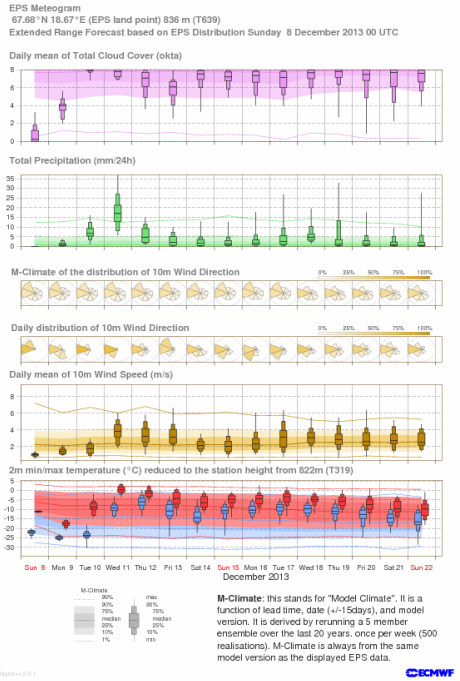
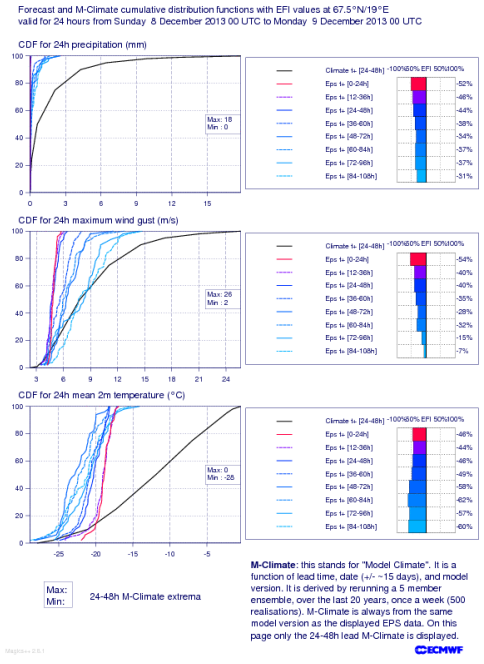
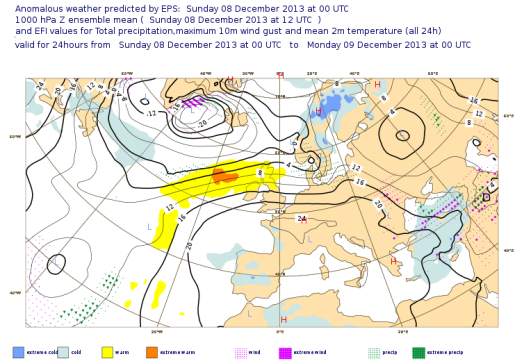
Estimation of the model climate (reforecasts)

