Heat wave and Cold Spells in seasonal forecast

Christian Viel, Jacques Richon, Frédéric Gayrard, Jean-Michel Soubeyroux, Gaëlle Ouzeau
DCSC (Météo-France)

MEDCOF 11, 26-29 November 2018, Cairo, Egypt

Heat Waves and Cold Spells in seasonal forecast

- Strong demand of Authorities and Media to provide first diagnoses on heat wave/cold spells probability at seasonal time scale

- First experiment in Western Africa (Batte et al) adapted to Europe for the development of new seasonal forecast products (C3S/433 contract)

Heat waves (Cold Spells) in seasonal forecast

- Method :

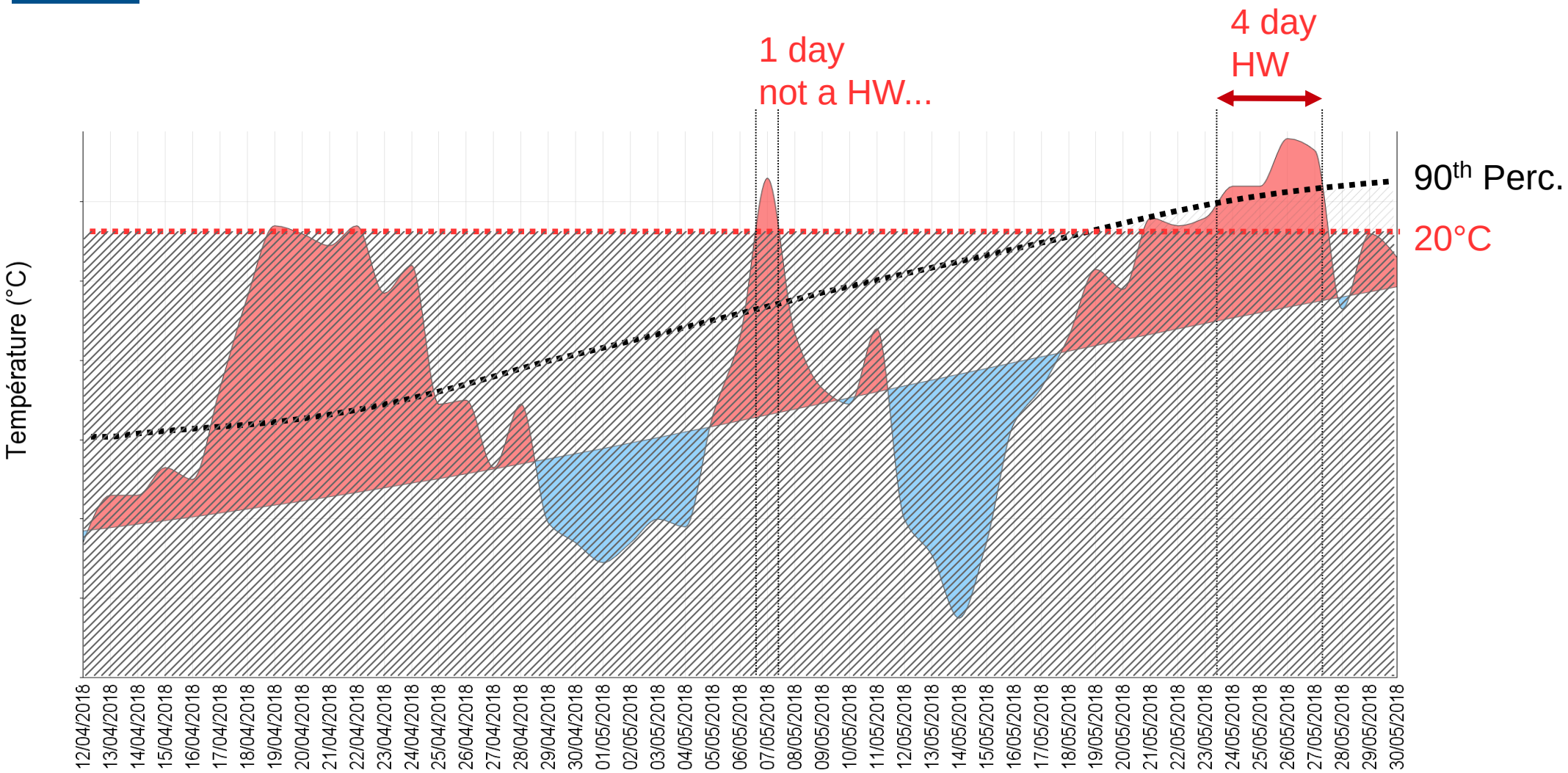
• based on **daily mean** temperature (T2m) from SF models (MF system 6, ECMWF SEAS5)
hindcast period : 1993 – 2016

