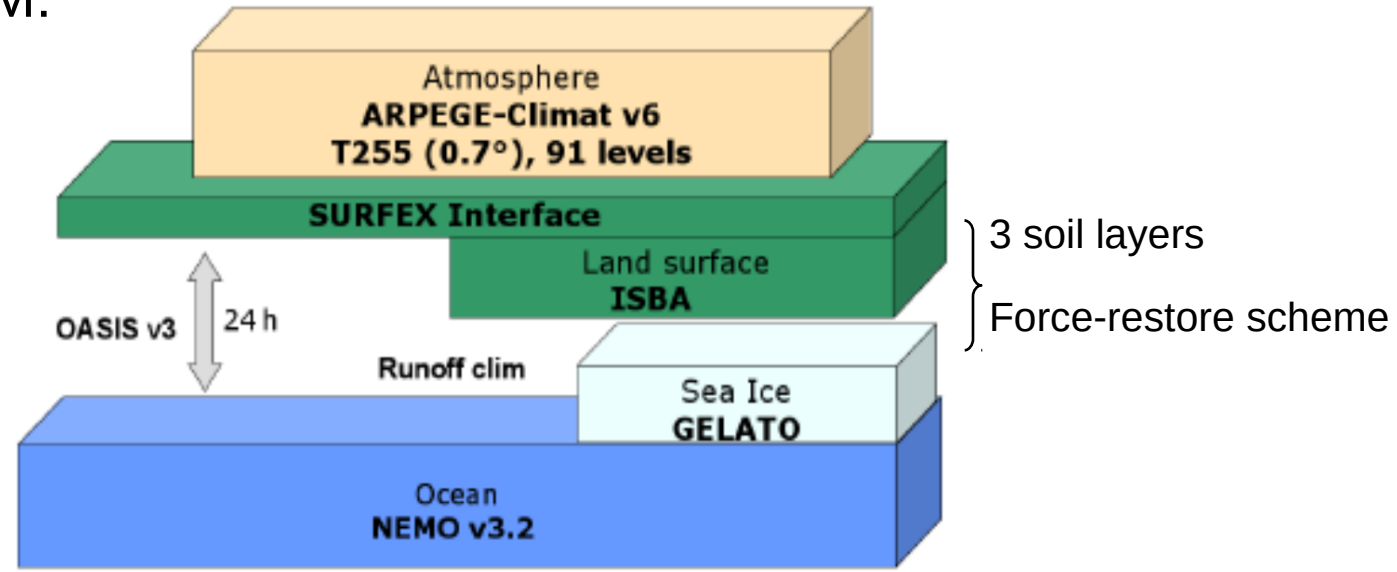
S2S predictions at CNRM

Coupled AOGCM:



1993-2014 fix re-forecast (2 start dates per month, 15 members) + real-time forecasts issued every Thursday (51 members)

The ensemble uses the so-called Dynamique Stochastique method (Batté and Déqué, 2012). Inital conditions:

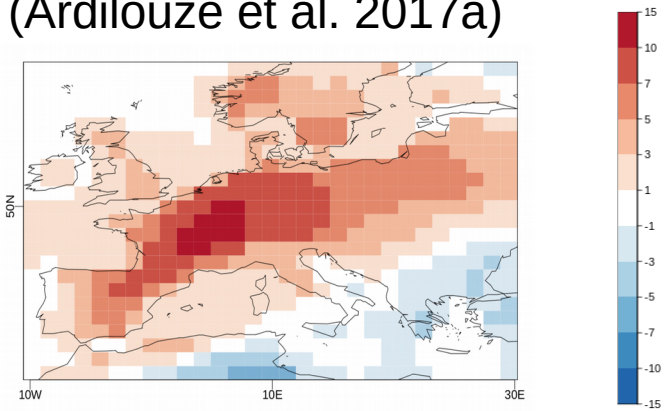
	Re-forecast	Forecast
Atmosphere and land surface	Era-Interim (Dee et al., 2011)	IFS operational Analyses at 00:00 UTC
Ocean and Sea-Ice	Mercator-Ocean GLORYS (Ferry et al., 2010)	Mercator-Ocean operational Analyses