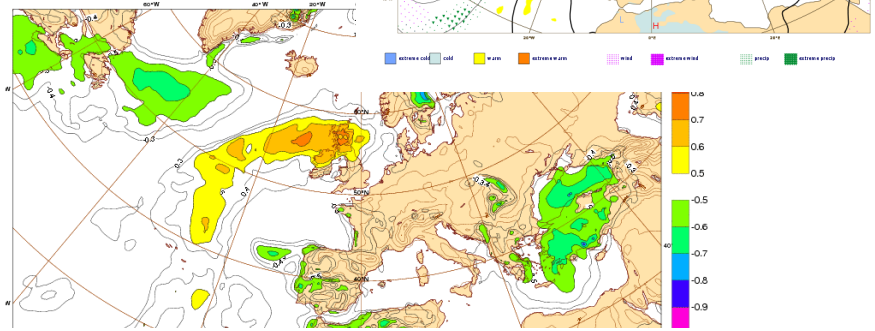
Linus Magnusson

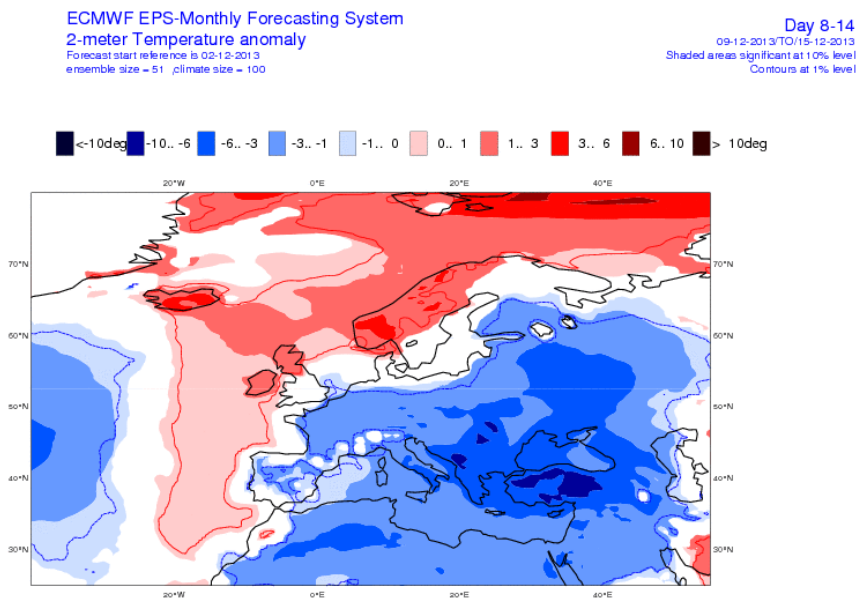
Model climate from reforecasts









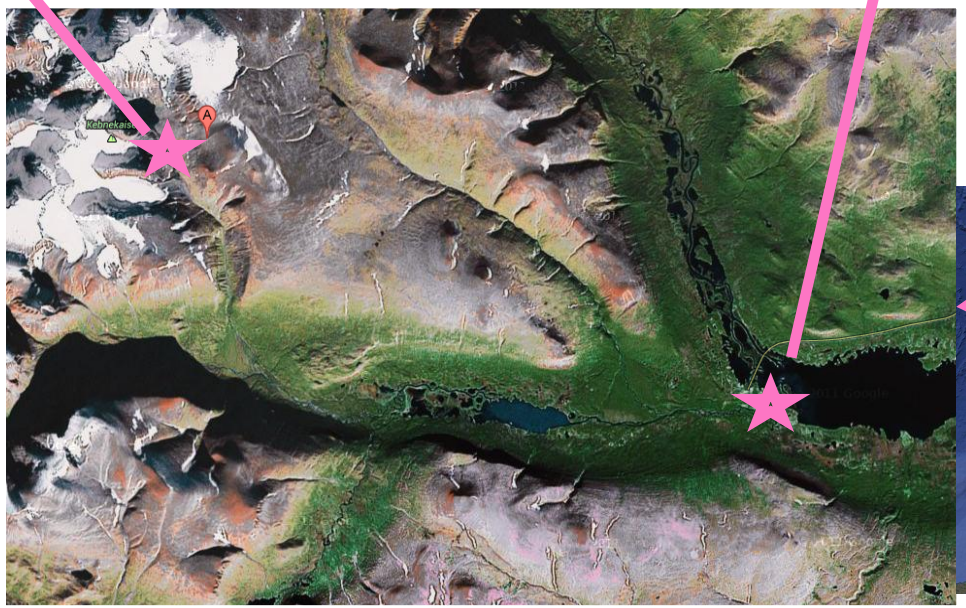


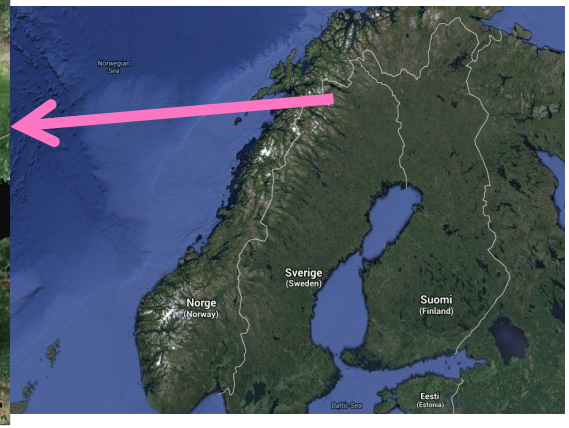
Why do we need reforecasts?

Motivation 1:

Tarfala

Nikkaloukta

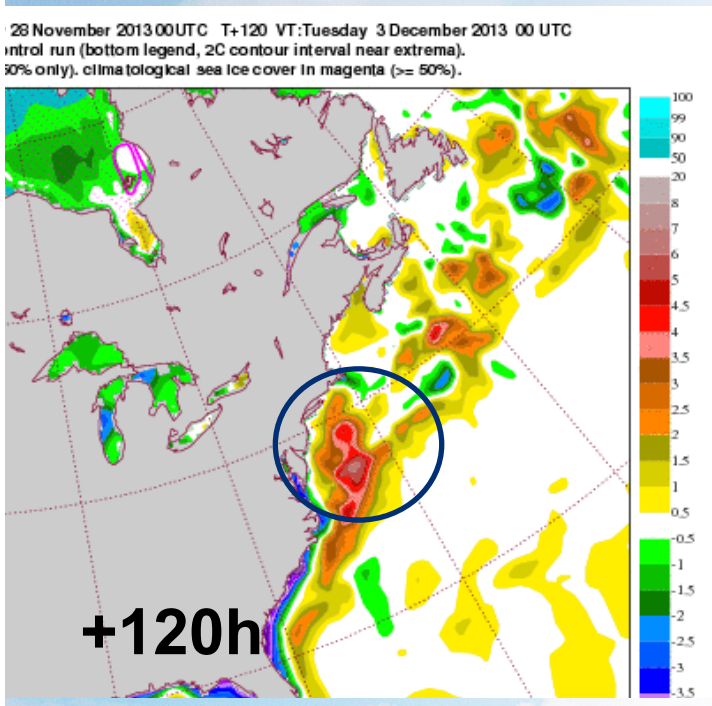


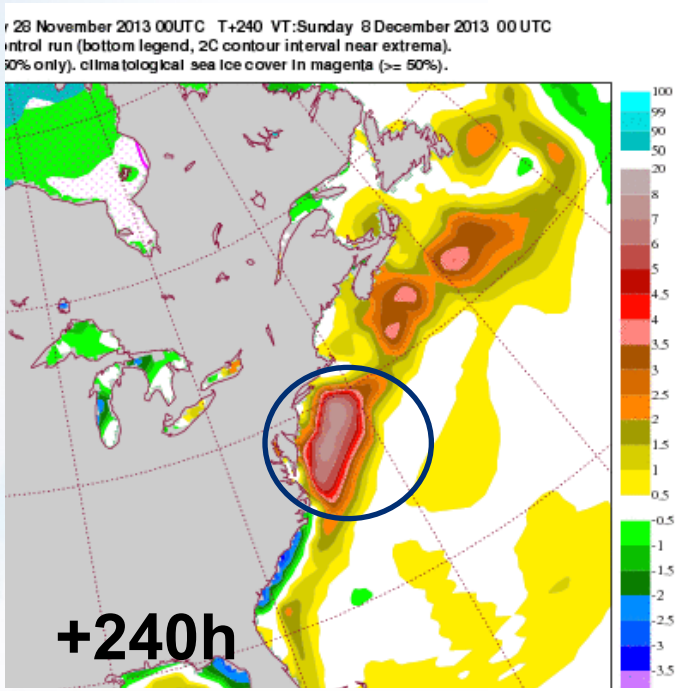


17 km between the stations, ENS resolution 32 km..

ECMWF

Motivation 2:

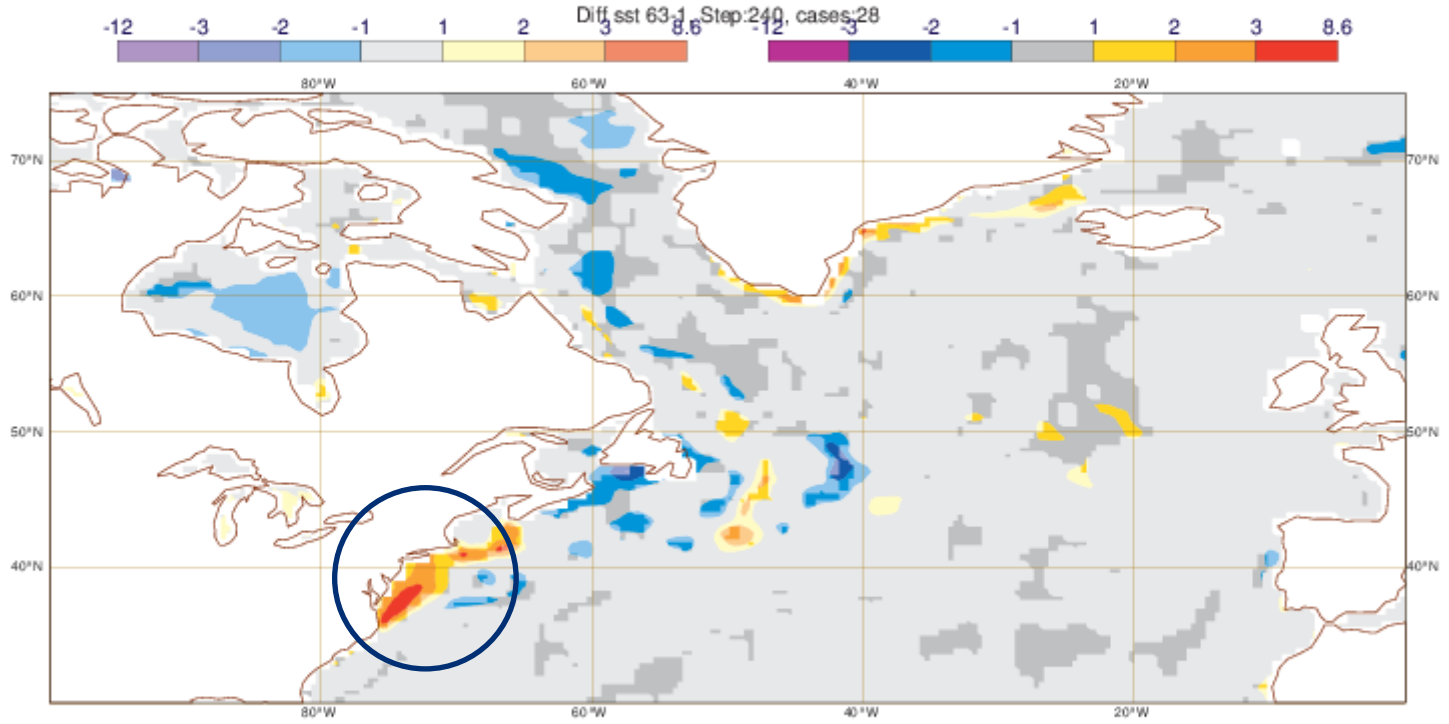




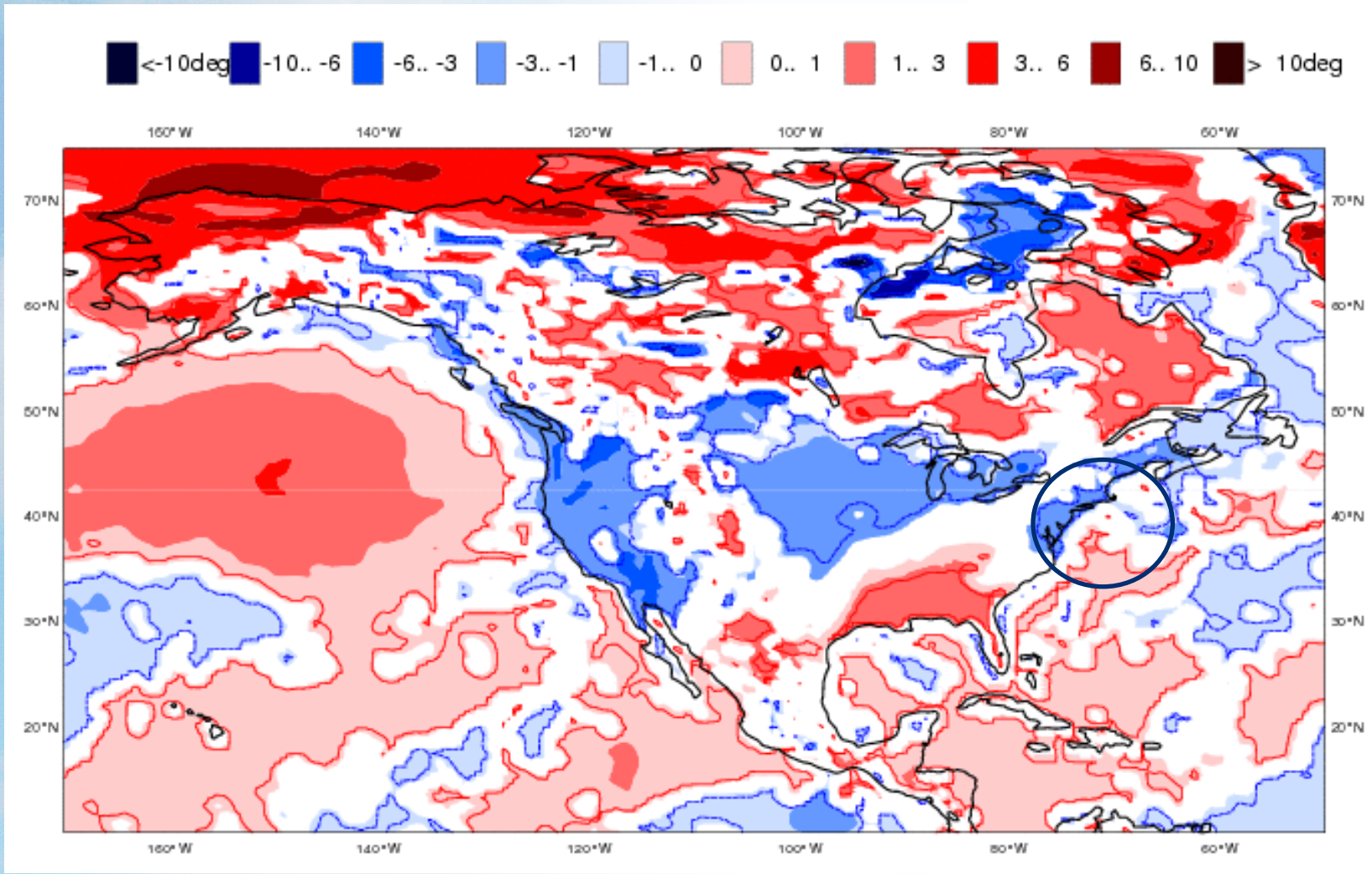
SST anomaly (from the obs. climatology)

Forecasts from 28 Nov 0 UTC

Model bias day 10



Anomaly in respect to model climate (weekly mean)



Why do we need reforecasts?

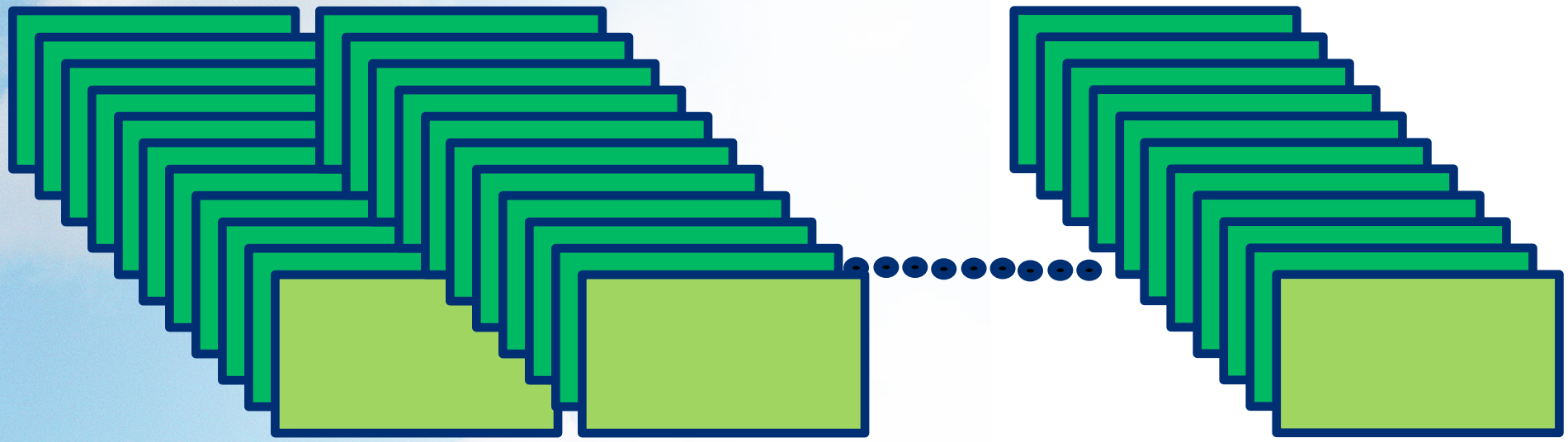
- Local conditions that is not covered by the model grid (look at anomalies to the model climate)
- Account for systematic errors in the model
- Account for model drift (change in systematic error with lead time)

