

Simulated Atmospheric Response to the 2015 North Atlantic SST Cold Blob

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Motivation

In the summer of 2015 central Europe experienced a major heat wave which in the months before was preceded by the development of an anomalously cold sea surface temperature (SST) in the northern North Atlantic. Duchez et al. 2016 has shown that the cold ocean anomaly preceded a pronounced southward deviation of the Jet Stream path in early June which favoured the development of the heat wave over central Europe. However, whether or not the cold SST anomaly in the North Atlantic was the cause in the change in atmospheric circulation is not yet clear.

Can a coupled climate model initialized with the 2015 cold blob simulate the 2015 central Europe heat wave?

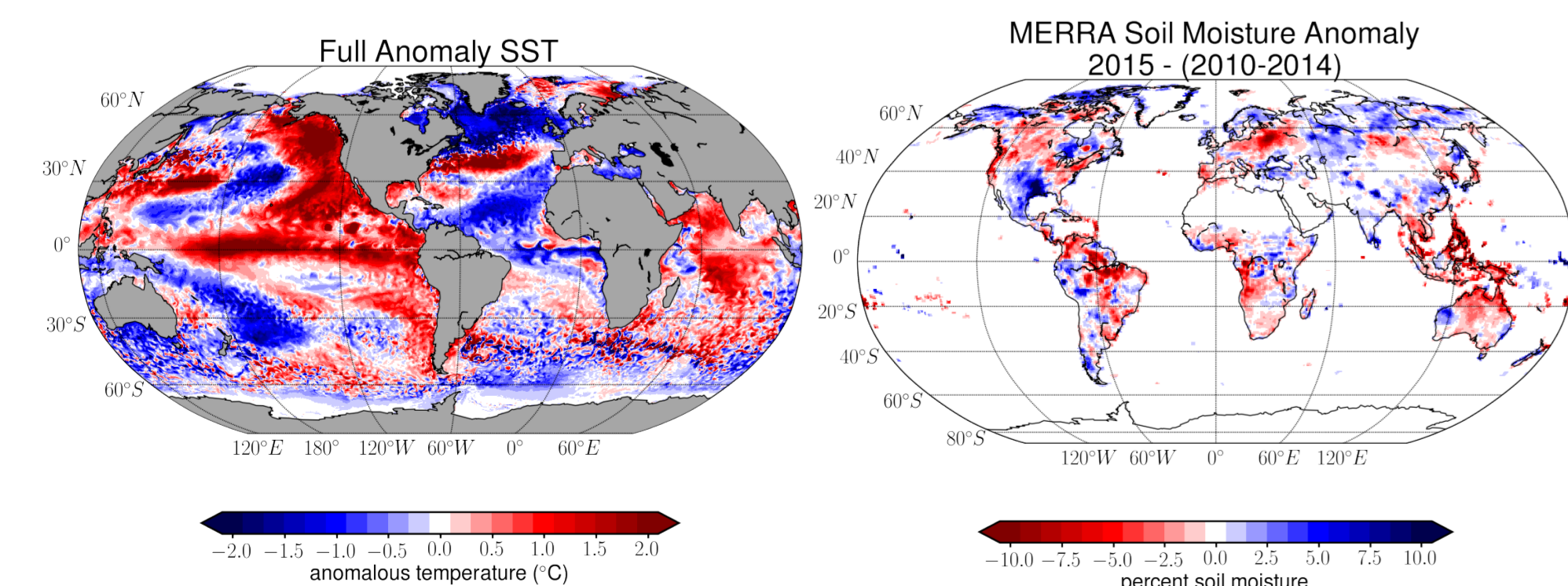
Climate Model Setup

Model: HadGEM3-GC2

- Ocean: NEMO GO5, ORCA025 (~0.25 horizontal grid), 75 vertical levels
- Atmosphere: UM GA6, N216 (~60km horizontal grid), 85 vertical levels