Forecast horizon: 32 days

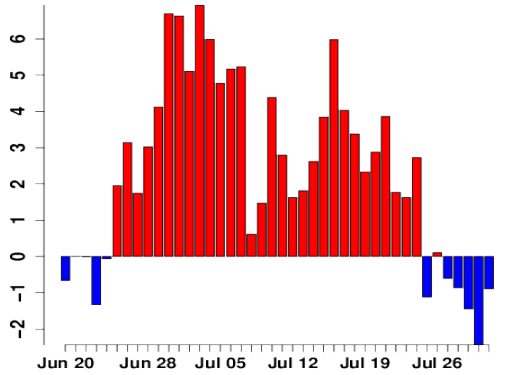
Forecast and re-forecast feed the S2S database (Vitart et al. 2017). Research purpose only. No operations

I) Work related to land surface initialization

- S2S prediction case study : the July 2015 heat wave over France (Ardilouze et al. 2017a)

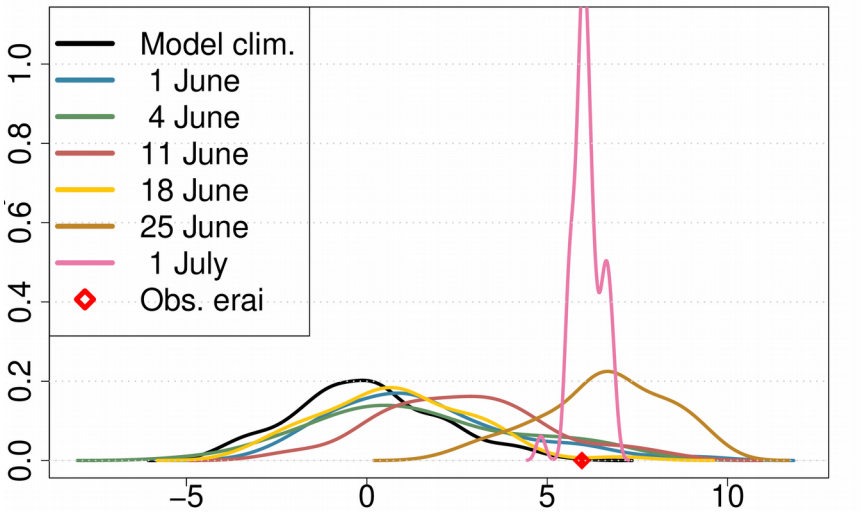


ERA-Interim Tmax anomaly (period 1 to 6th July 2015)



Daily Tmax departure from climatology over France (ERA-Interim)

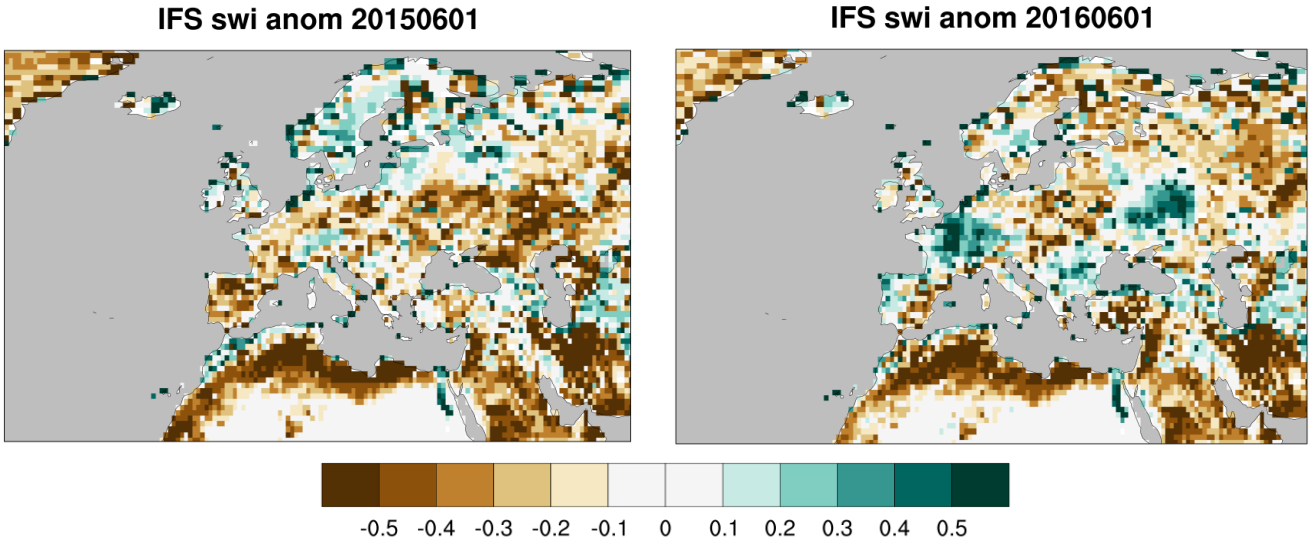
- Target event defined as the anomaly of the mean 1-to-6 July daily Tmax over France w.r.t. the 1993-2014 period



