

# S2S and early warning of severe conditions

How far in advance can we predict changes in large-scale flow leading to severe cold conditions over Europe?

Laura Ferranti Linus Magnusson Frederic Vitart

[Laura.Ferranti@ecmwf.int](mailto:Laura.Ferranti@ecmwf.int)

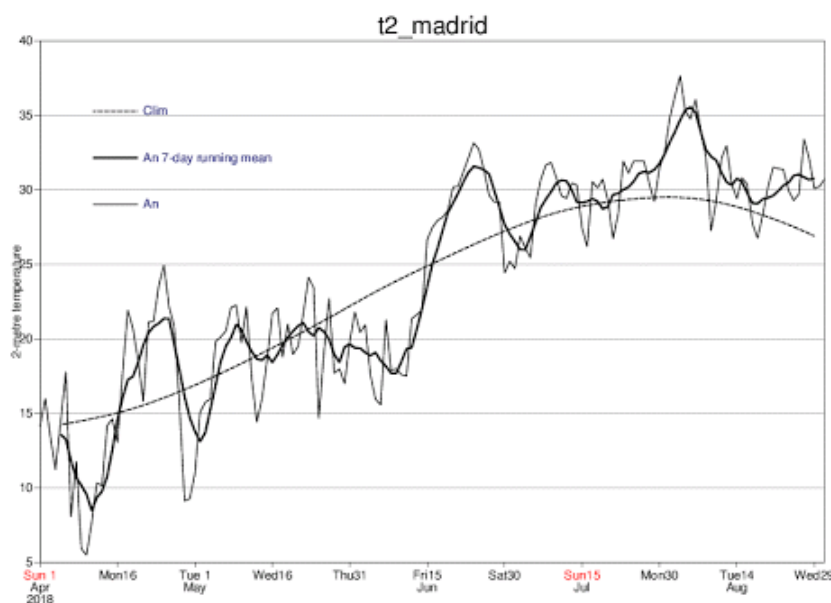
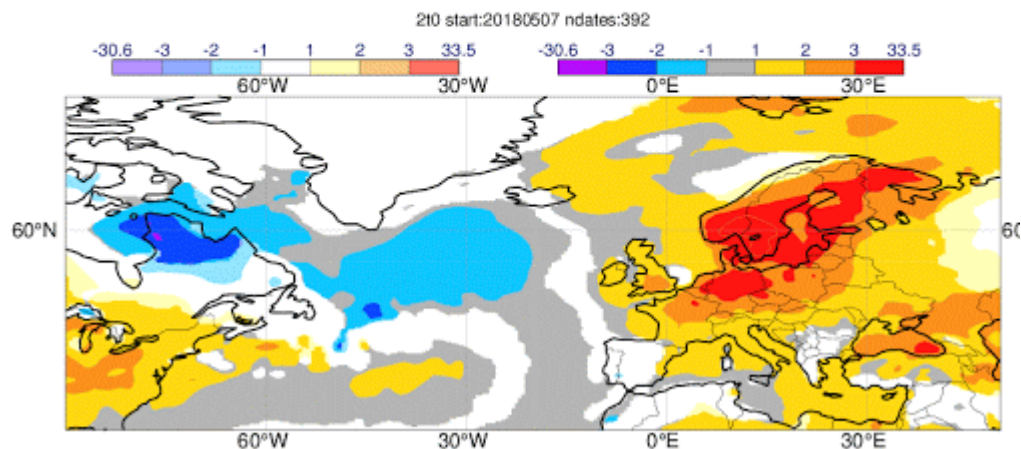


The prediction of extreme events is one of the major challenges of S2S forecasting due to their high human and financial cost.  
(S2S sub-project).

Extreme events that the S2S forecast could predict are long lasting, large scale extreme weather hazards which occur on a scale of 1000 km with a lifetime ranging from a week to a few months. These events can be particularly destructive.

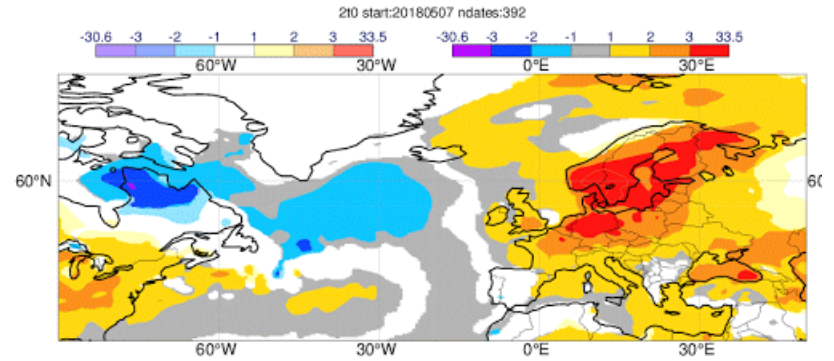
S2S models will probably not have skill to predict the daily variations of these extreme events, but they are expected to provide guidance on their genesis, time evolution, intensity and decay on at least a weekly basis.

# Summer of 2018 : warmest and driest for northern Europe

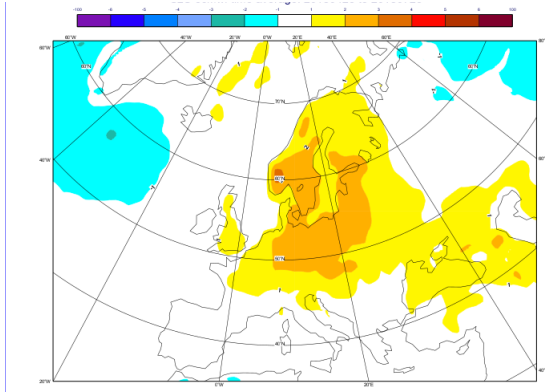


Time series of daily 12 UTC 2m temp (thin lines) 7day running mean thick lines  
Climatology (dashed lines) for St and M from the 1 of April to 31 August 2018

