



Predictability of meteorological droughts and extreme temperature anomalies in Europe

Christophe Lavaysse

JRC, European Commission, Ispra, IT

EDO meeting, Ispra, November 2017

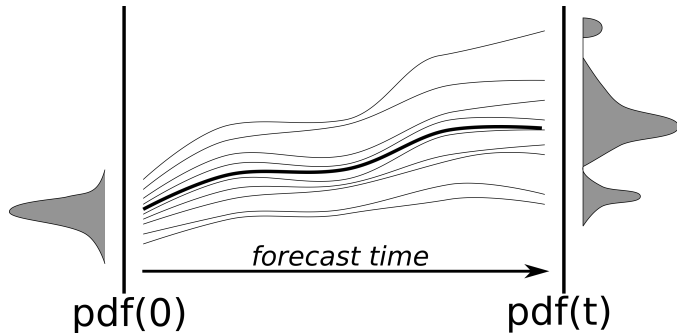
Challenges

① How to detect/forecast operationally extreme events ?

- Developing metrics : obs/forecasts
- Extracting information (How to deal with ensemble forecasts ?)
- Developing indices most robust and comprehensible as far as possible

② Improving our knowledge

- Estimating the predictability of these events
- Assessing the uncertainties (obs/method/forecasts)
- Understanding the origins to propose alternative methods (predictors)



Datasets

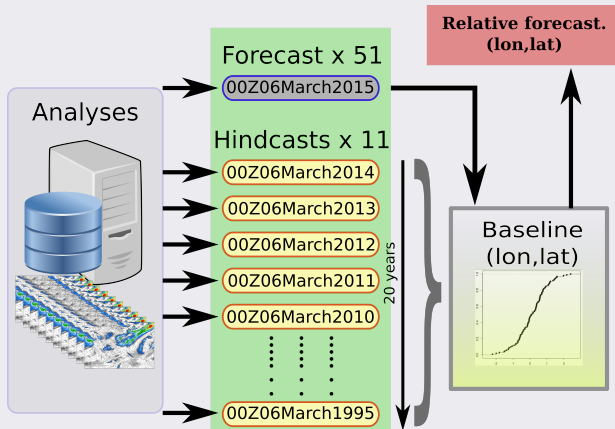
Observation

- Three different datasets
 - **LisFlood** *De Roo et al. 2000*
 - **E-OBS v14** *Haylock et al. 2008*
 - **ERA-Interim** *Dee et al. 2011*

Variables

- Variable used
 - daily Precipitation
 - daily T_{min} & T_{max}
- Resolution
 - 1 square deg.
 - diff. sets of smoothing
- Period of study (hindcasts)
 - Droughts : 1993-2014
 - H&CW : 1995-2015
- Region of study
 - Extended Europe

Forecasts (ENS ECMWF)



Metrics

Definition

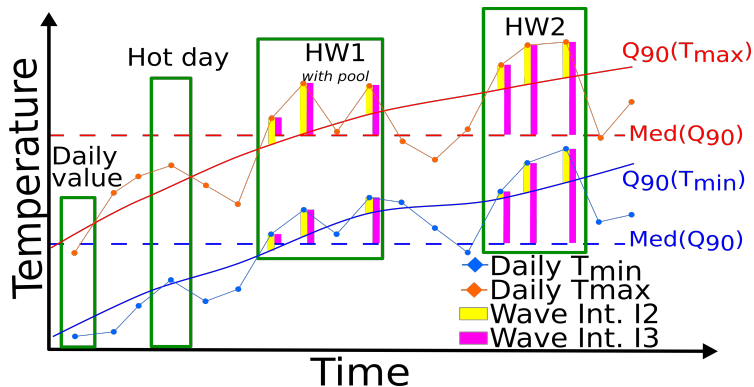
→ Droughts

- SPI-1 (30-day cumulated precipitation)

→ Heat & Cold waves

- adaptation of the HWDI and HWMI
IPCC 2012

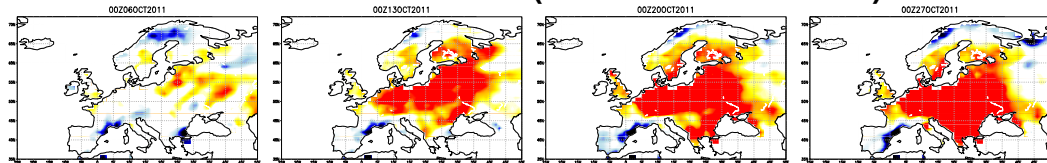
Russo et al. 2015



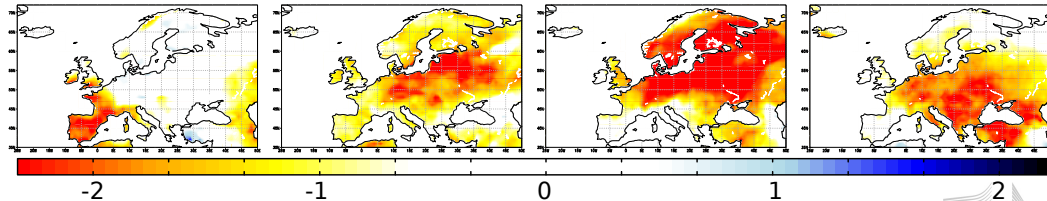
Lavaysse et al., Towards a monitoring system of temperature extremes in Europe, NHESSD