• **Data correction** : quantile-mapping from the ERA-Interim daily T2m distribution

• for each grid point/day, heat wave (cold spells) detected if during 3 consecutive days :
- T2m > 90th percentile of the hindcast distribution (T2m < 10th percentile)
- T2m > 20°C (T2m < 3°C)

- On each gridpoint, computation of the number of heat wave (cold spells) days per season (for each grid point) for the 25 runs over the 1993-2016 period and representation of tercile/quintile probabilities

- Occurrence probability :
  % of runs which HW or CS Days **> <u>higher</u> tercile or higher quintile**


1 day
not a HW...
4 day
HW
90th Perc.
20°C
Température (°C)
12/04/2018
13/04/2018
14/04/2018
15/04/2018
16/04/2018
17/04/2018
18/04/2018
19/04/2018
20/04/2018
21/04/2018
22/04/2018
23/04/2018
24/04/2018
25/04/2018
26/04/2018
27/04/2018
28/04/2018
29/04/2018
30/04/2018
01/05/2018
02/05/2018
03/05/2018
04/05/2018
05/05/2018
06/05/2018
07/05/2018
08/05/2018
09/05/2018
10/05/2018
11/05/2018
12/05/2018
13/05/2018
14/05/2018
15/05/2018
16/05/2018
17/05/2018
18/05/2018
19/05/2018
20/05/2018
21/05/2018
22/05/2018
23/05/2018
24/05/2018
25/05/2018
26/05/2018
27/05/2018
28/05/2018
29/05/2018
30/05/2018

Heat waves (Cold Spells) in seasonal forecast

- Method :

• based on **daily mean** temperature (T2m) from SF models (MF system 6, ECMWF SEAS5)
hindcast period : 1993 – 2016

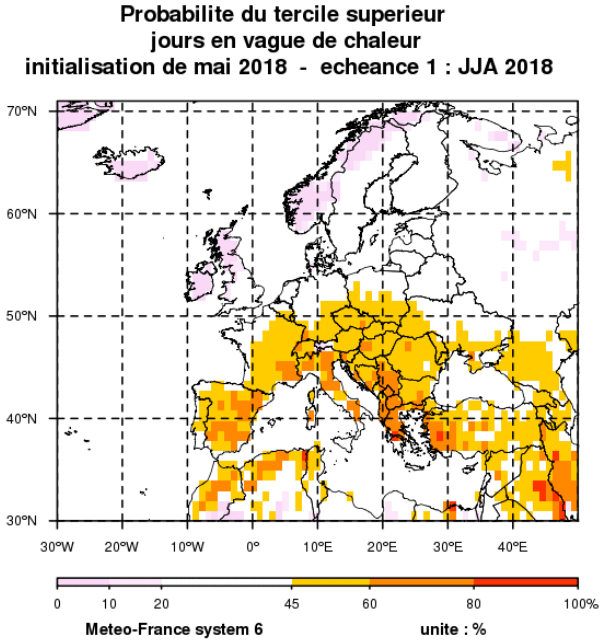
• **Data correction** : quantile-mapping from the ERA-Interim daily T2m distribution