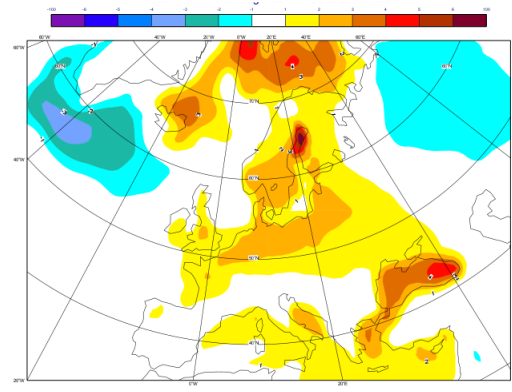
# Composites of weekly 2mt anomalies range 12-18 days from some S2S models valid from 7 May to 12 August:



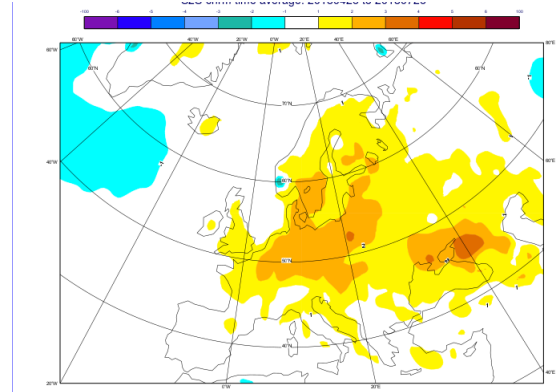
2mt weekly anomalies range 12-18days composites valid for 20180507 to 20180812