Drought forecasting : case study

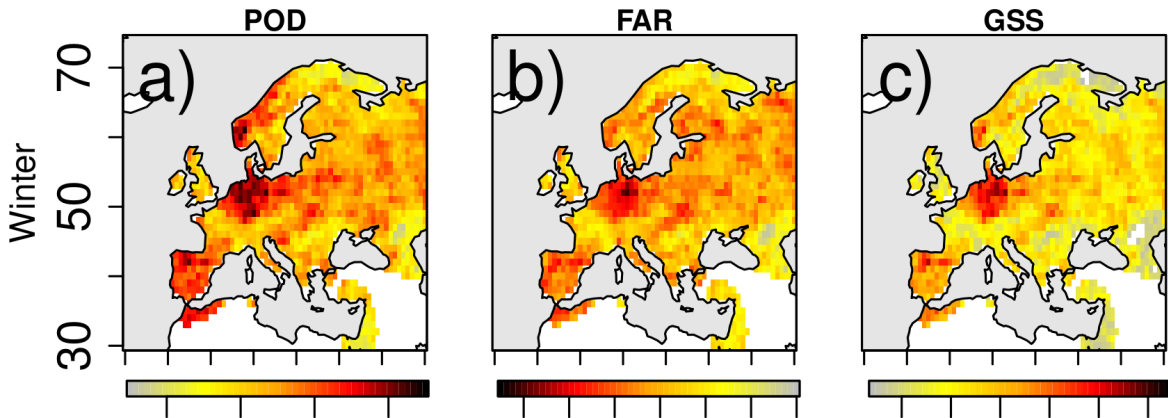
Forecasting meteorological droughts SPI1 observed (Oct-Nov 2011)



SPI1 forecasted (Oct-Nov 2011)

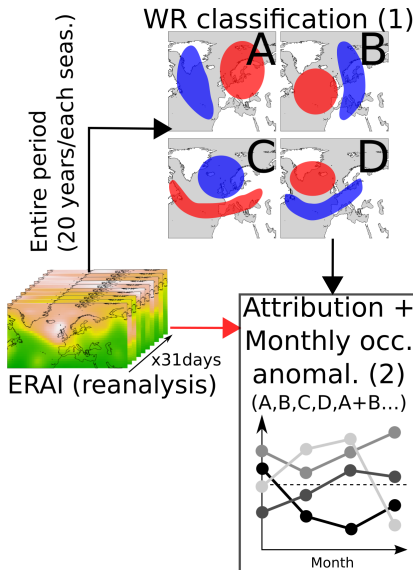


Scores of drought (SPI<-1) forecasting using precipitation

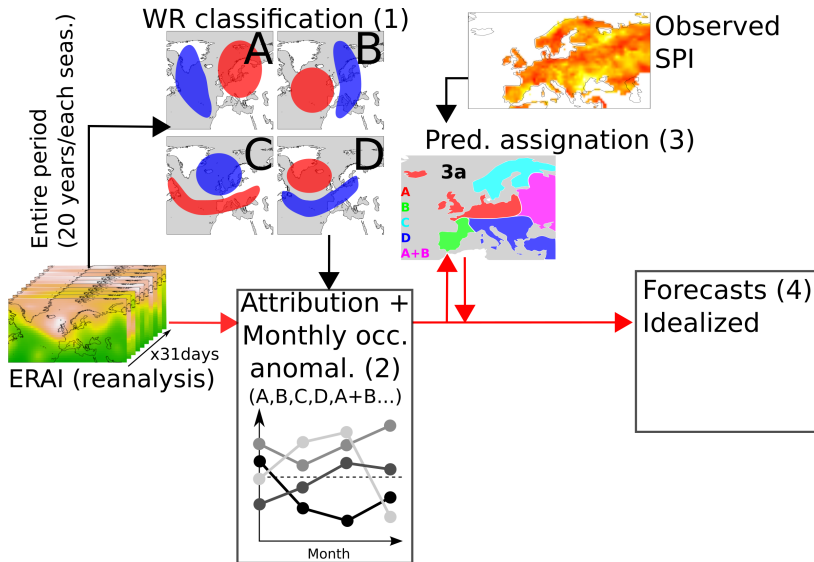


Lavaysse et al., Early warning of drought in Europe using the monthly ensemble system from ECMWF (2015)