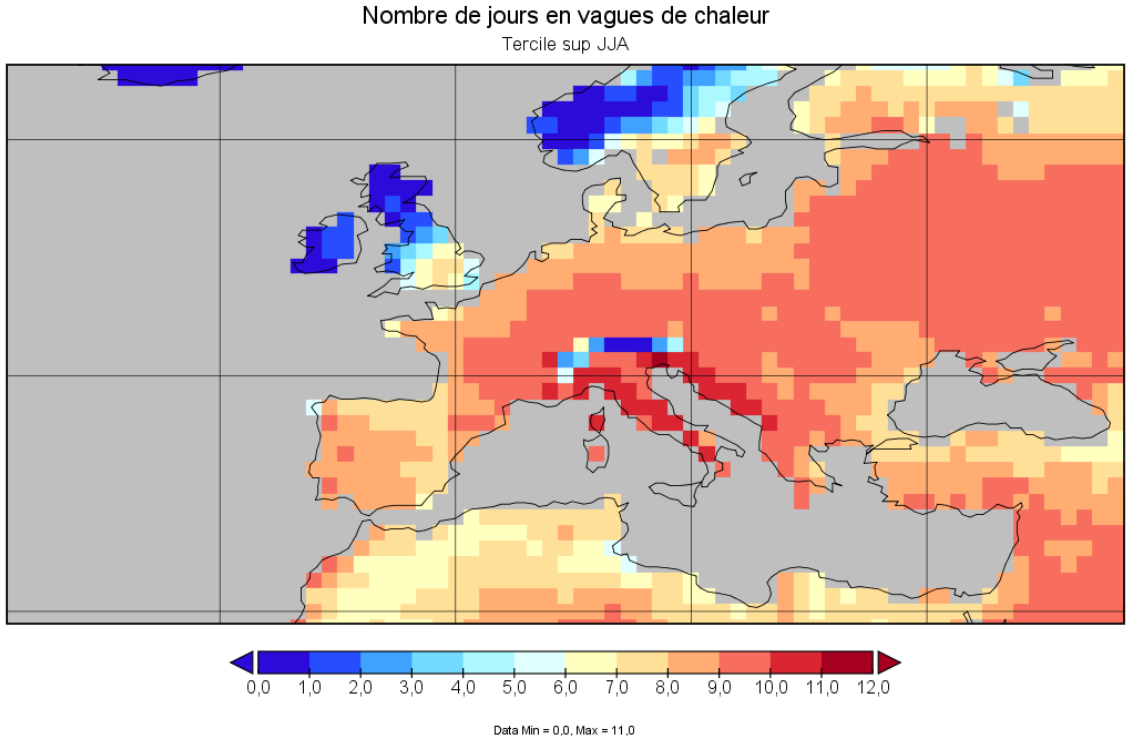
• for each grid point/day, heat wave (cold spells) detected if during 3 consecutive days :
- T2m > 90th percentile of the hindcast distribution (T2m < 10th percentile)
- T2m > 20°C (T2m < 3°C)

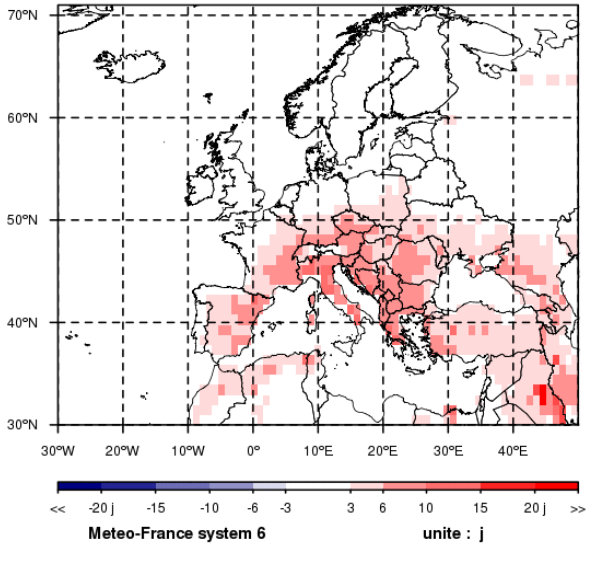
- On each gridpoint, computation of the number of heat wave (cold spells) days per season (for each grid point) for the 25 runs over the 1993-2016 period and representation of tercile/quintile probabilities