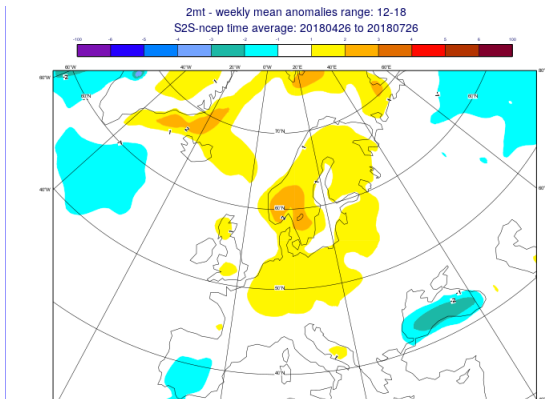
**ECMWF**



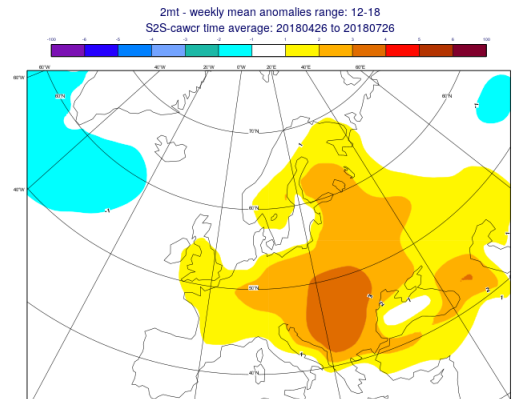
**CMA**



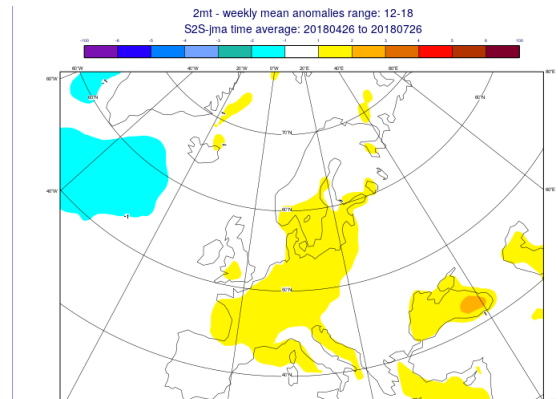
**MET. FRANCE**



**NCEP**



**Bom**

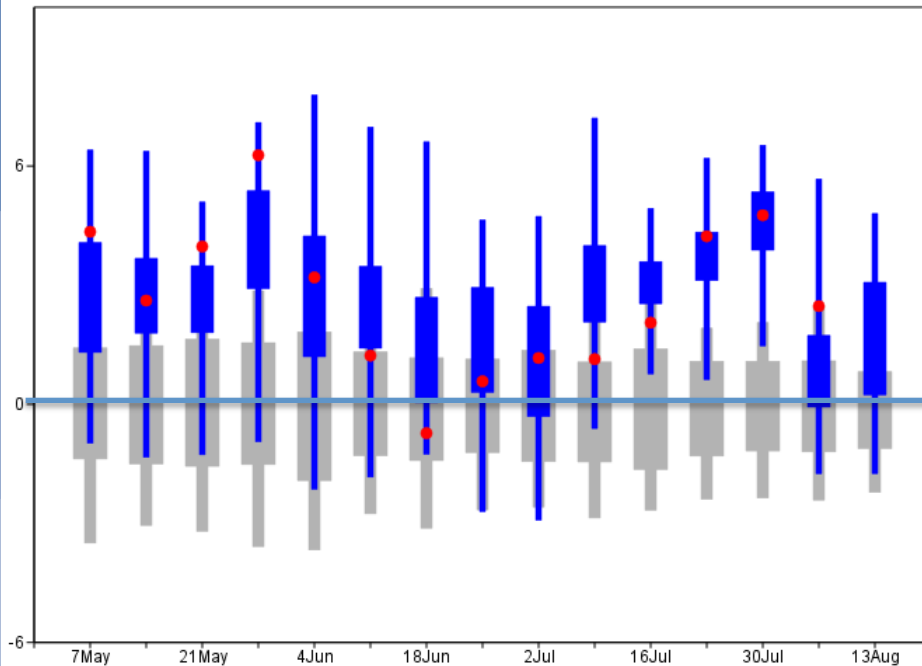


**JMA**

# Evolution of weekly 2mt anomalies over 60-50N 10-20E :

forecast range 8-14

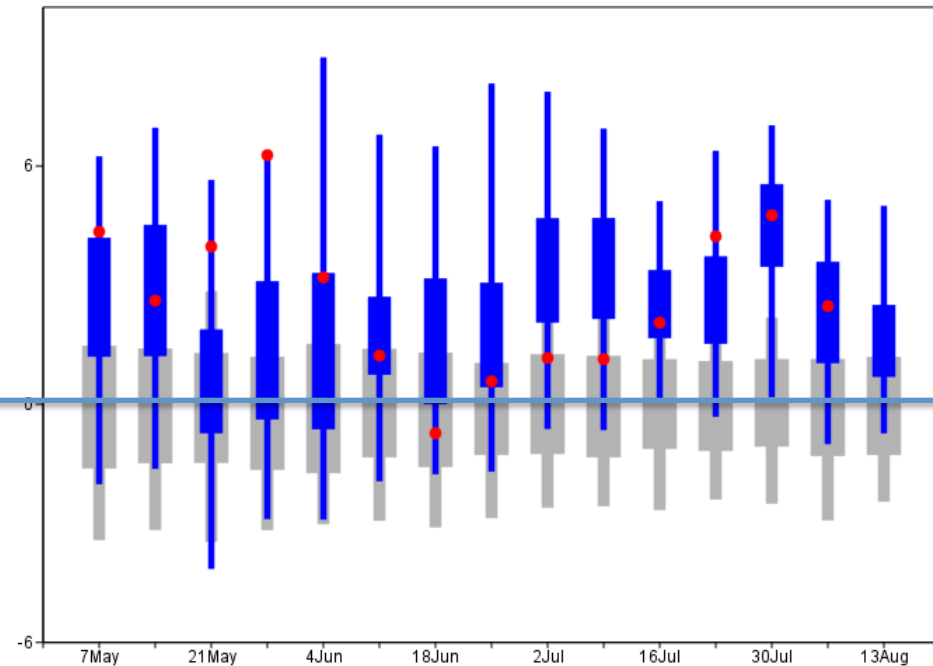
2mt - weekly mean anomalies range: 168-336



**Cor= 0.72**

forecast range 12-18

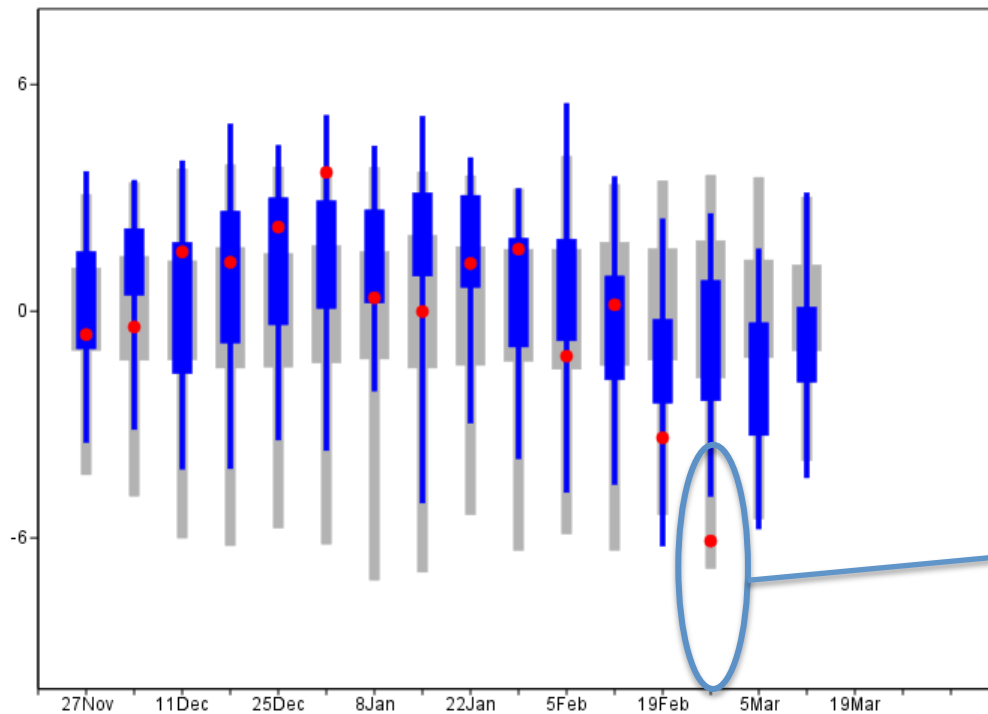
2mt - weekly mean anomalies range: 264-432



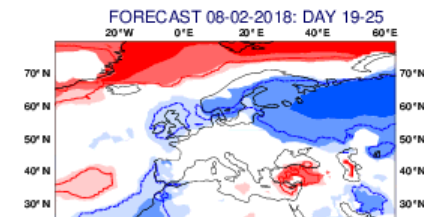
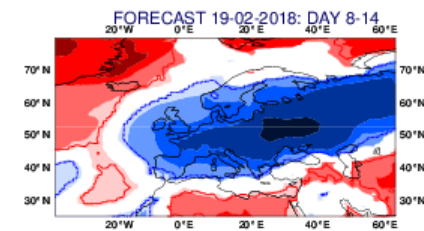
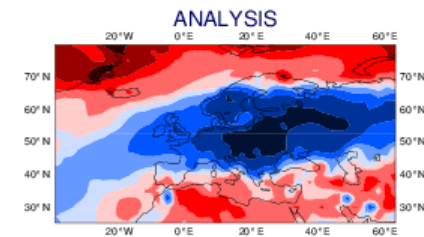
**Cor = 0.04**