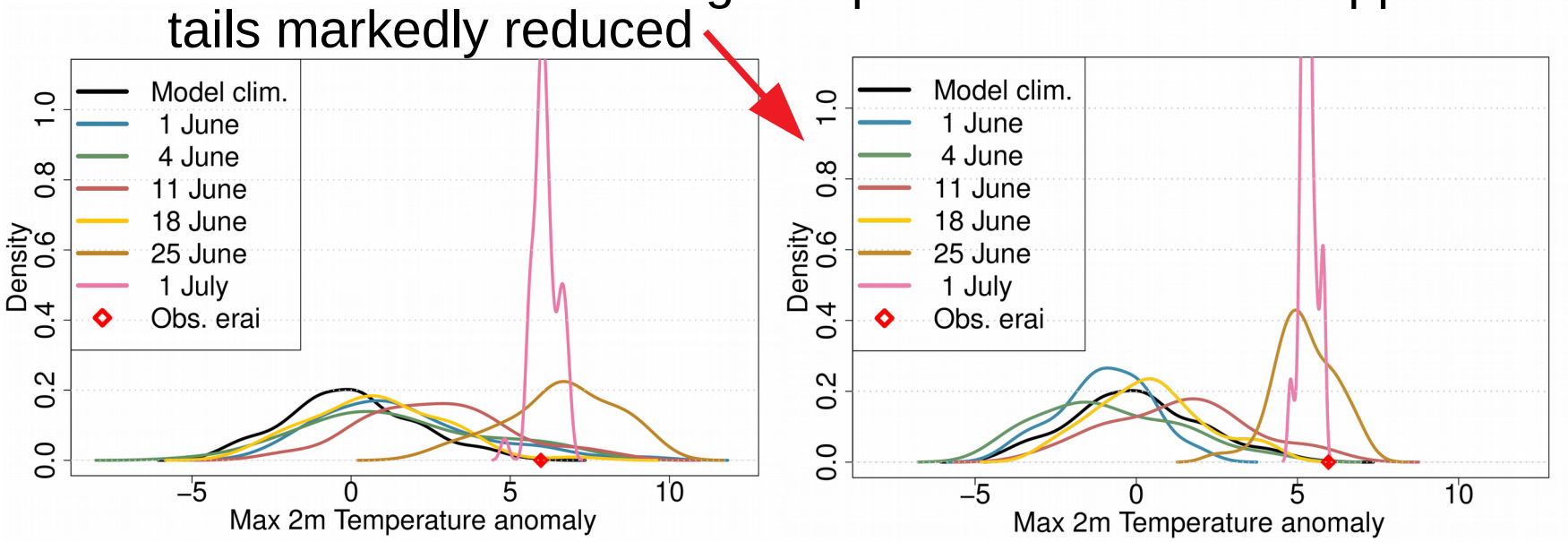
Forecast probability density functions for the target event (forecasts issued between June 1st and July 1st 2015)

I) Work related to land surface initialization

- Forecasts re-computed with modified land surface initial conditions



- Earlier forecasts no longer capture the event and upper distribution tails markedly reduced