- Occurrence probability :
  % of runs which HW or CS Days **> <u>higher</u> tercile or higher quintile**

Examples (Heat Waves)

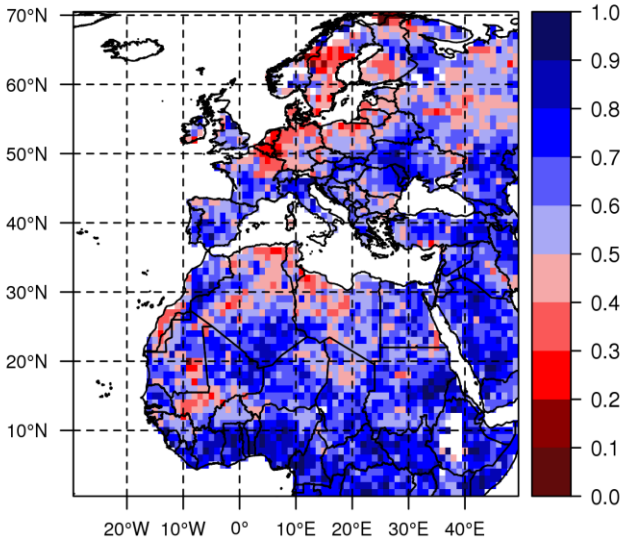






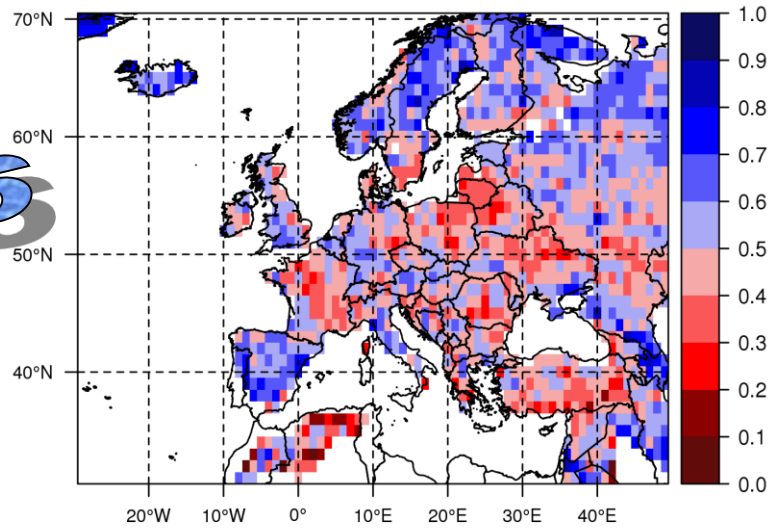
Scores (Heat Waves & Cold Spells)

Meteo-France system 6 - HW - ROC Area Higher Tercile (empirical)
Init. : 6 (JUN) - Lead Time : 1 (JAS)
reference ERAI 1993-2016