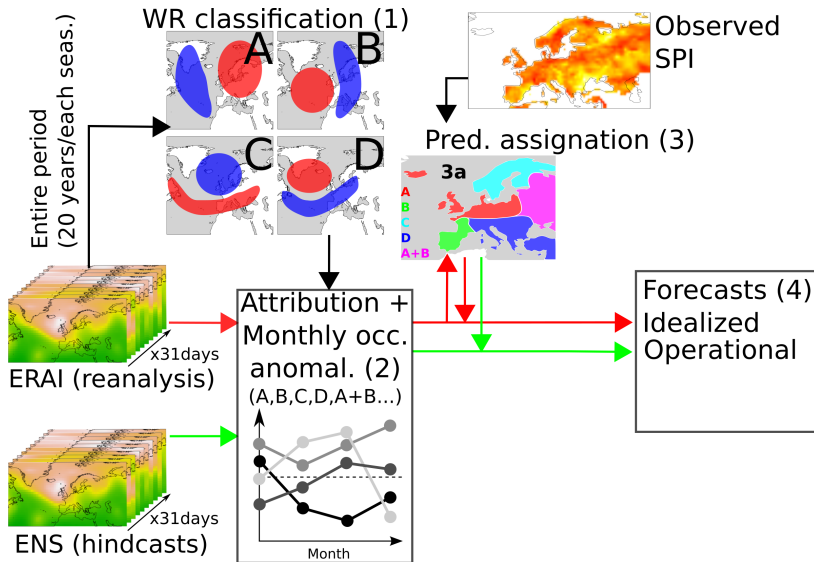
Drought forecasting using predictors (occurrence anomalies of WRs)



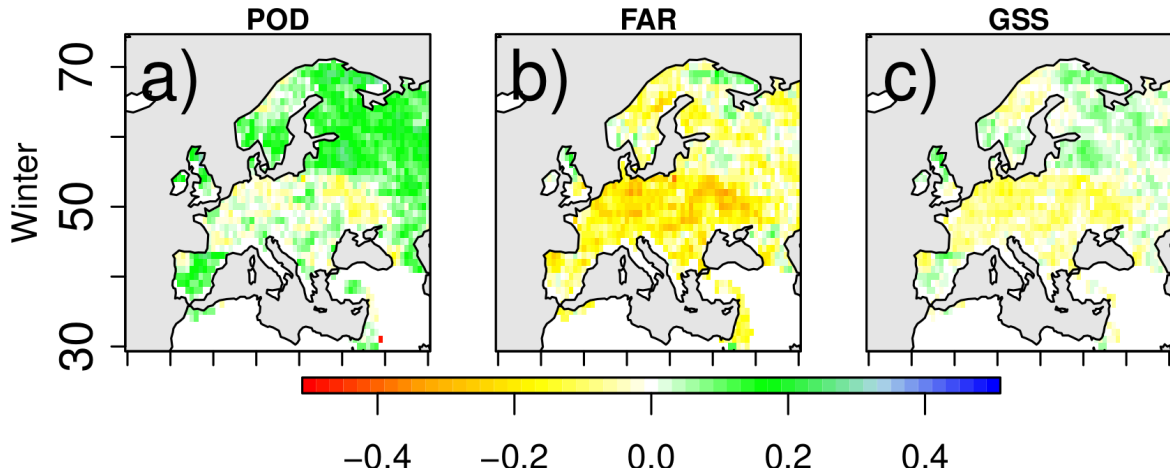
Drought forecasting using predictors (occurrence anomalies of WRs)



Drought forecasting using predictors (occurrence anomalies of WRs)

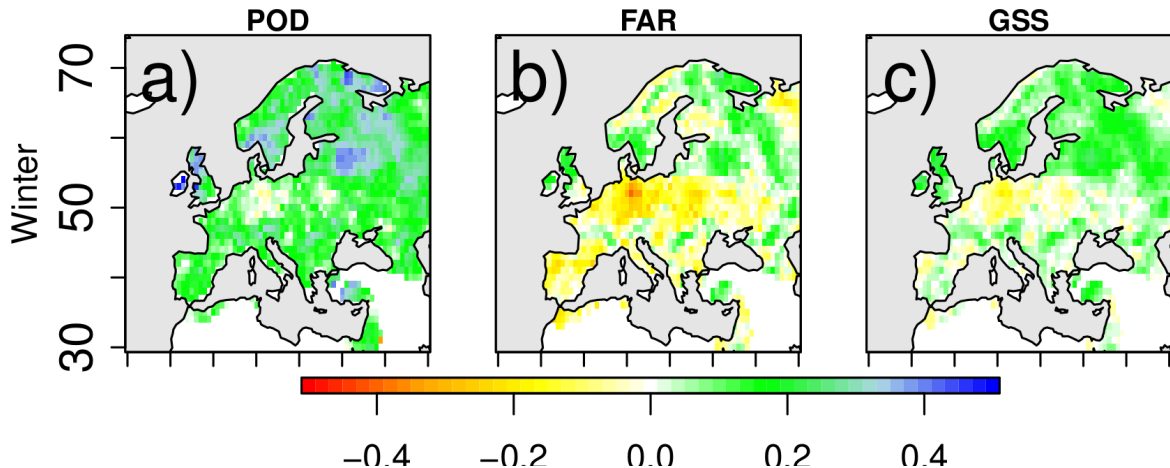


Improvement of drought forecasting using WRs (Operational forecasts) vs. precip.