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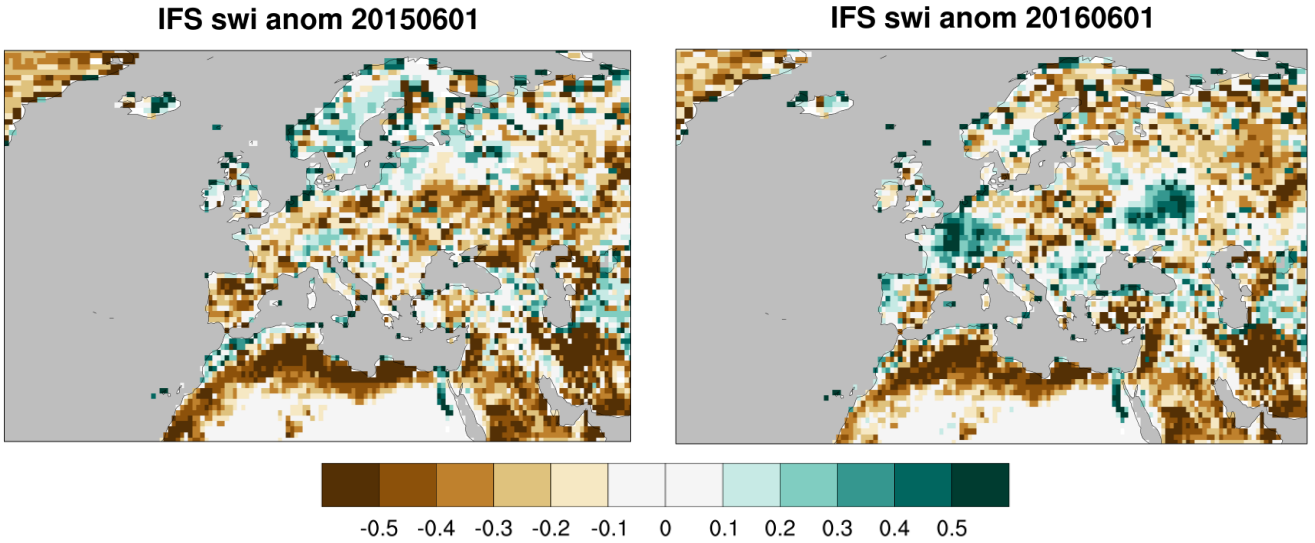

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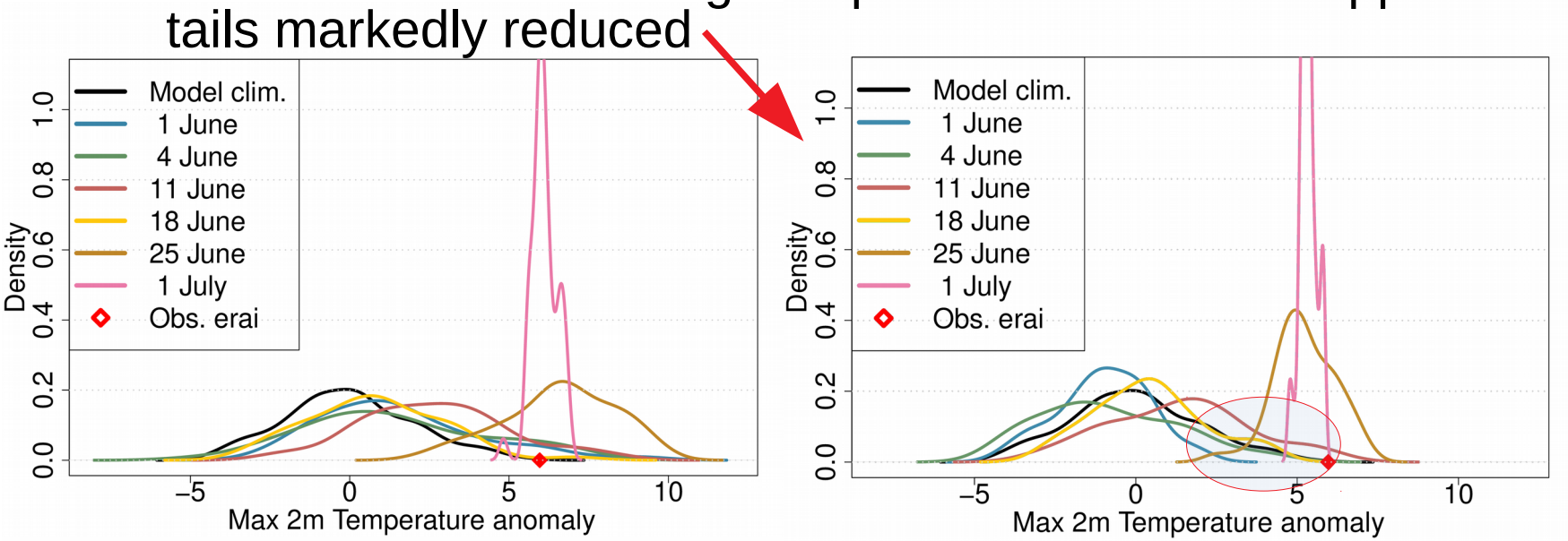