Aim of reforecasts:
Sampling the climatology of the current model version

Configuration of reforecasts

Example: Thursday 28 January 2016:

28 January 2016 : 28 January 1997 : 28 January 2015:



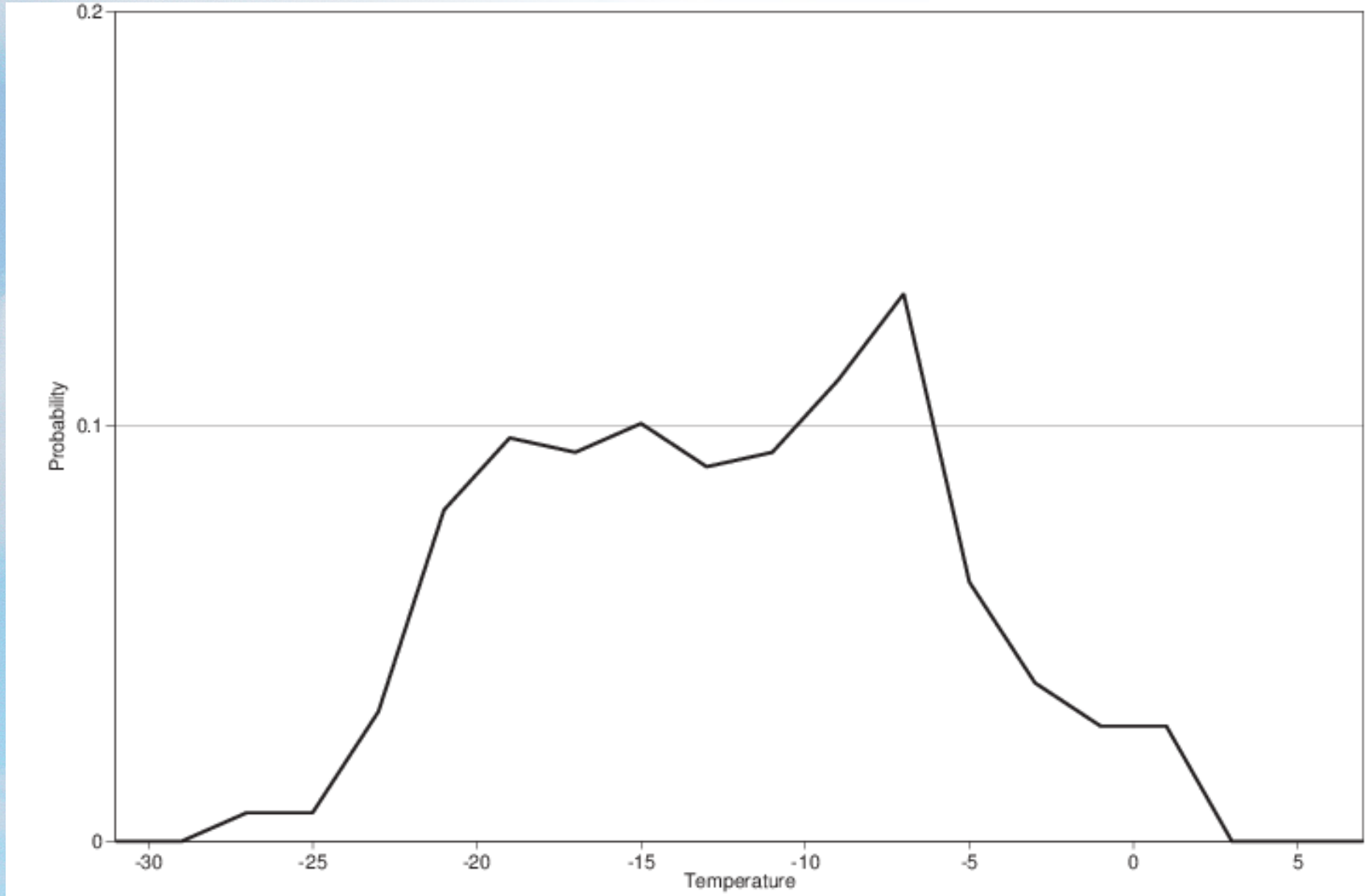
20 years x 11 forecasts = 220 forecasts
Present model version
Ensemble configuration to 45 days
Initialised from ERA Interim