# Severe cold spell end of February 2018:

2mt over Europe  
weekly means anomalies at 19-25  
days

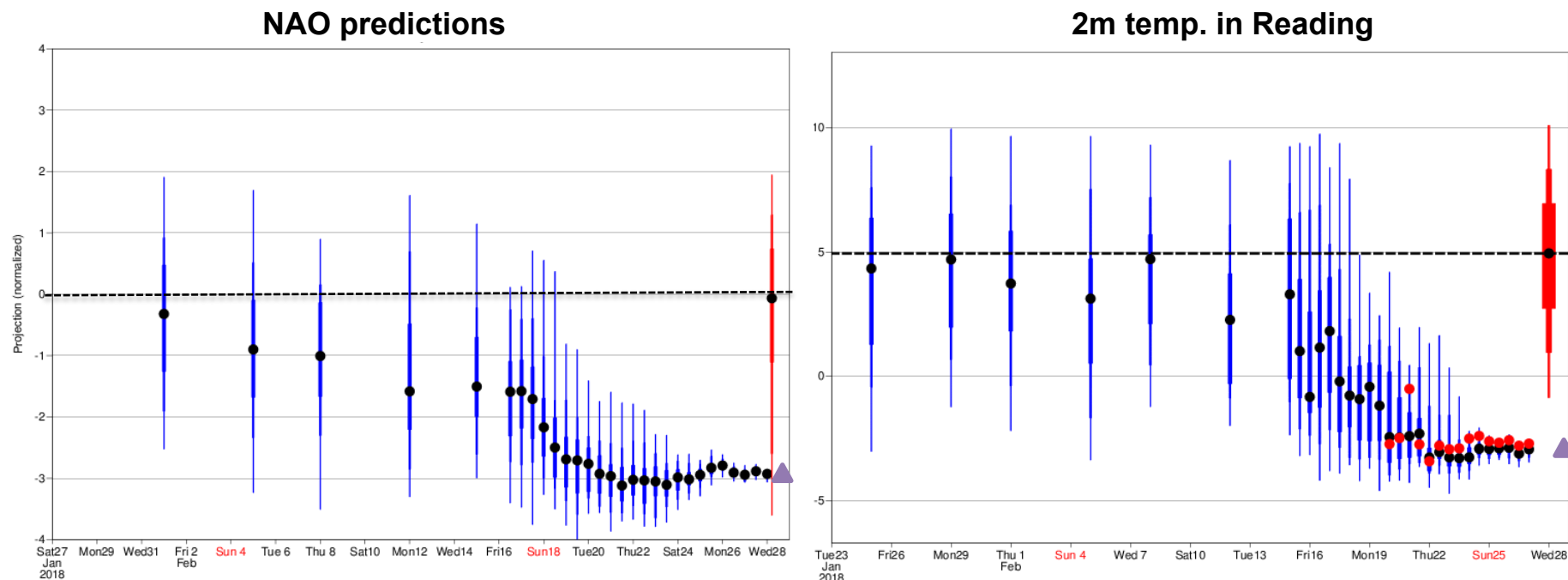


26/2-4/3 2018



# How far in advance this cold event was predicted?

Predictions initialized at different time and verifying the 3-days mean (27 Feb to 1 March)



Persistent high pressure systems are associated with severe events: cold spell in winter and heat waves in summer.

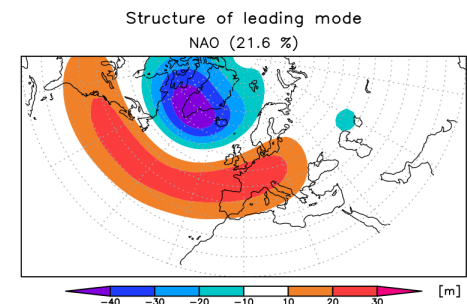
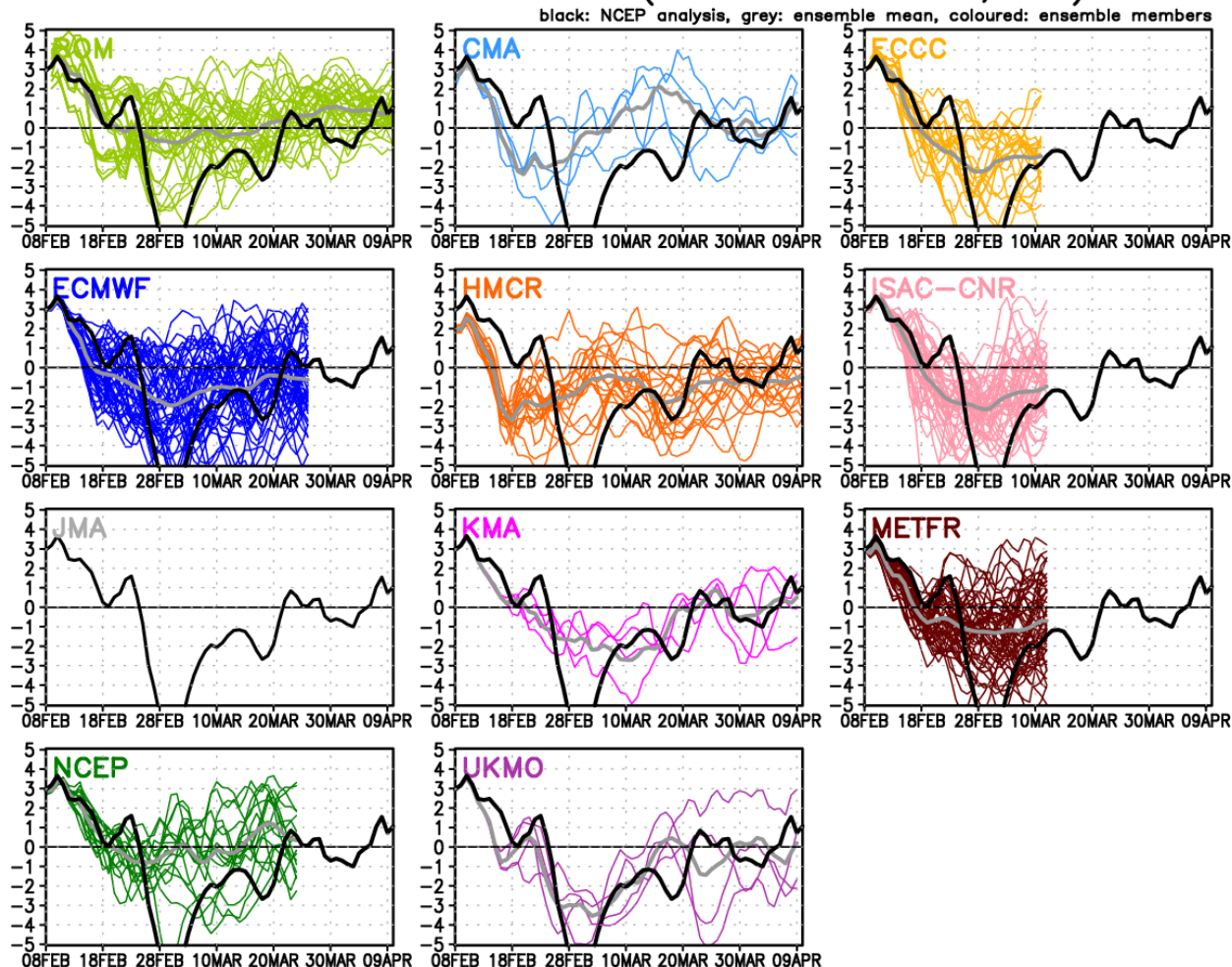
Circulation regimes, usually associated with global teleconnections, play an important role in the atmospheric predictability on sub-seasonal time scale.