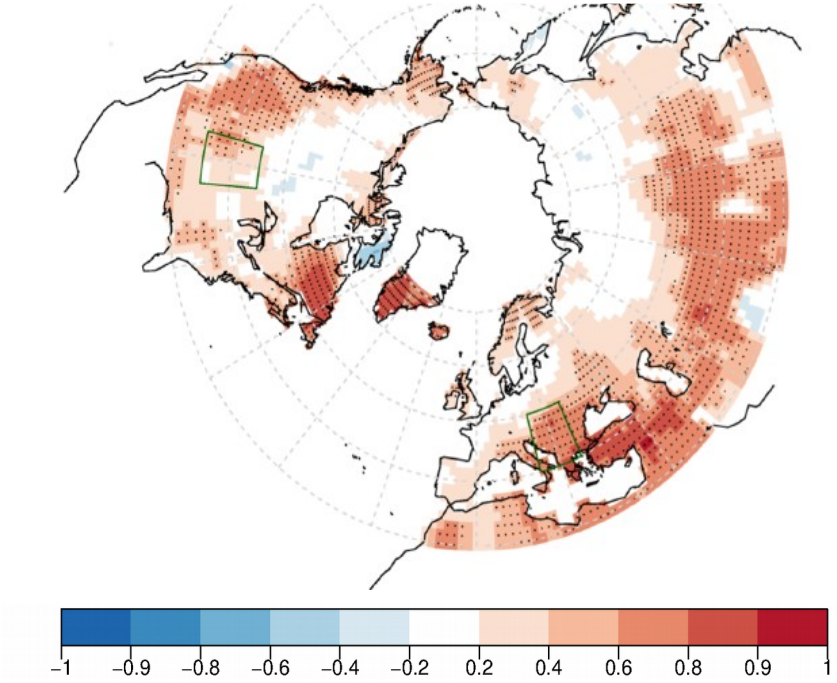
II) Seasonal forecasting : impact of soil moisture initialization

- GLACE2 (Koster et al. 2011): Multi-AGCM S2S experiment on the impact of soil moisture initialization
  - T2m prediction skill improved up to 60 days ahead over N. America