Twice a week + 5 weeks window for EFI
= 1980 forecasts

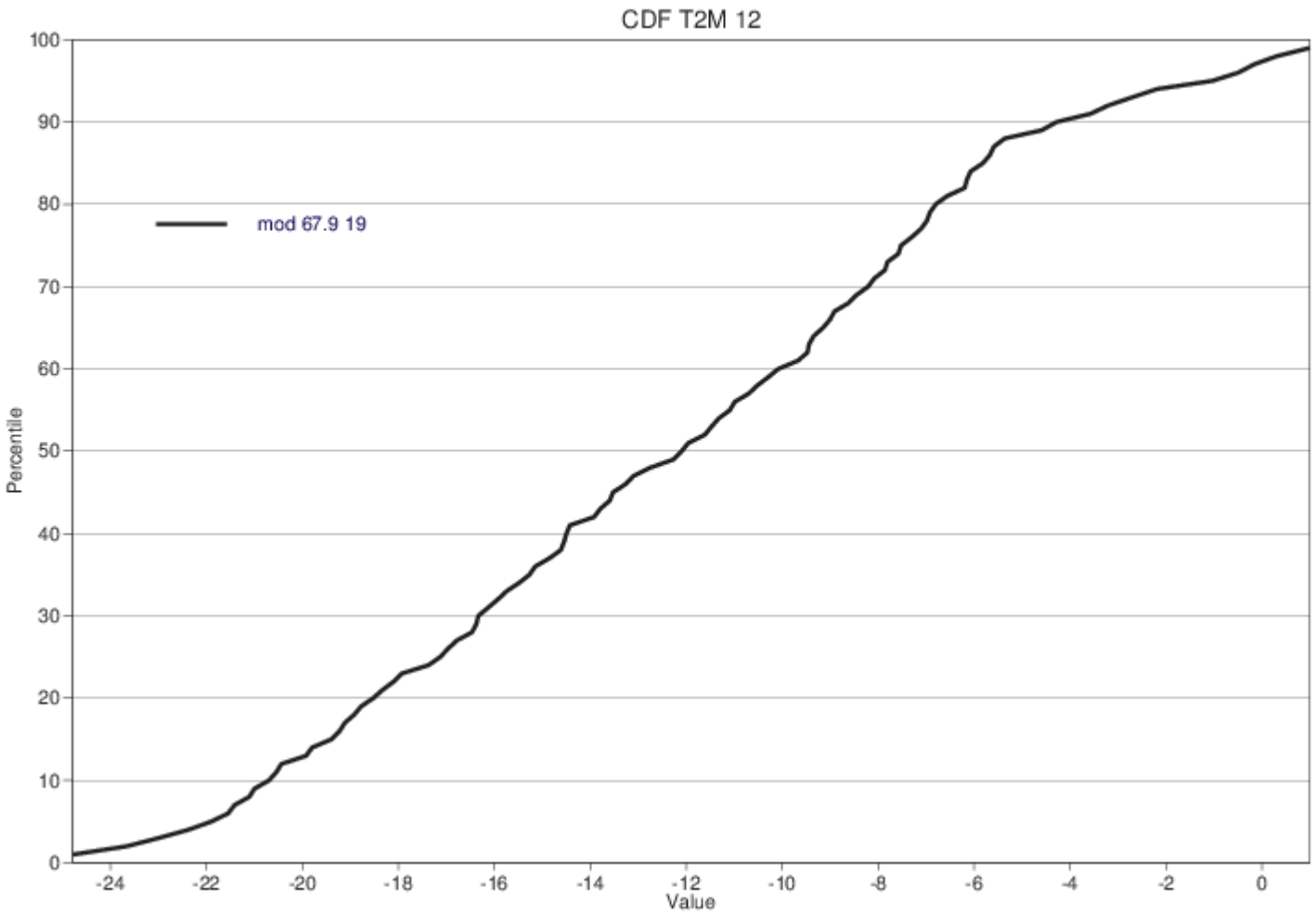
Example: 2-metre temperature values for 132-hour reforecasts

-11	-16	-16	-23	-22	-19	-19	-12
-17	-11	-13	-18	-18	-21	-18	-20
-12	-17	-22	-22	-21	-19	-7.6	-6.2
-8.9	-6.7	-24	-21	-26	-18	-8.2	-8.4
-11	-13	-19	-11	-13	-9.7	-24	-18
-20	-25	-6.8	-9.1	-6.9	-6.9	-15	-15
-15	-16	-21	-11	-15	-19	-24	-21
-26	-22	-15	-15	-17	-15	-18	-21
-5.4	-20	-3	-5.7	-8.8	-5.4	-21	-12
-9.4	-17	-8.6	-7.3	-9	-10	-17	-21
-16	-19	-19	-23	-16	-18	-22	-21
-20	-24	-15	-16	-13	-21	-17	-20
-21	-19	-4.6	-3.7	-6.8	-5.9	-8.1	-11
-7.7	-9.6	-10	-9.9	-12	-12	-12	-7.1
-20	-15	-9.5	-19	-12	-14		

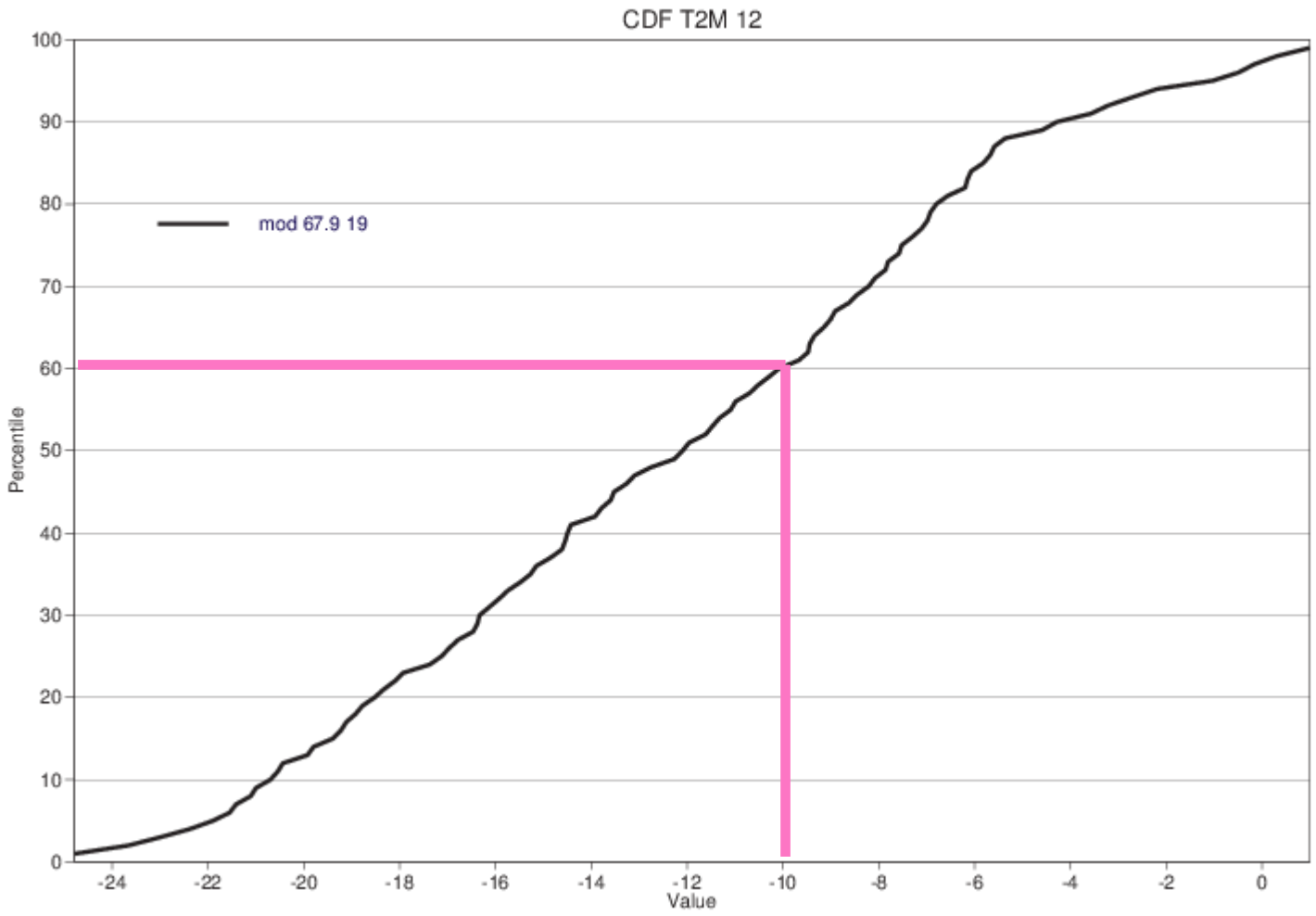
Probability distribution function (PDF)