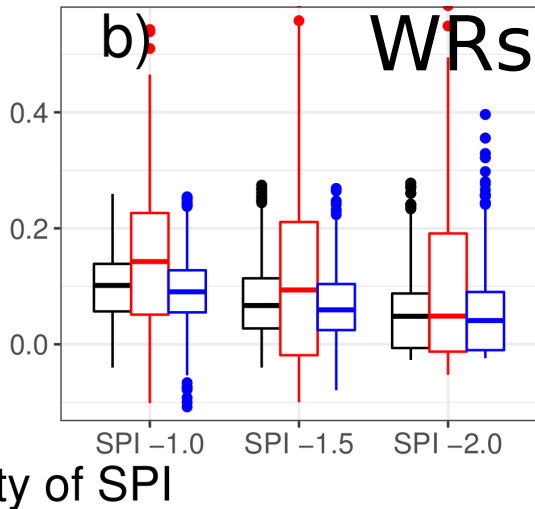
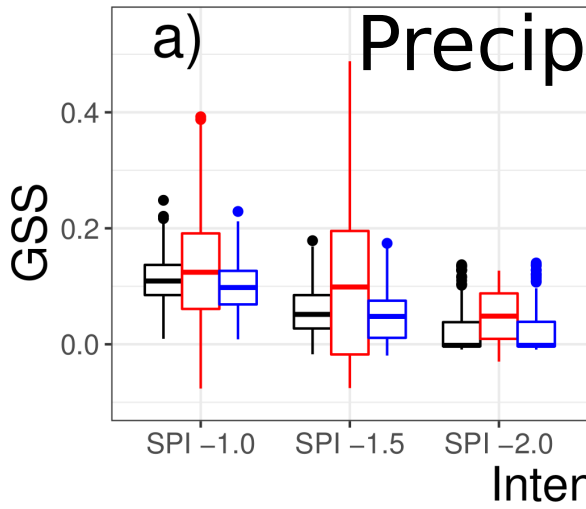
Lavaysse et al., On the use of Weather Regimes to forecast meteorological droughts in Europe (under review)

Theoretical improvement of drought forecasting using WRs (ERA-I) vs. precip.



Lavaysse et al., On the use of Weather Regimes to forecast meteorological droughts in Europe (under review)

Sensibility of the intensities and initial conditions

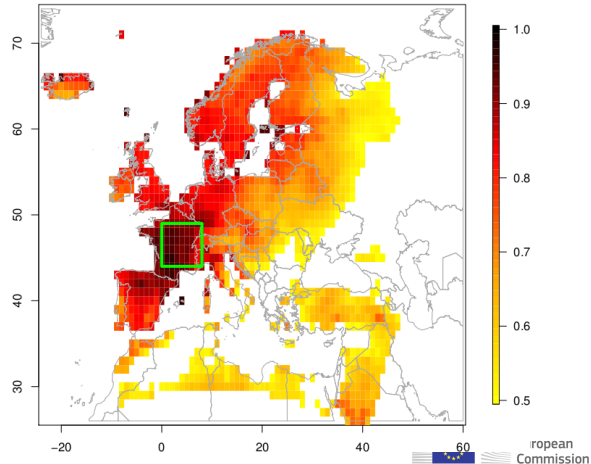
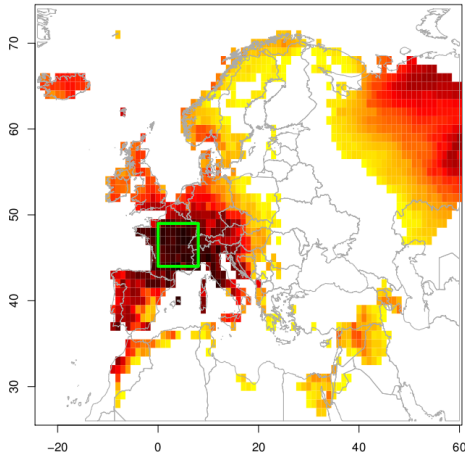


Case studies heat wave : France (2003)