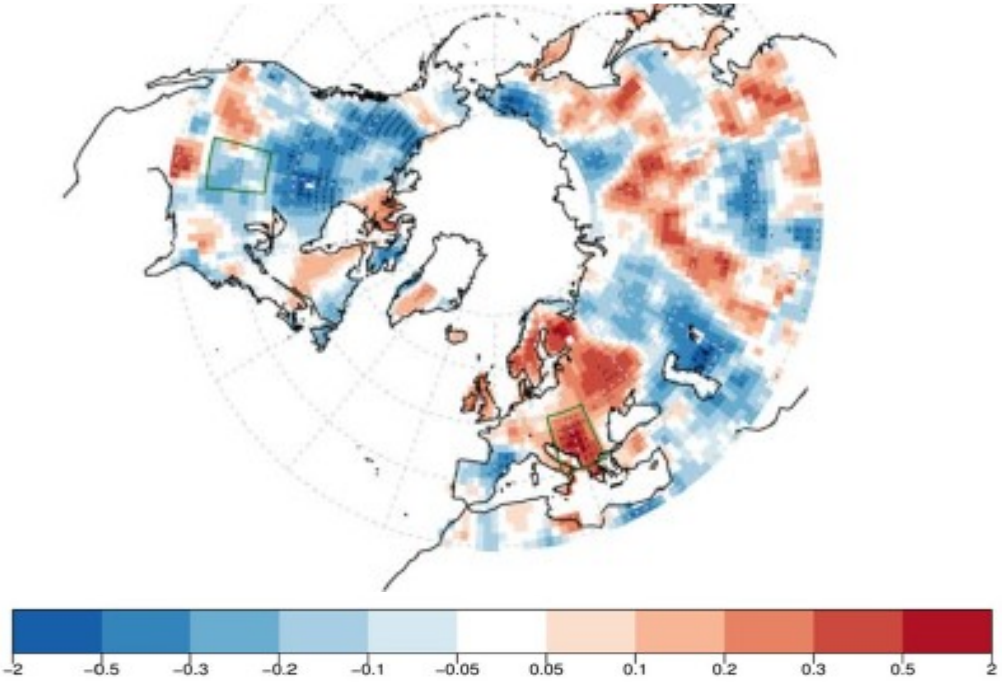
- Here, update of GLACE2 with 5 AOGCM, extended to the seasonal timescale (Ardilouze et al, 2017b)

- Experimental setup
  - 5 coupled models x 10 members = 50-member multi-model ensembles
  - 2 sets of re-forecasts with either climatological (**CLIM**) or realistic (**INIT**) soil moisture initialization.
  - MJJA re-forecasts initialized on May 1st (1992 to 2010)