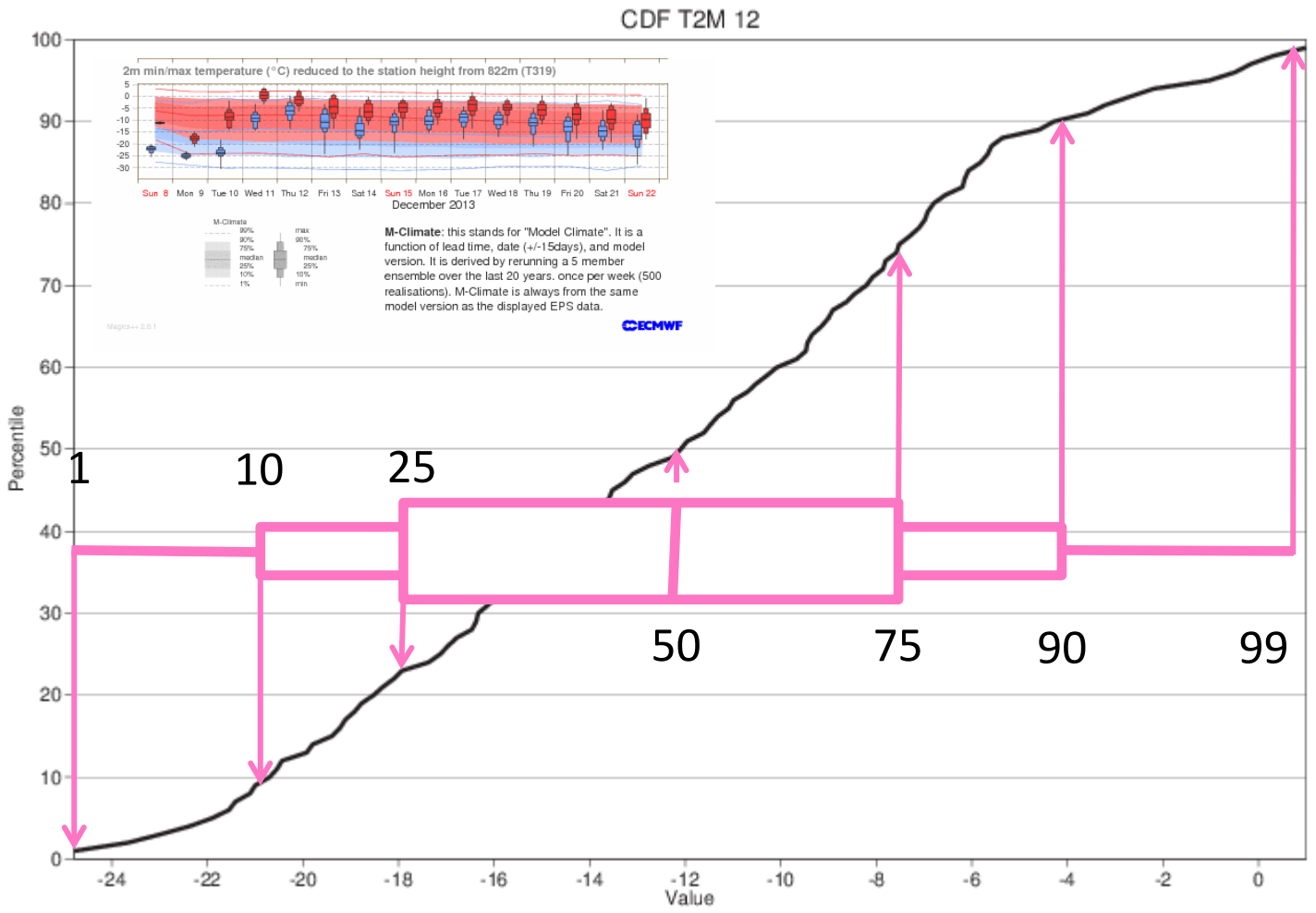
Cumulative distribution function (CDF)



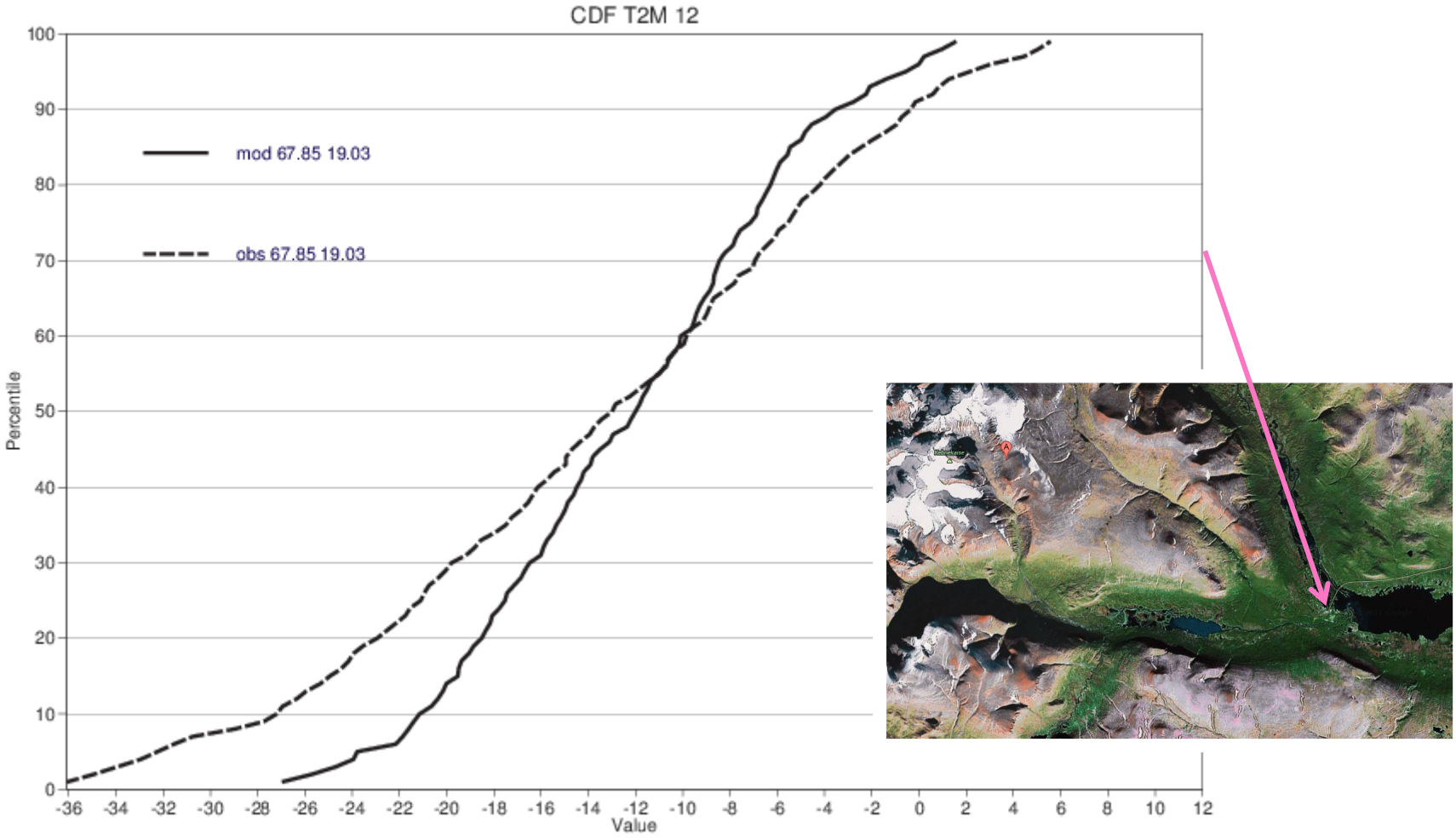
What is the probability for temperature < -10 ?