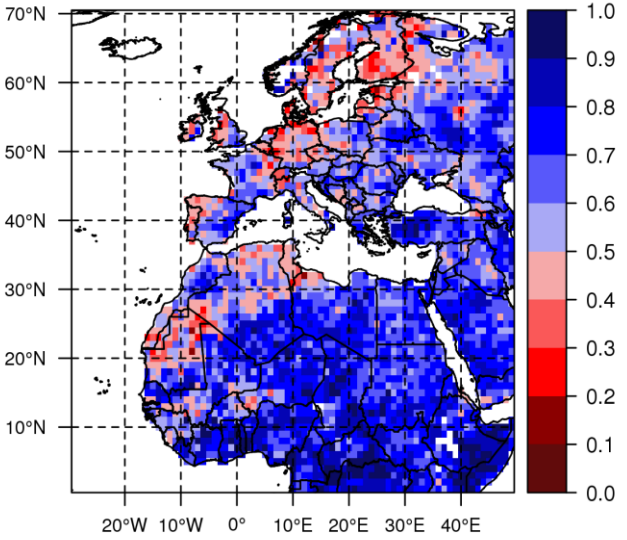


MF-S6

Meteo-France system 6 - CS - ROC Area Higher Tercile (empirical)
Init. : 11 (NOV) - Lead Time : 1 (DJF)
reference ERAI 1993-2016

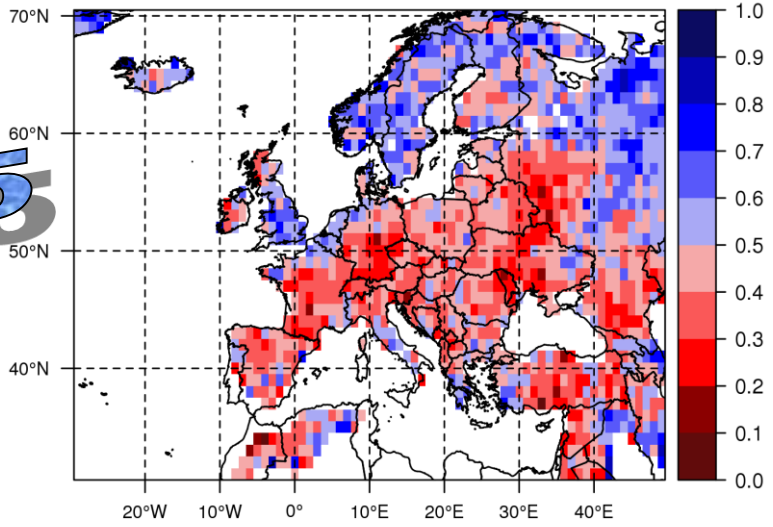


ECMWF system 5 - HW - ROC Area Higher Tercile (empirical)
Init. : 5 (MAY) - Lead Time : 1 (JJA)
reference ERAI 1993-2016



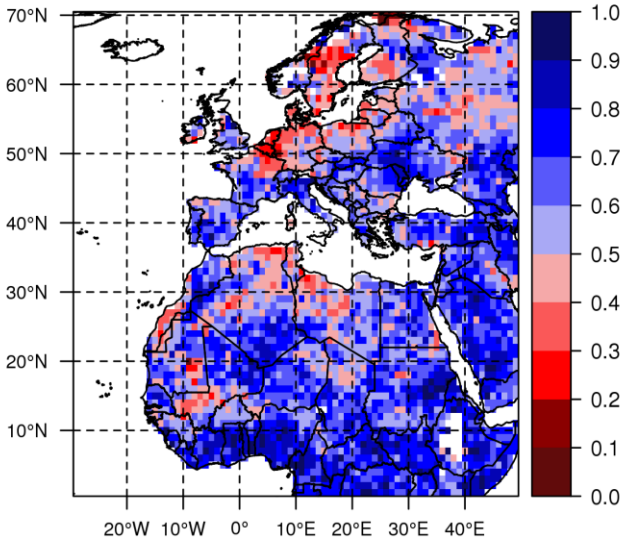
SEAS5

ECMWF system 5 - CS - ROC Area Higher Tercile (empirical)
Init. : 11 (NOV) - Lead Time : 1 (DJF)
reference ERAI 1993-2016