II) Seasonal forecasting : Results



Multi-model JJA T2m correlation against CRUTS3 anomaly for INIT

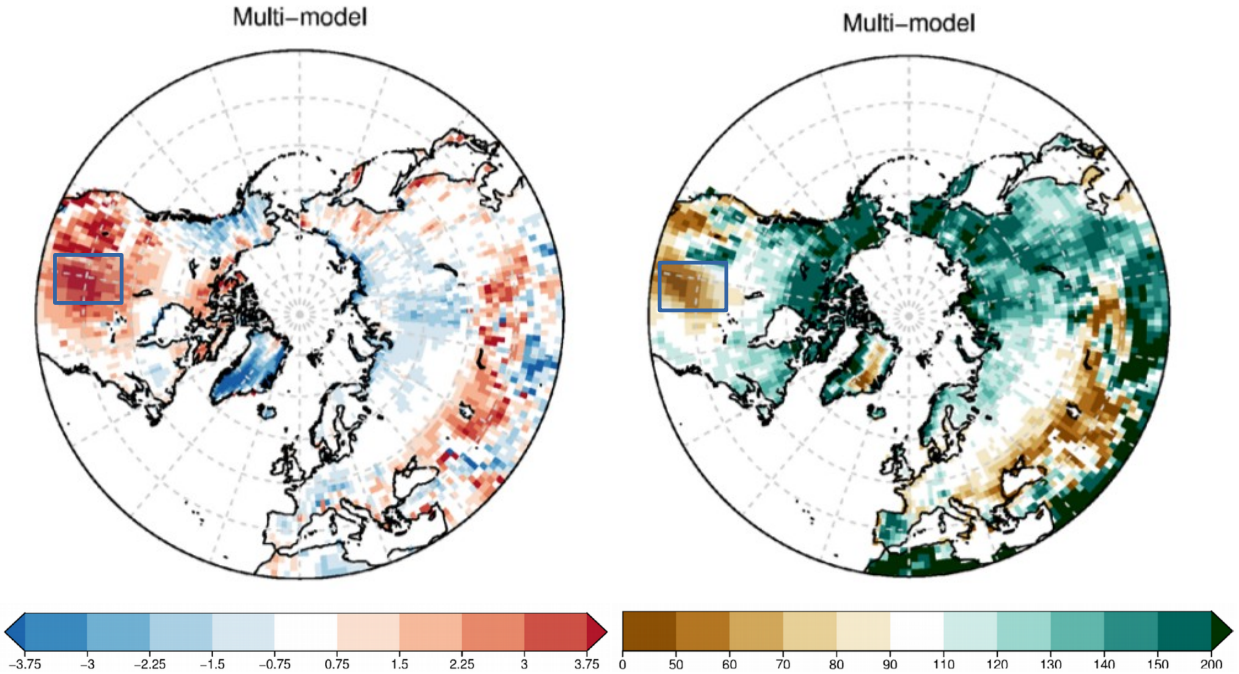


INIT minus CLIM correlation difference

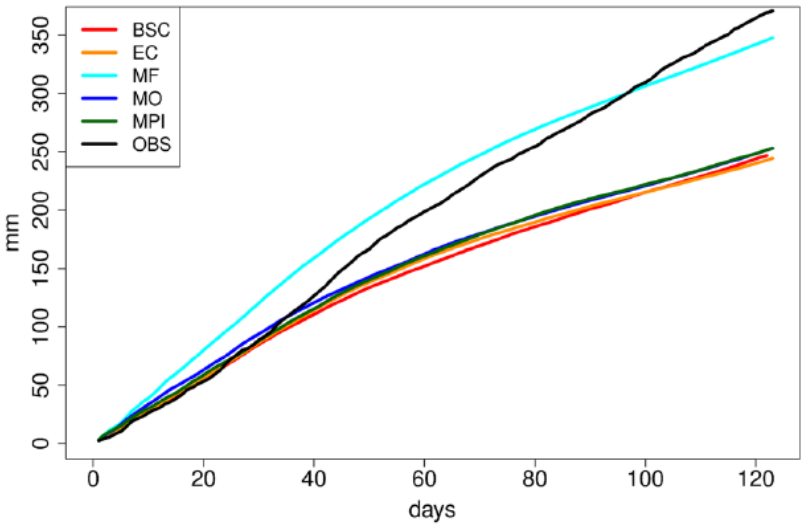
- Realistic soil moisture initialization in May → increased summer temperature prediction skill over South-East Europe but not over the US Great Plains

- Both regions are hot spots of land-atmosphere coupling. What could explain such poor results over the US ?

II) Seasonal forecasting : Bias could be the culprit



*Multi-model JJA **2m temperature** (left) and **precipitation** (right) **bias.** Reference : CRUTS and GPCC*



Individual model ensemble mean daily climatologies for cumulated precipitation from May 1st to August 31st over the US Great Plains. OBS= GPCC

- All the models have a warm and dry summer bias over the US Great Plains.
- Consequence : soil drys out fast and inter-annual information brought by land-surface initial conditions is rapidly lost
- Perspective : on-going experiments to confirm this link between bias and prediction skill over the US

Perspectives for ILSTSS2S :

- Within the framework of ILSTSS2S, we can run S2S experiments with CNRM CMIP6-configured climate model :
  - Refined land surface soil scheme with 14L (ISBA-Dif) and 12L explicit snow scheme
  - But at a coarser horizontal resolution T127 (~150 km)

References

- Ardilouze C., L. Batté, M. Déqué, (2017a): Subseasonal-to-seasonal (S2S) forecasts with CNRM-CM: a case study on the July 2015 West-European heat wave, *Adv. Sci. Res.*, 14, 115-121, doi:10.5194/asr-14-115-2017, 2017
- Ardilouze C, L. Batté, F. Bunzel, D. Decremer, M. Déqué, F.J. Doblas-Reyes, H. Douville, D. Fereday, V. Guemas, C. MacLachlan, W. Müller, C. Prodhomme (2017b): Multi-model assessment of the impact of soil moisture initialization on mid-latitude summer predictability. *Clim Dyn*. doi:10.1007/s00382-017-3555-7
- Batté, L., C. Ardilouze, M. Déqué (2018): Forecasting West African heat waves at sub-seasonal and seasonal time scales. *Mon. Weather Rev.* doi:10.1175/MWR-D-17-0211.1