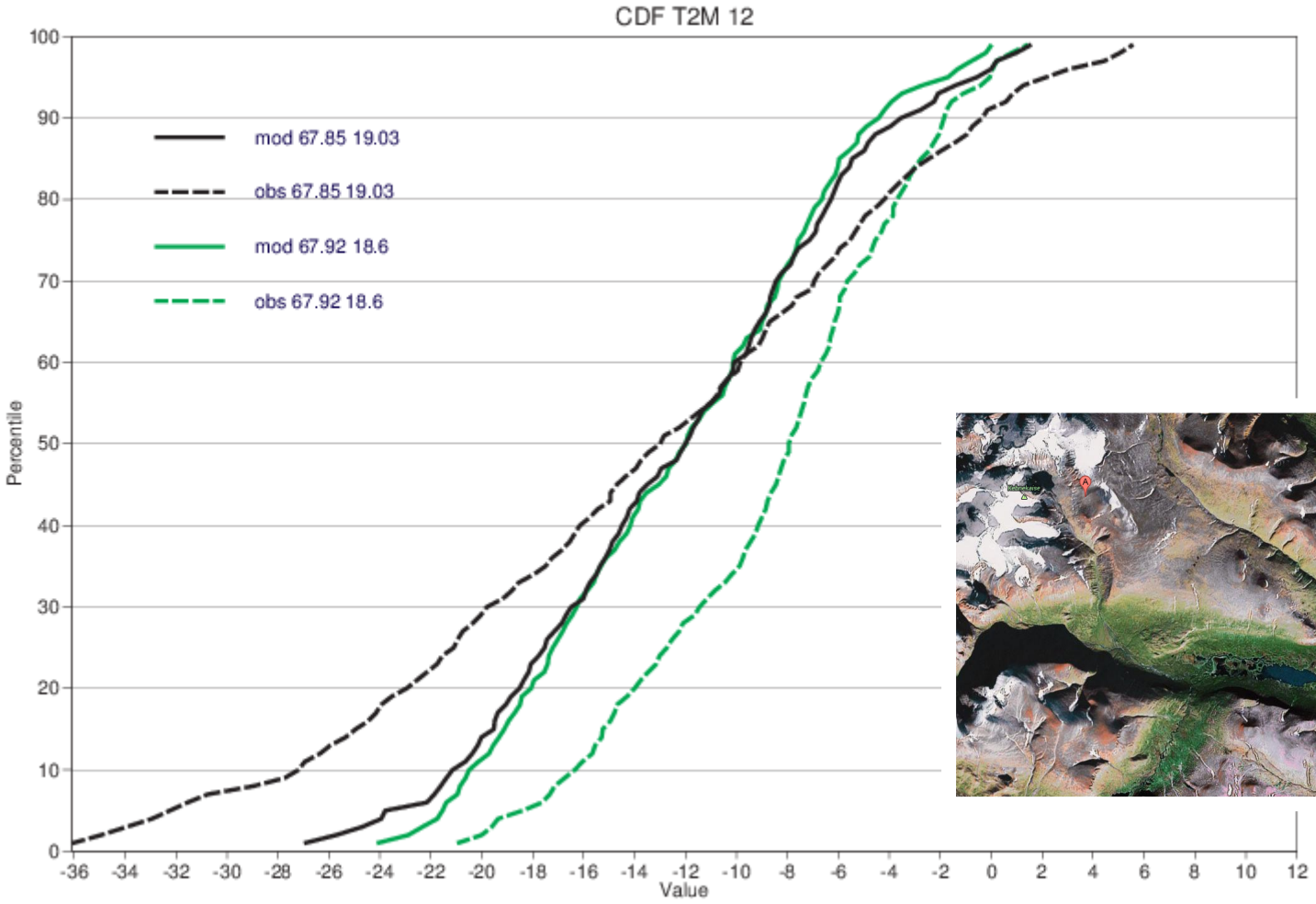
Cumulative distribution function

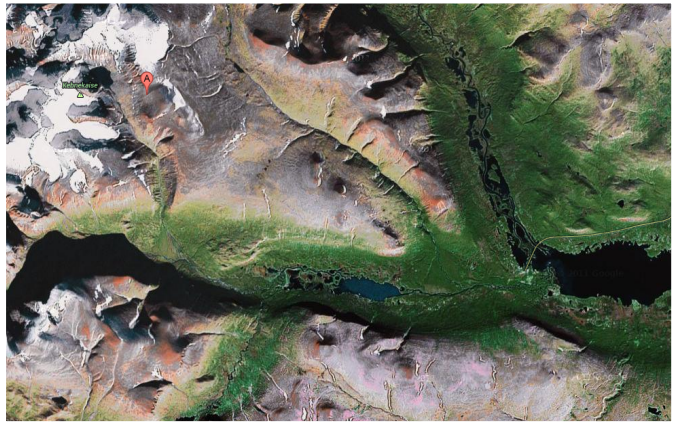


Model climate and observed climate (Nikkaloukta)