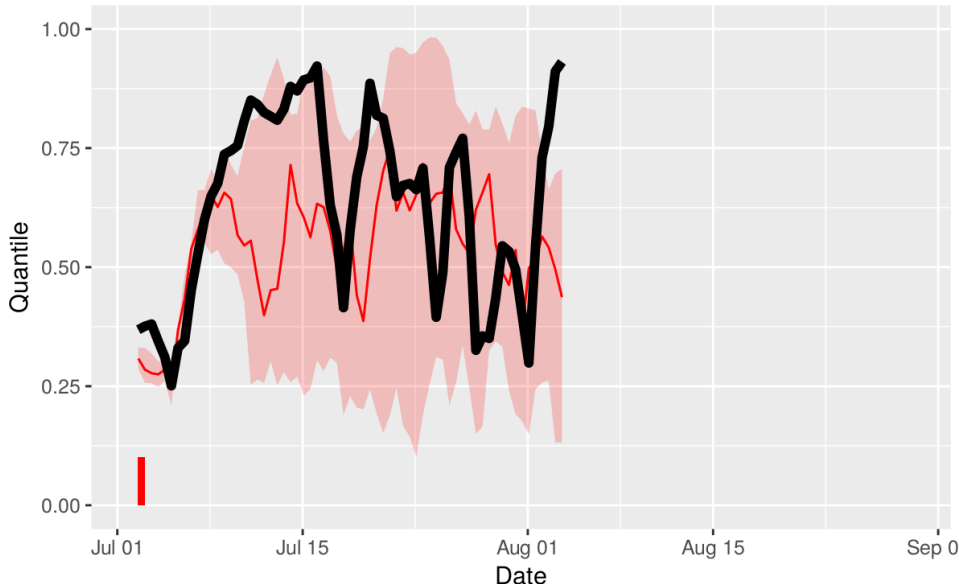
Forecasting Heat & Cold waves

Observed heatwave: 5 to 16Aug 2003

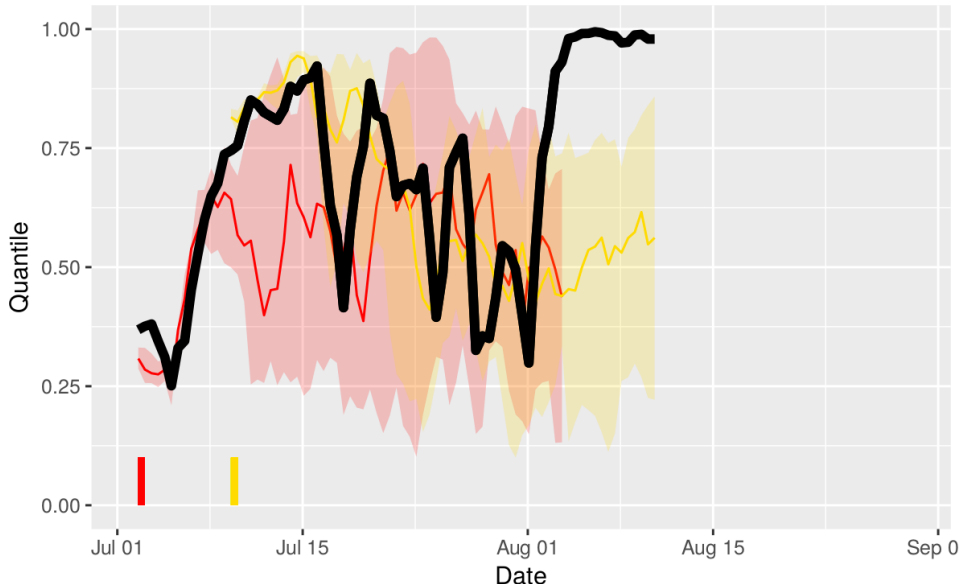
Forecast of the same period, from the 30Jul



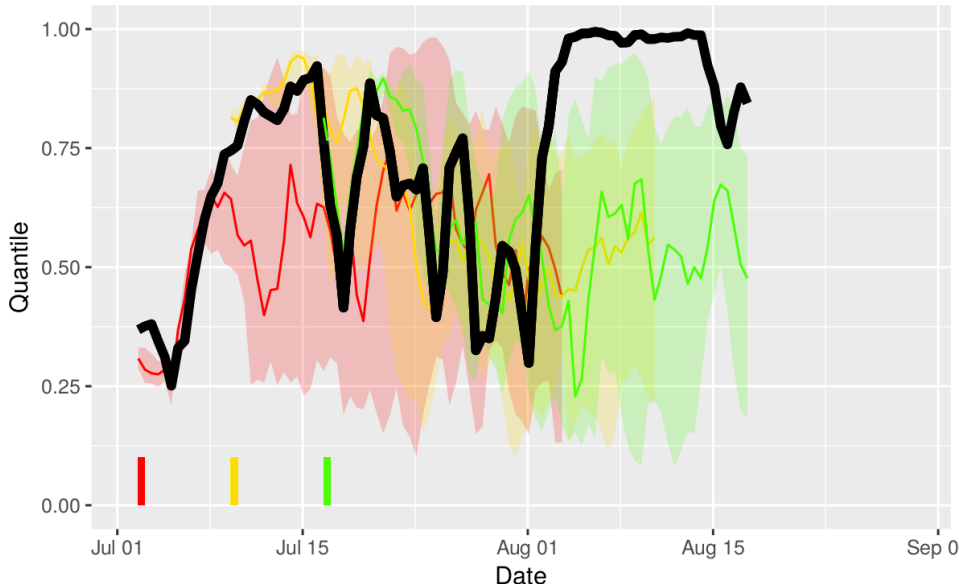
Case studies heat wave : France (2003)