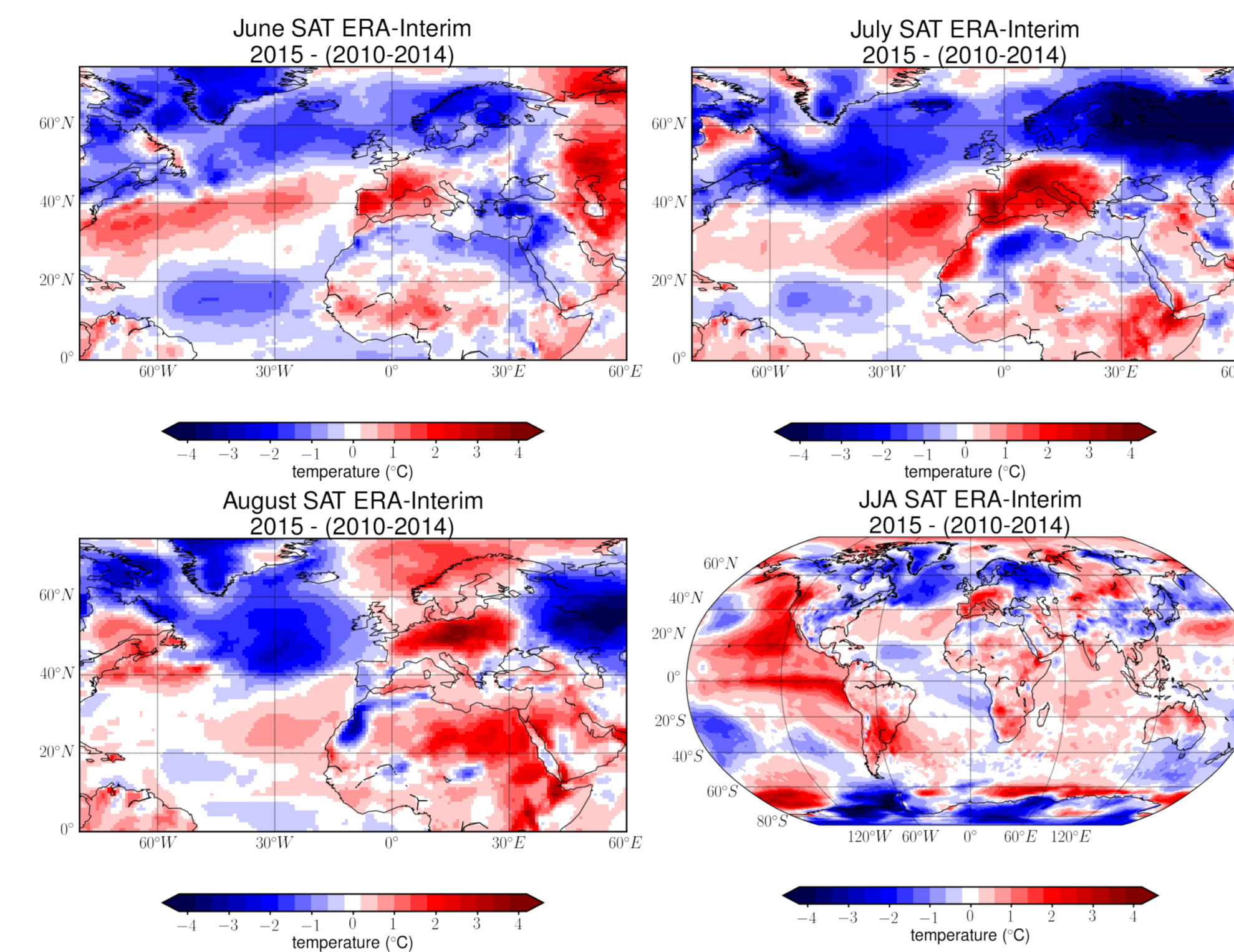
Experiments:

- Initialized on June 1st, 2015 from historical+rcp4.5 HadGEM3 experiment, with the exception of 3D ocean temperature and salinity
- 3D ocean temperature and salinity climatology is defined as mean May&June from 2010 to 2014
- 3 experiments are set up:
 - CLIM: T&S climatology (15 members)
 - GLOB: T&S clim. + June 2015 global anomaly from ORCA025 hindcast (15 members)
 - GLOBSM: Same as GLOB but with 2015 Soil Moisture Anomaly from MERRA Satellite Data (3 members)