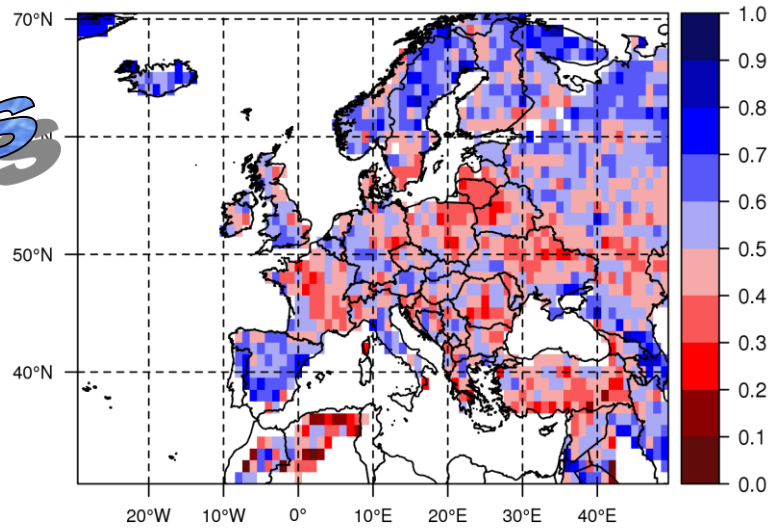
Scores (HW/CS vs Temperature)

Meteo-France system 6 - HW - ROC Area Higher Tercile (empirical)
Init. : 6 (JUN) - Lead Time : 1 (JAS)
reference ERAI 1993-2016

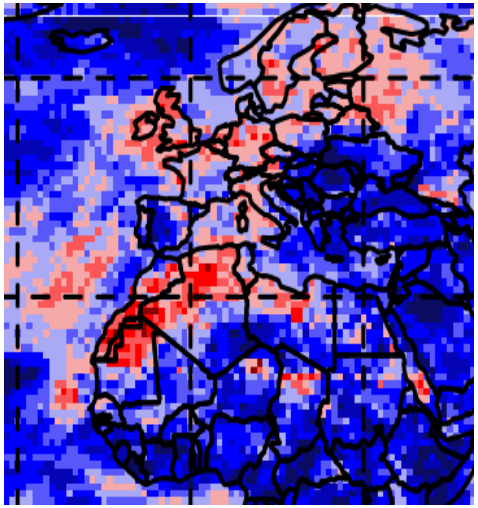


HW & CS MF-S6

Meteo-France system 6 - CS - ROC Area Higher Tercile (empirical)
Init. : 11 (NOV) - Lead Time : 1 (DJF)
reference ERAI 1993-2016

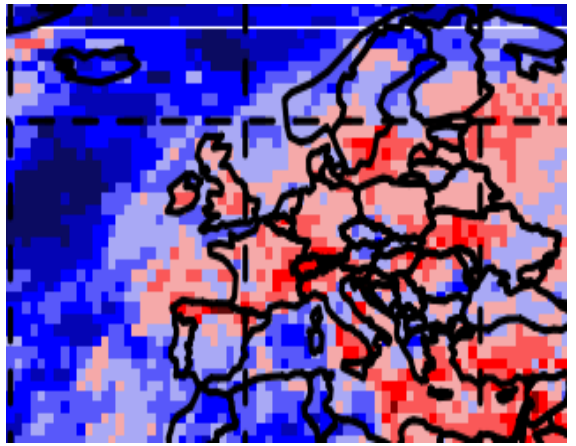


Meteo-France system 6 - T2M - ROC Area Higher Quintile (empirical)
Init. : 5 (MAY) - Lead Time : 1 (JJA)
reference ERAI 1993-2016



T2m MF-S6

Meteo-France system 6 - T2M - ROC Area Lower Quintile (empirical)
Init. : 11 (NOV) - Lead Time : 1 (DJF)
reference ERAI 1993-2016



Conclusion

- Some new climate tools to qualify **heat wave and col spell risk** at seasonal time scale, **using corrected 2m temperature**

- **Operational production** (+ scores and doc.) available on seasonal.meteo.fr
  - Models : MF-S6 and SEAS5
  - Heat Wave : monthly and seasonal, for init. 2 to 6
  - Cold spell : monthly and seasonal, for init. 9 to 12 and 1

- Performance : equivalent to T2m

- Related products : heating degree days

http://elaboration.seasonal.meteo.fr