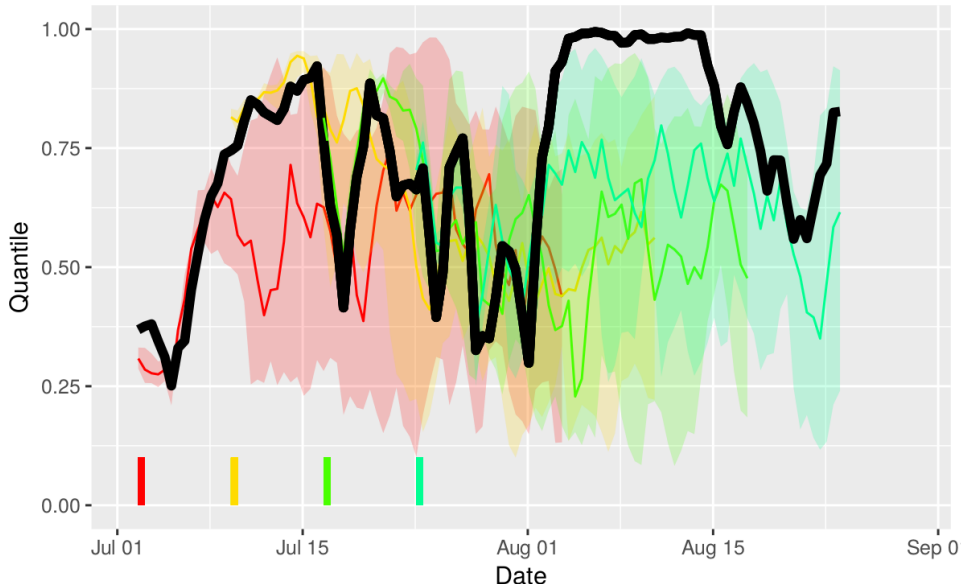
Case studies heat wave : France (2003)



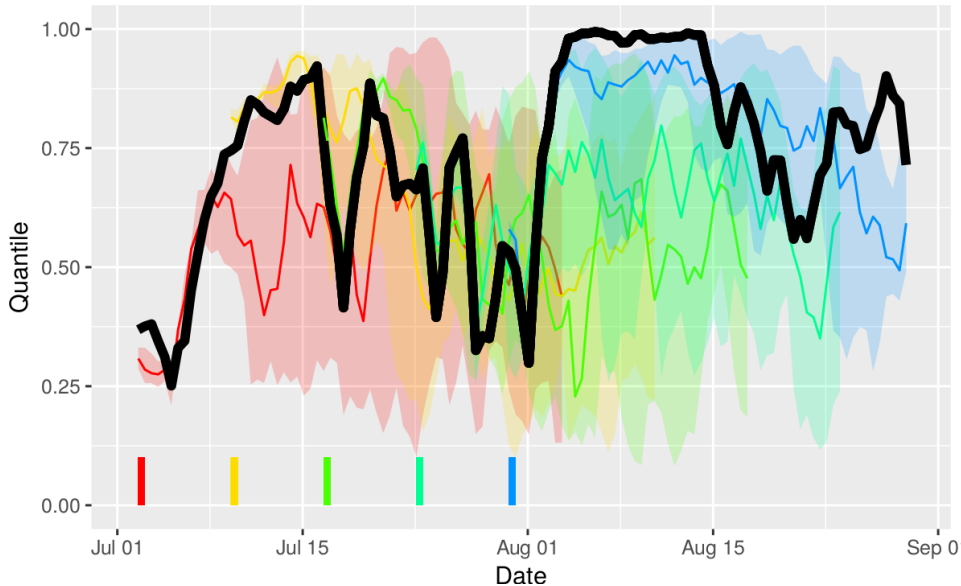
Case studies heat wave : France (2003)