# From: the S2S Museum @University of Tsukuba, Japan

Dr. Mio Matsueda

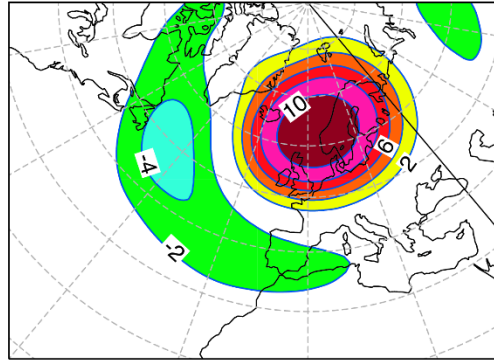
[http://gpvjma.ccs.hpcc.jp/S2S/S2S\\_NAO.html](http://gpvjma.ccs.hpcc.jp/S2S/S2S_NAO.html)

## S2S NAO index forecasts (initial: 2018.02.08, Thu)

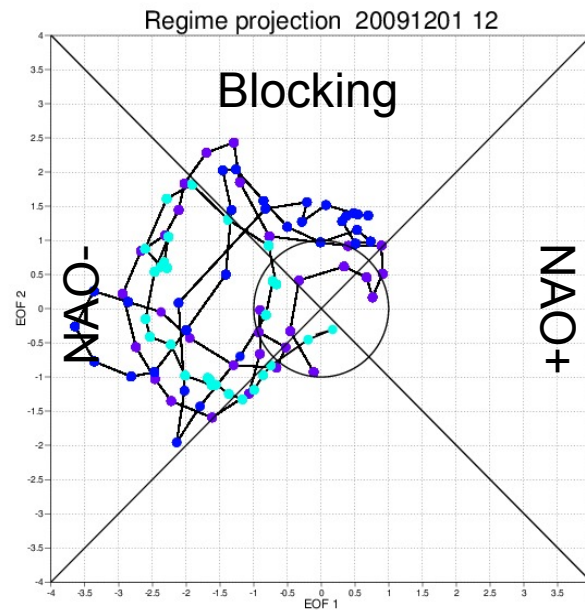
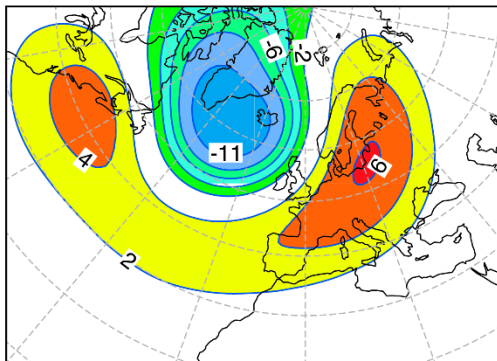




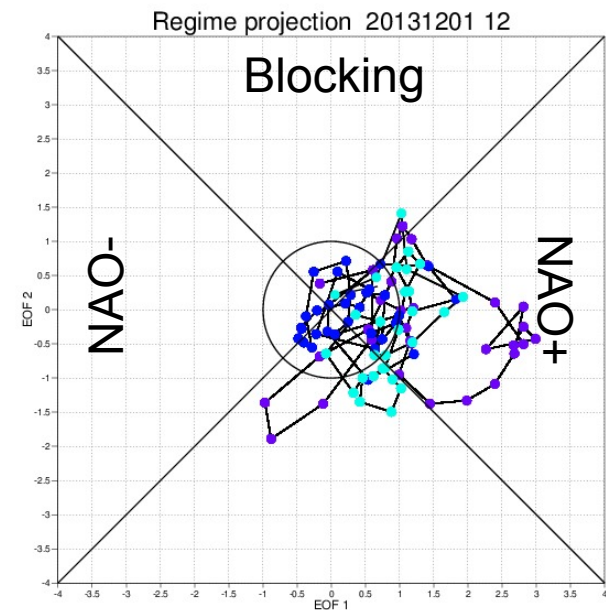
# How far in advance we predict changes in large scale flow leading to sever cold spell over Europe?



- $\pm$ EOF1 and  $\pm$ EOF2 represent quite well  $\pm$ NAO and BL
- Trajectories in phase space summarise regime evolution



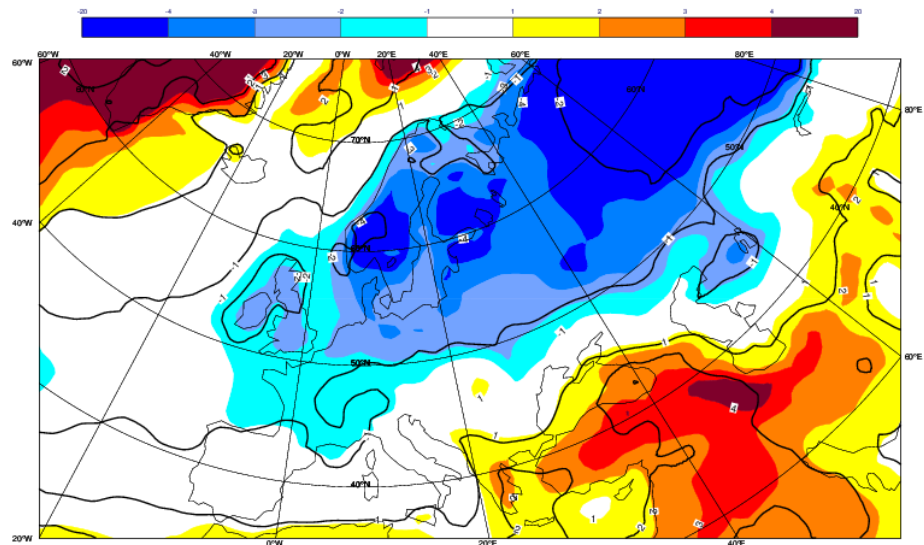
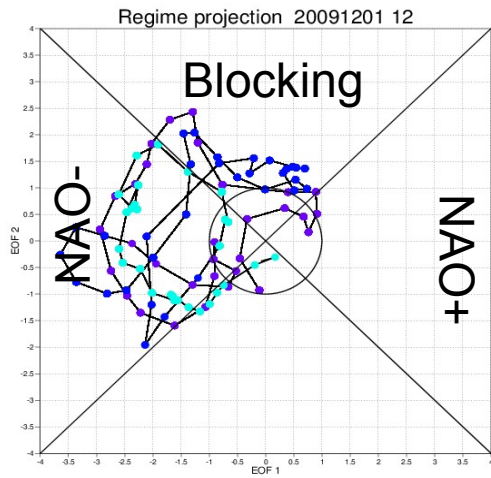
BL: record-breaking cold temperatures over Europe