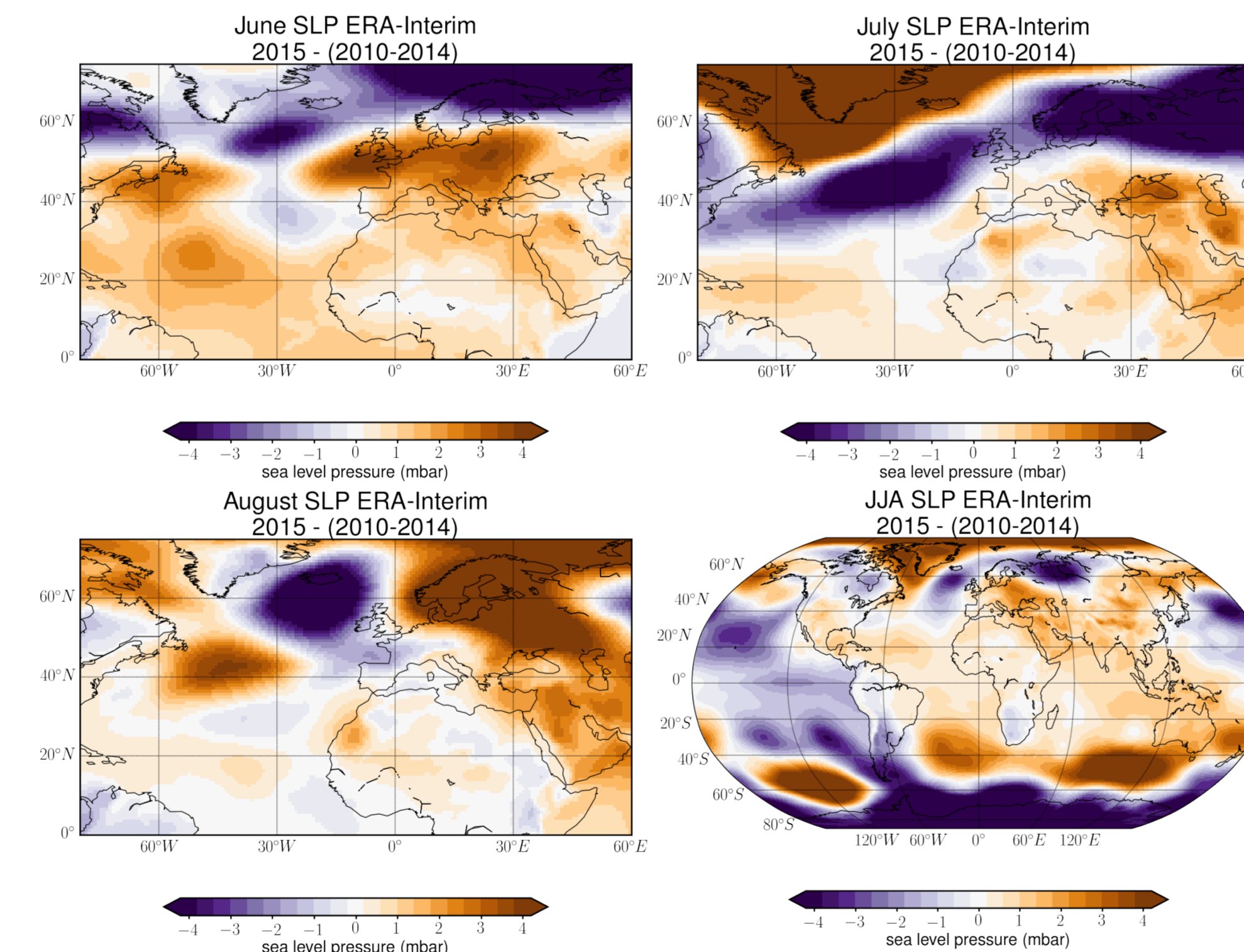


Observations

ERA-Interim Surface Air Temperature

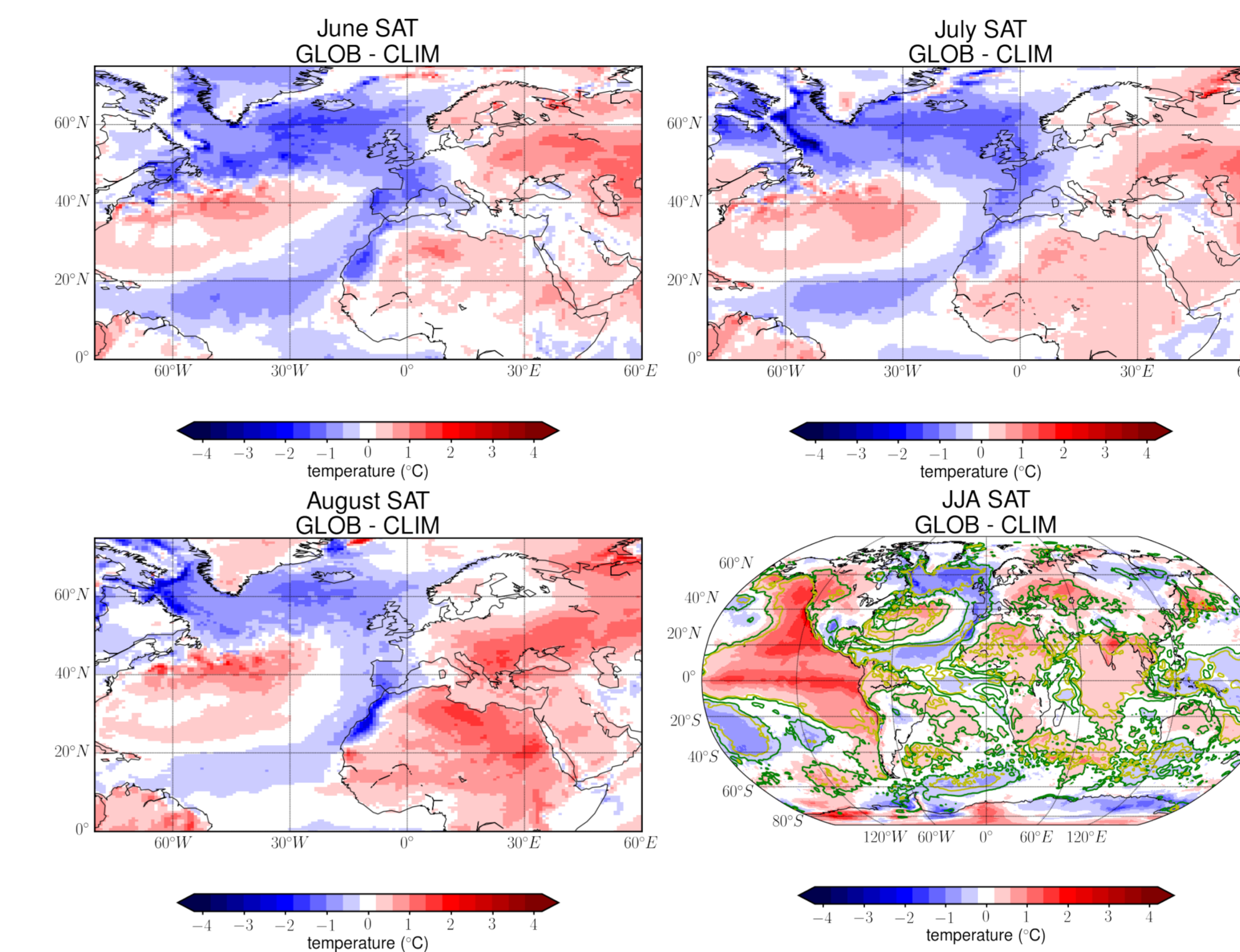


ERA-Interim Sea Level Pressure

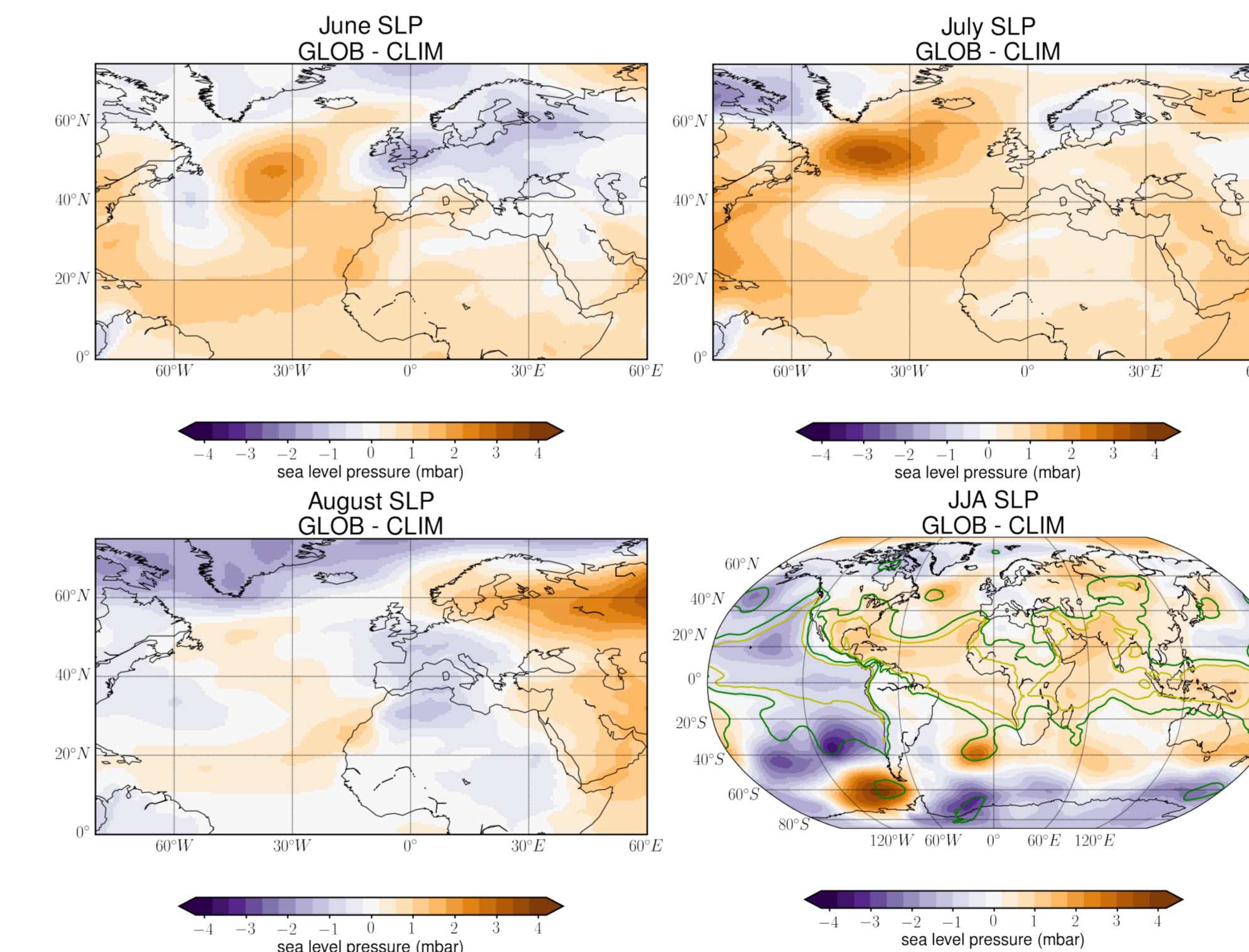


SST Cold Blob

GLOB - CLIM Surface Air Temperature