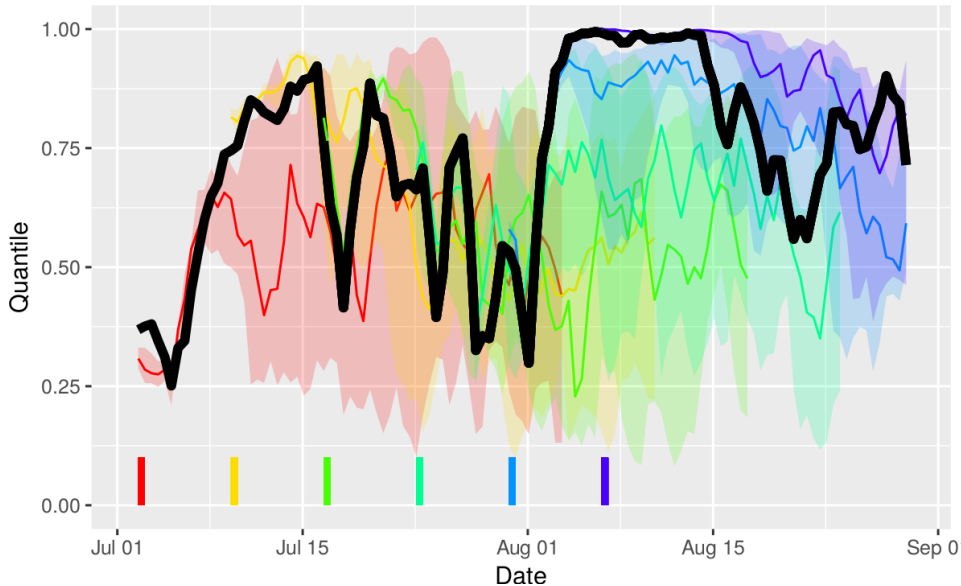
Case studies heat wave : France (2003)



Case studies heat wave : France (2003)



Case studies heat wave : France (2003)

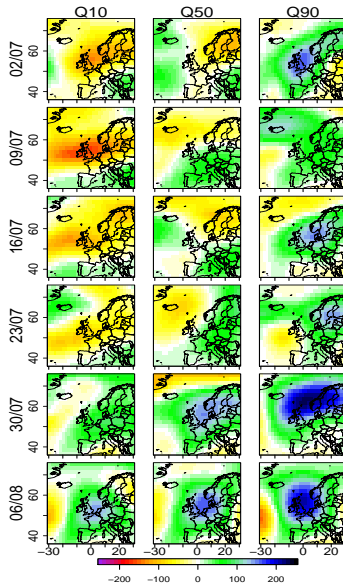
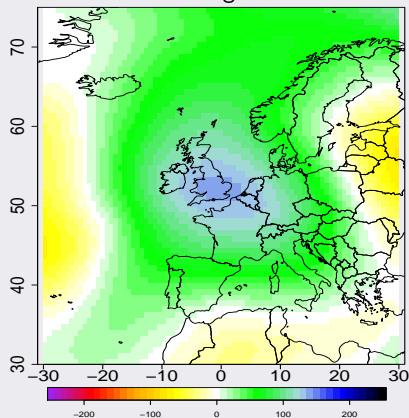


Case studies heat wave : France (2003)

Origins

Trigo et al. (2010) : HW linked to a blocking situation

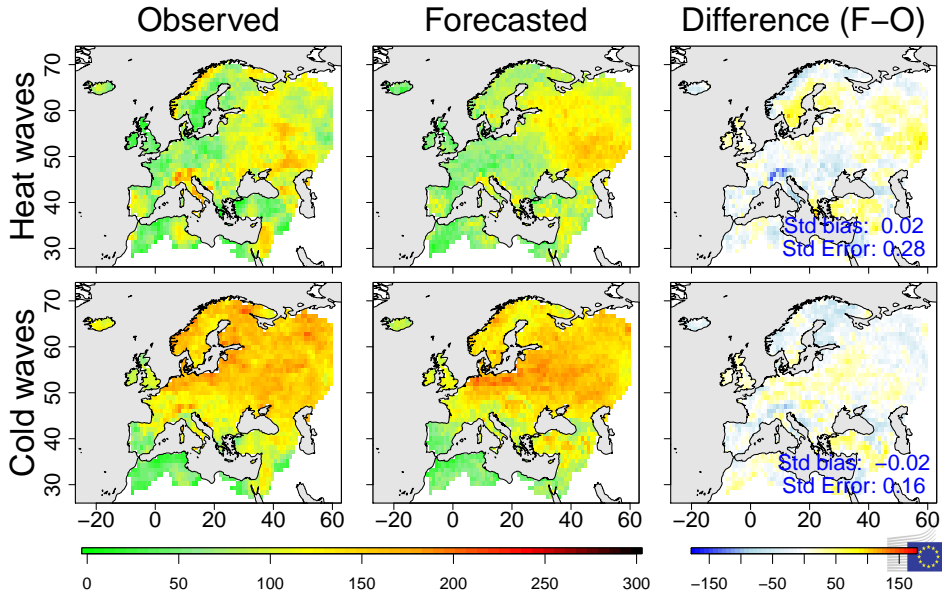
Geopotential ano. @500hPa (ERA-Interim),
6-16 Aug 2003 :