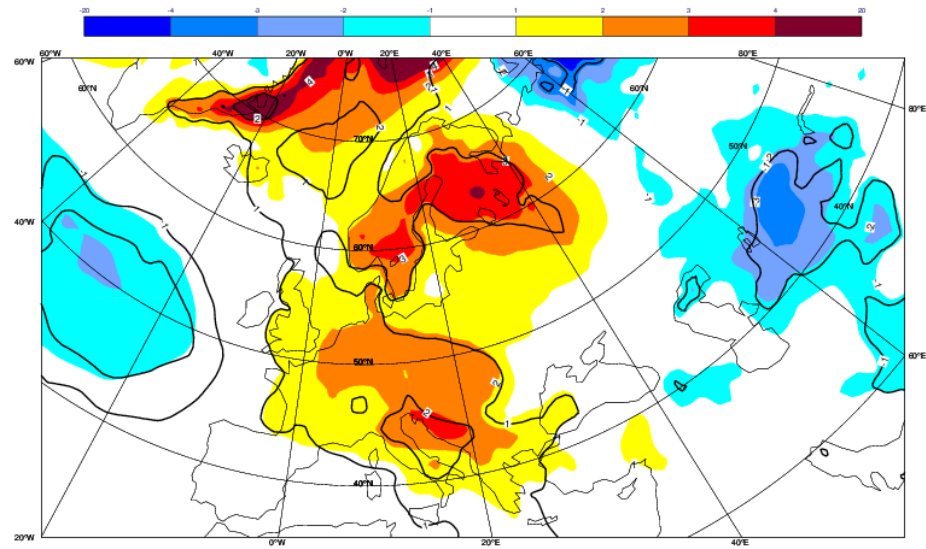
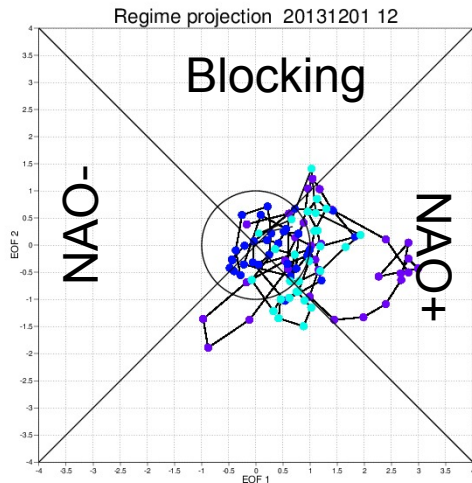
+NAO: exceptional storminess, but mild temperatures over Europe

# 2M Temp anomalies for DJF:

2009/2010

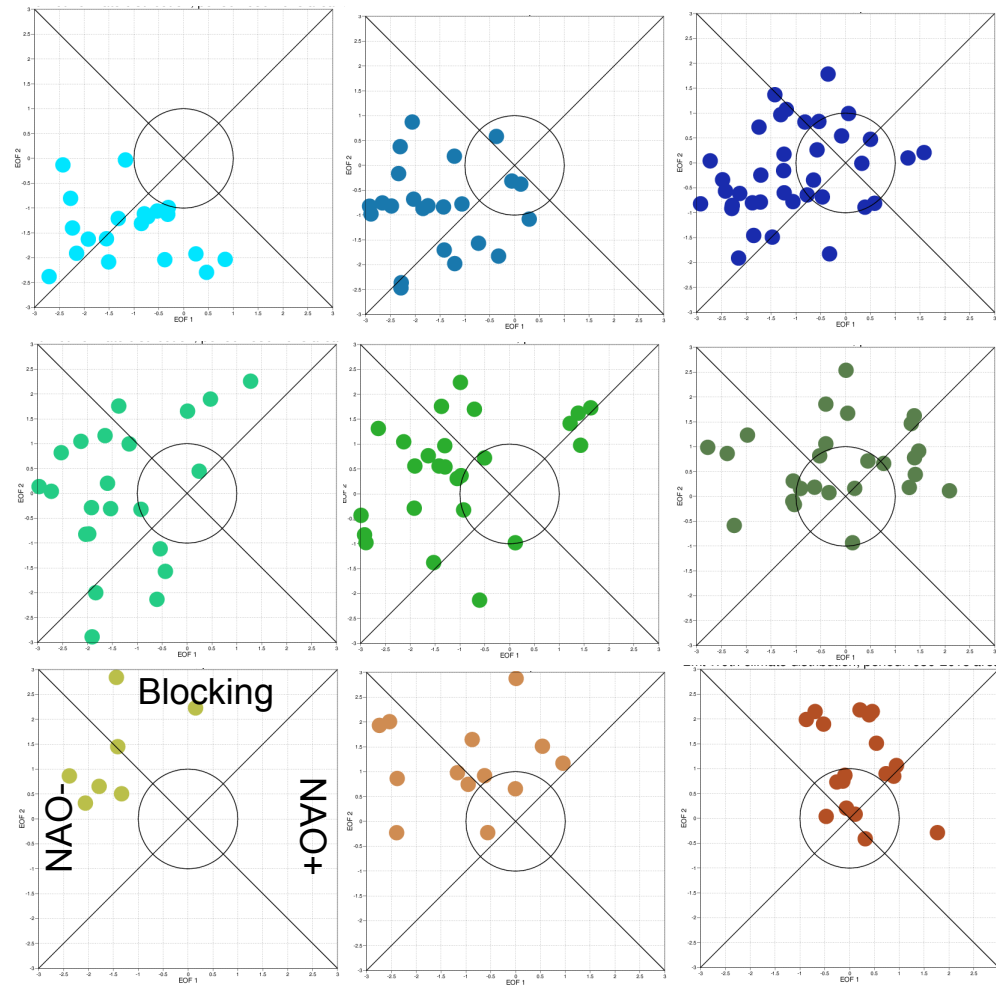
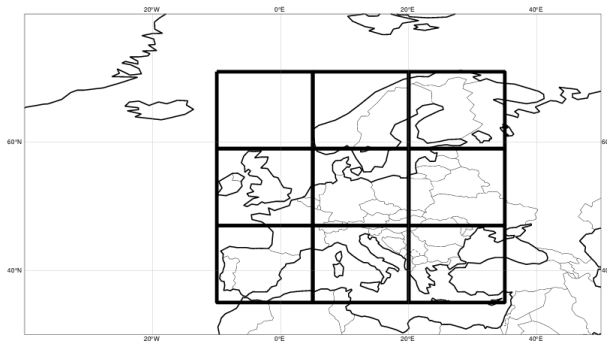