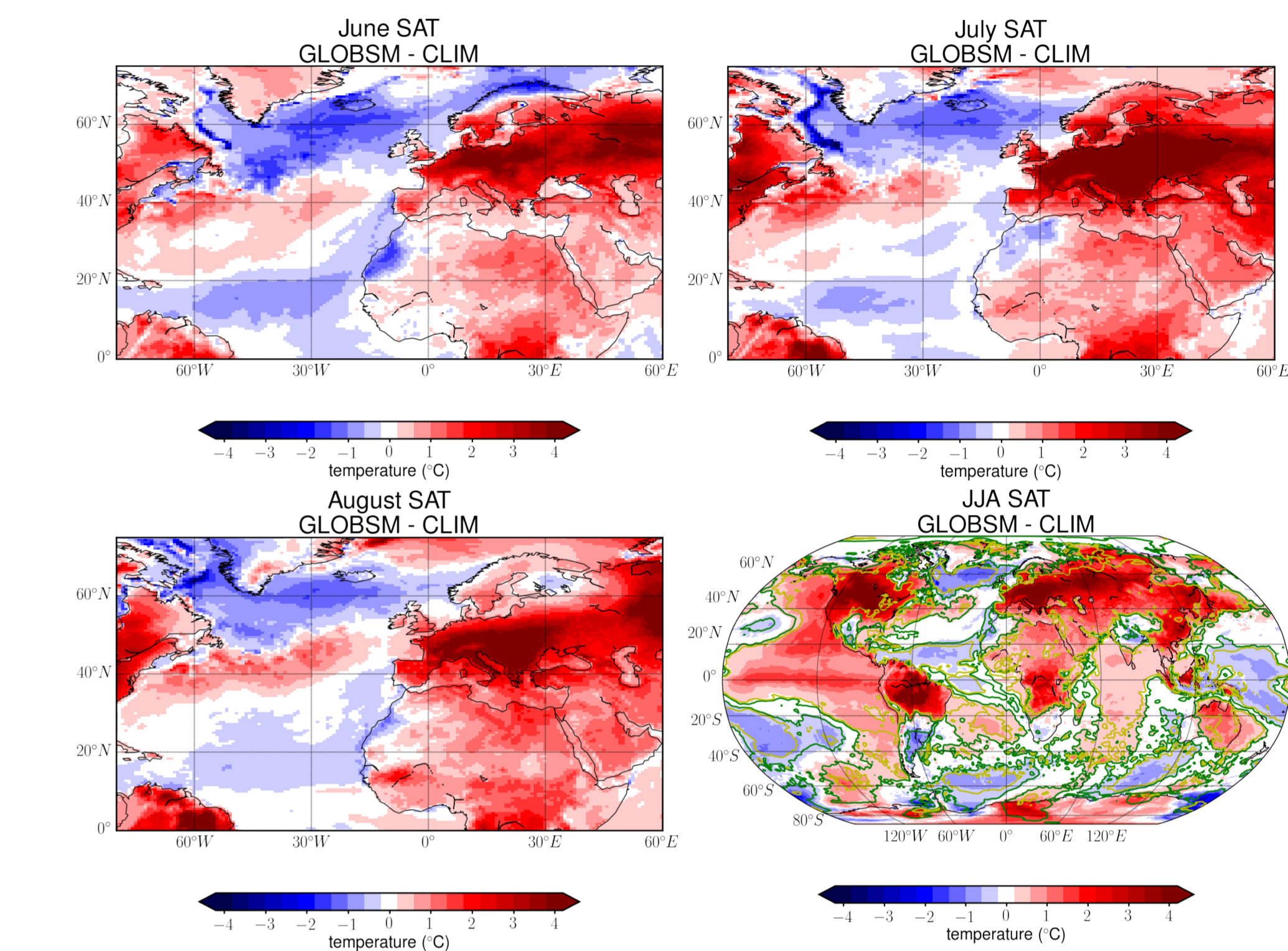


GLOB - CLIM Sea Level Pressure

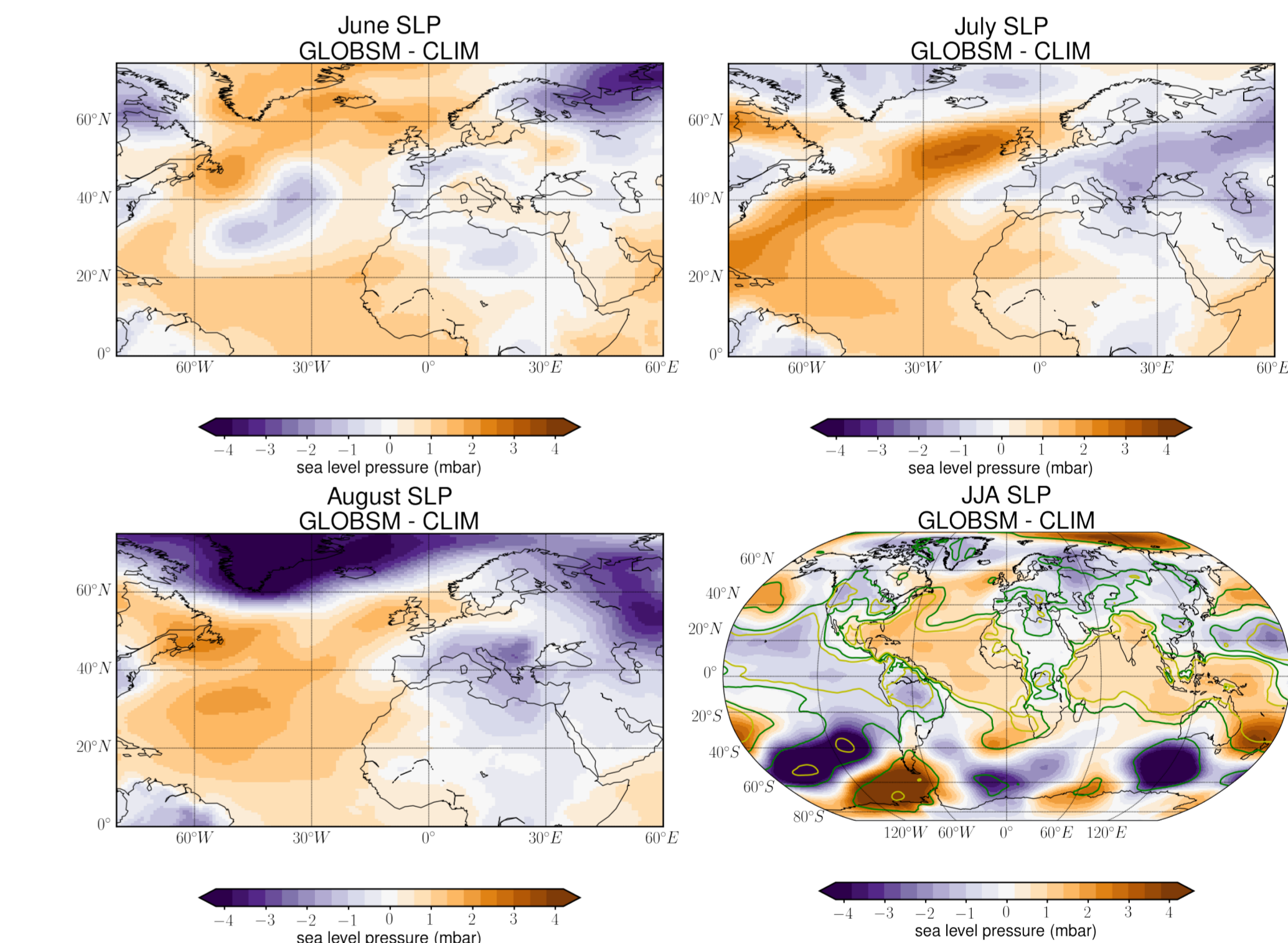


Soil Moisture

GLOBSM - CLIM Surface Air Temperature



GLOBSM - CLIM Sea Level Pressure



Conclusions

- A heat wave over Europe can be seen when forcing the coupled climate model with the 2015 temperature and salinity anomalies. The heat wave is too far to the east and the SLP pattern is very different compared to observations.
- Including the 2015 soil moisture anomaly creates a response closer to observations over Europe. However, the response is very large and has a global pattern. We suspect the soil moisture is biased dry and exaggerates the latent heat feedback during this period.
- Further Investigation is needed into the 2015 Central European Heat Wave.

Reference

Duchez A., Frajka-Williams E., Josey S.A., Evans D.G., Grist J.P., Marsh R., McCarthy G.D., Sinha B., Berry D.L., Hirschi J.J.-M. (2016) Drivers of exceptionally cold North Atlantic Ocean temperatures and their link to the 2015 European Heat Wave. Environmental Research Letters