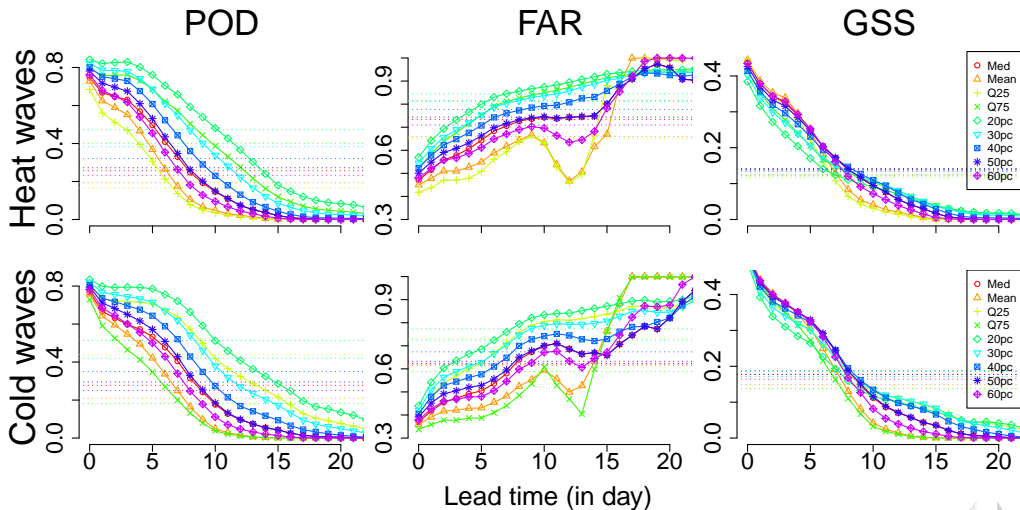
Forecasted

- Ranked members according to the mean of Geop @500hPa over UK from week 5 to week 0
- Abrupt change week 2
- Prediction reliable from 30/07

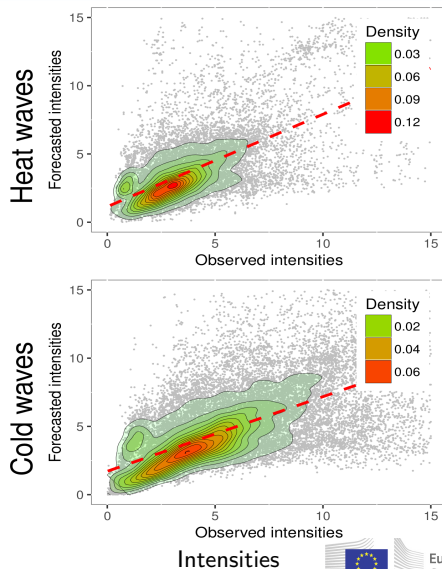
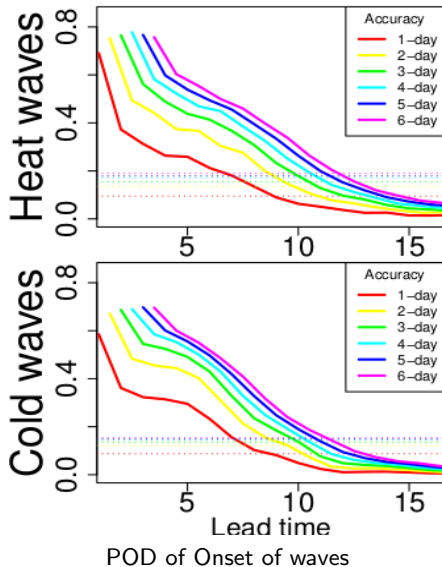
Predictability 1/3 : **Occurrence** of heat and cold waves



Predictability 2/3 : **Presence** of heat and cold waves : POD / FAR / ETS (or GSS)



Predictability 3/3 : Onset/End/Intensities of heat and cold waves



Conclusions and perspectives

Conclusions

- Droughts
 - using forecasted precipitation
 - benchmark of predictability (40% of droughts forecasted over Cent. Eur.)
 - using predictors
 - significant improvement over Northern and Eastern Europe
 - + perfect forecast illustrated the potential interest
 - - good representation of the processes
- Heat & cold waves
 - origins
 - connected to the large scale situations
 - predictability
 - significant up to 15d, not sensib. to the tempo/spatial accuracies
 - lower predictability of the onsets/ends
 - intensities ($R \approx .62$)

Perspectives

- other models : S2S/multi-model approaches
- Seasonal forecasts (S5)
- impacts : relationship between morbidity-intensity (ANYWHERE project)

Risk Assessment