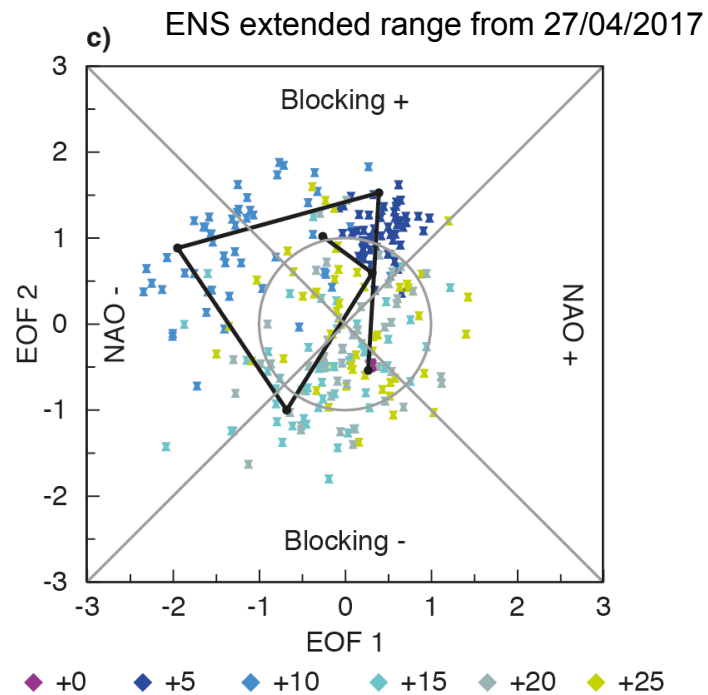
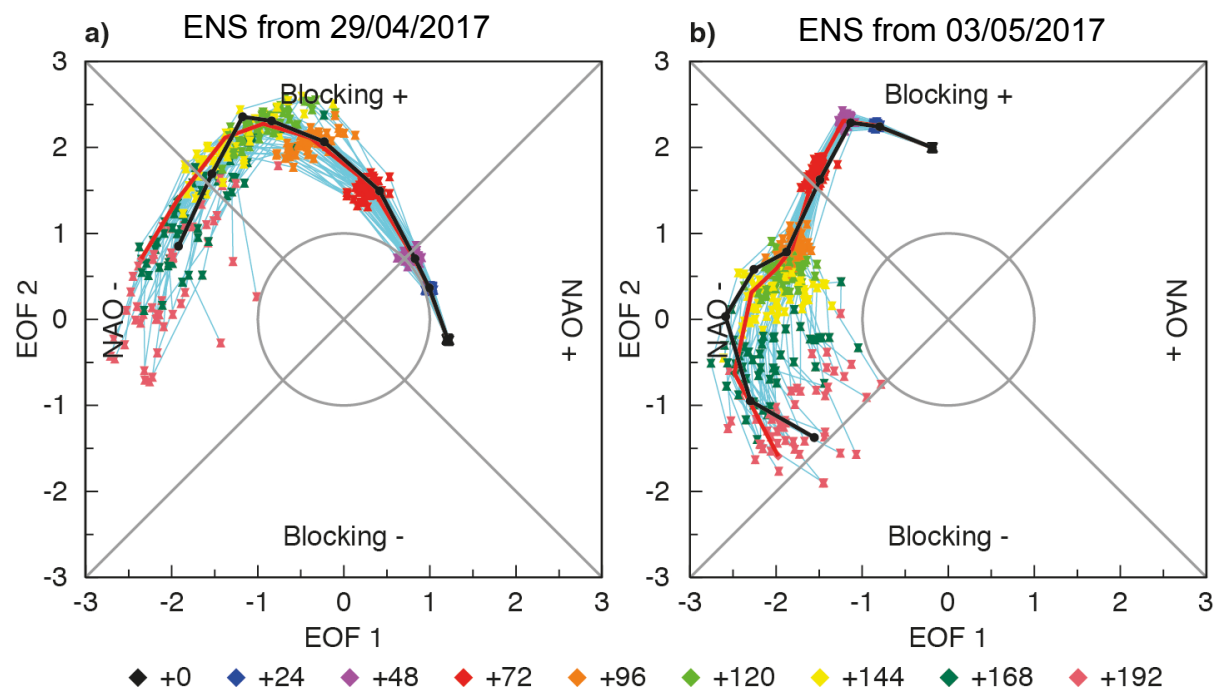
2013/2014

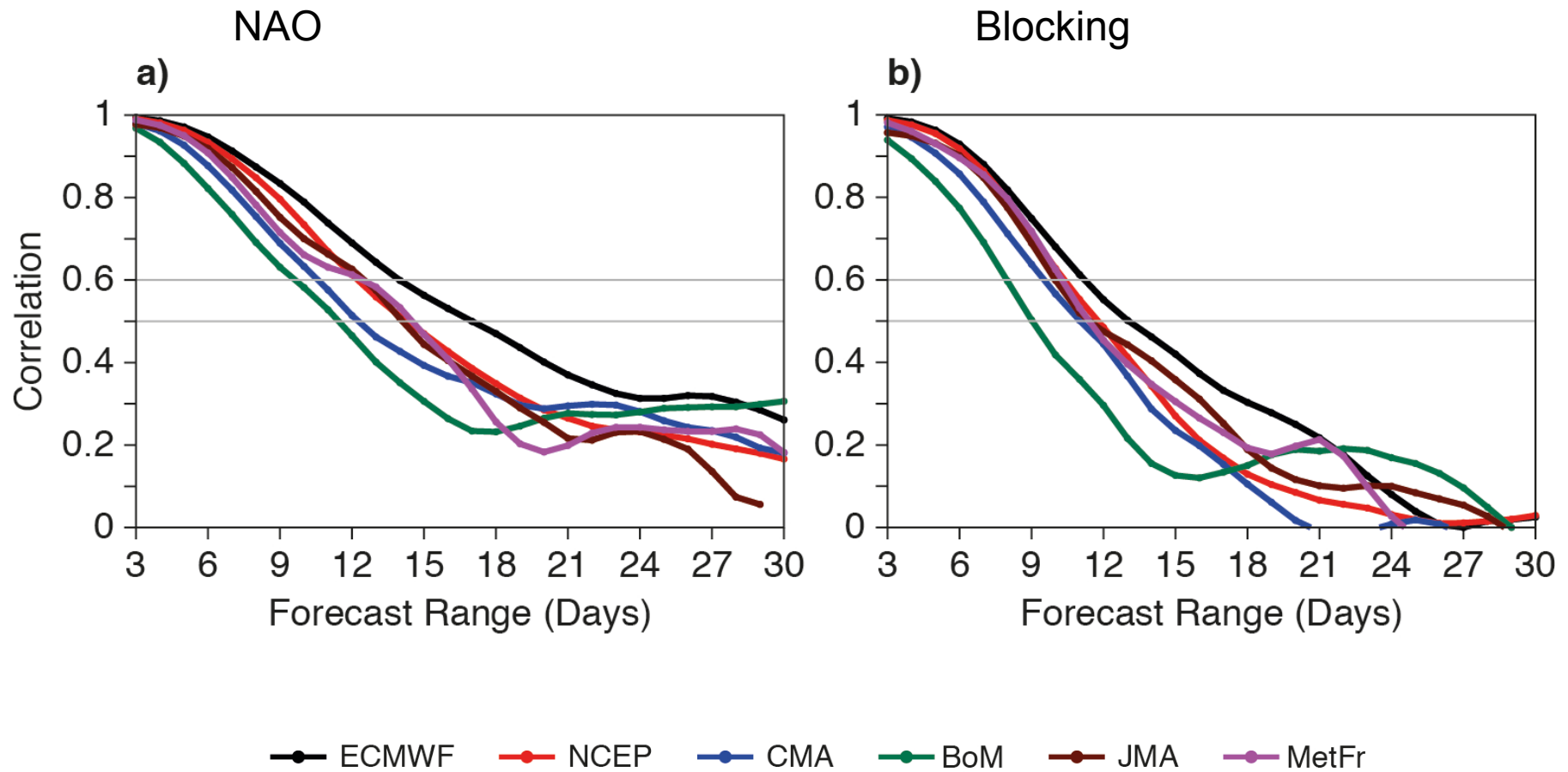


## Distribution of severe winter (NDJF) events in era-interim (1980-2015)

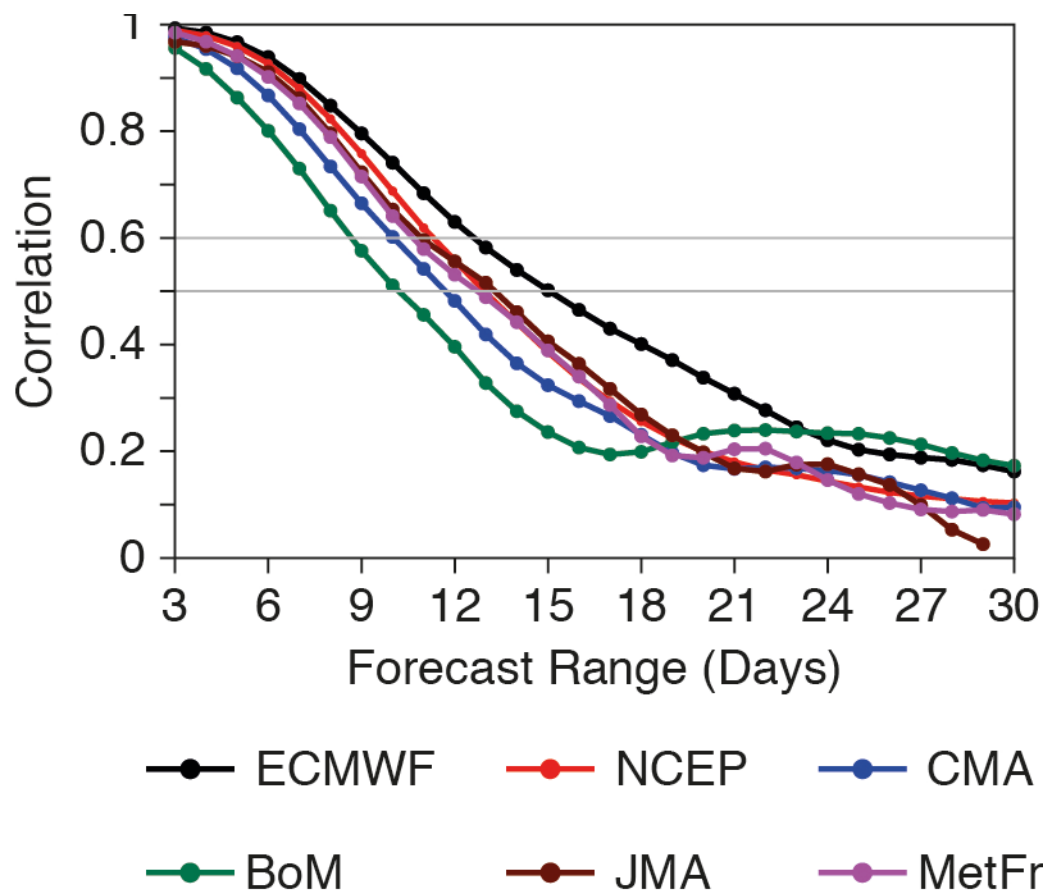
When for 60% grid points in each box the daily 2mt < 10<sup>th</sup> quantile of daily climate for at least 4 consecutive days







## Regime transitions:



*Lin et al. (2008)*

ecmwf  
FORECAST BASED 27/04/2017 00UTC