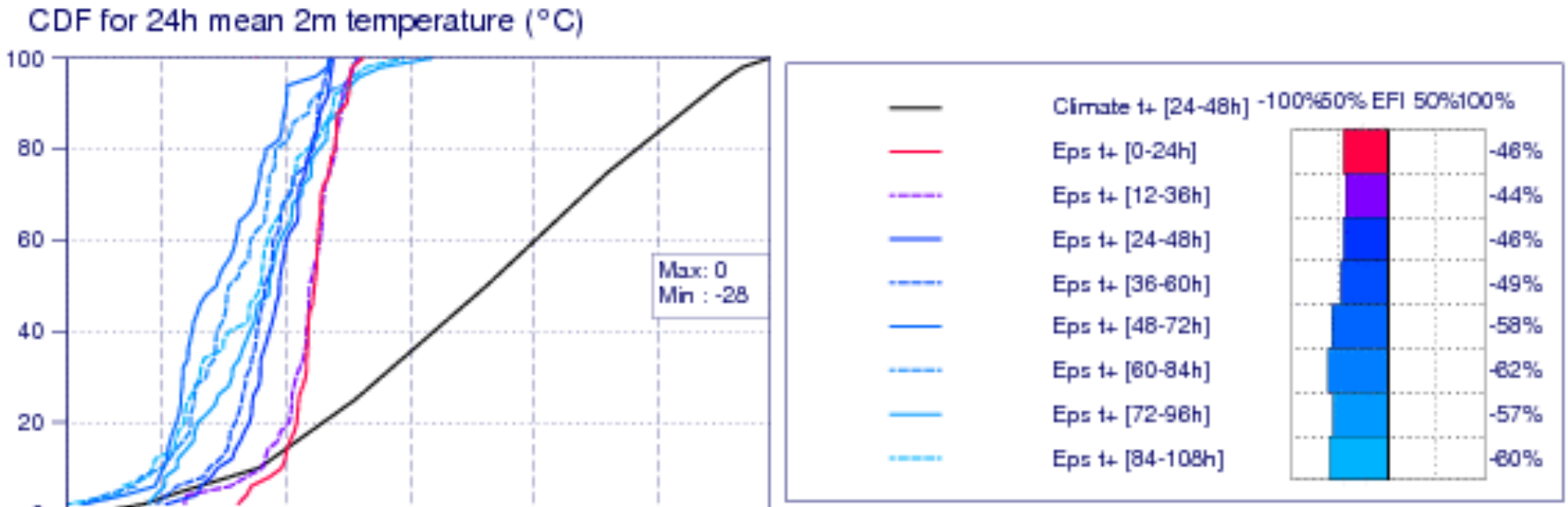


Nearby stations (Nikkaloukta –black, Tarfala – green)





How to use the reforecast data set?



Max:
Min:

24-48h M-Climate extrema

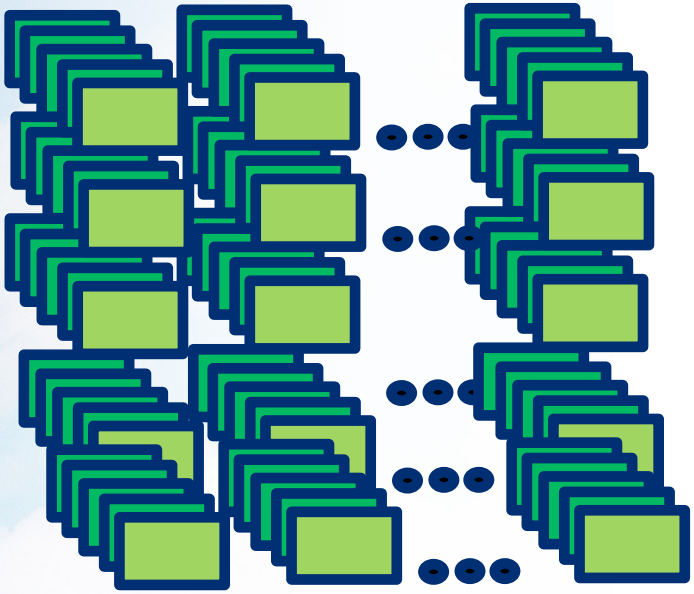
M-Climate: this stands for "Model Climate". It is a function of lead time, date (+/- ~15 days), and model version. It is derived by rerunning a 5 member ensemble, over the last 20 years, once a week (500 realisations). M-Climate is always from the same model version as the displayed EPS data. On this page only the 24-48h lead M-Climate is displayed.

Magics++ 2.8.1

Sampling issues: Extreme forecasts (example from old configuration – motivation for the new)

- Need to sample the tails of the distribution
- Focus on short to medium range
- Problems with correlated forecasts (members, steps)

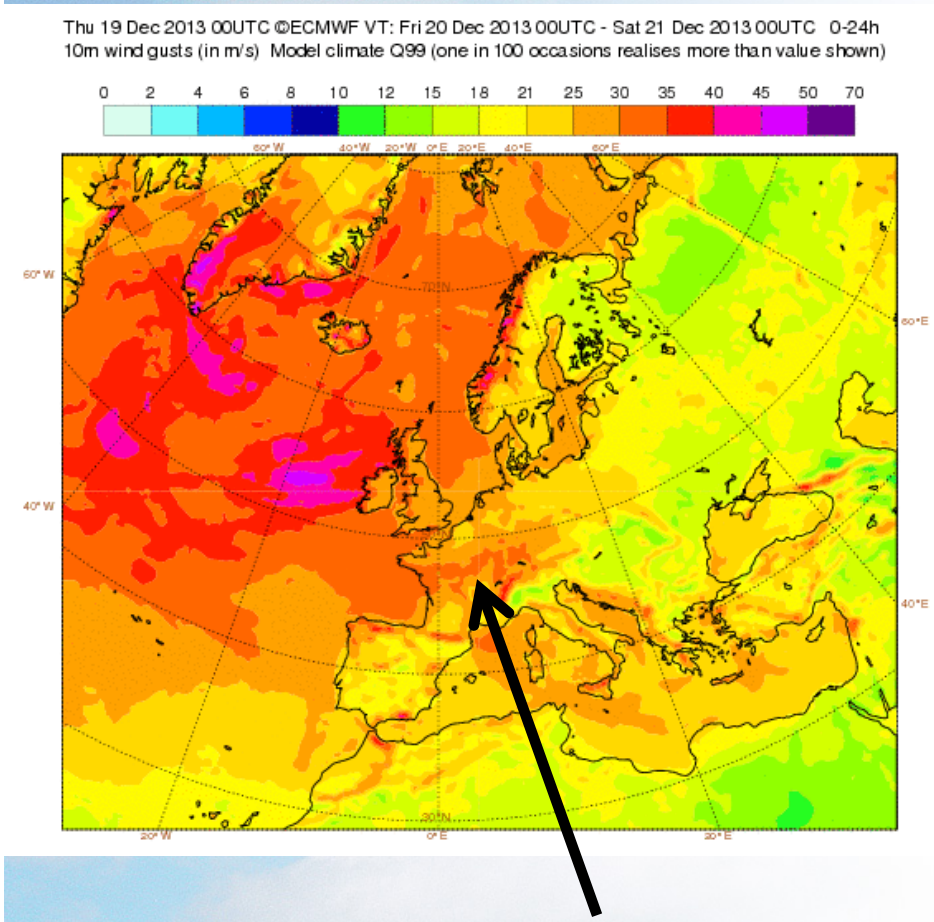
2013
28 November
5 December
12 December
19 December
26 December



5 x 5 x 20 = 500 fields

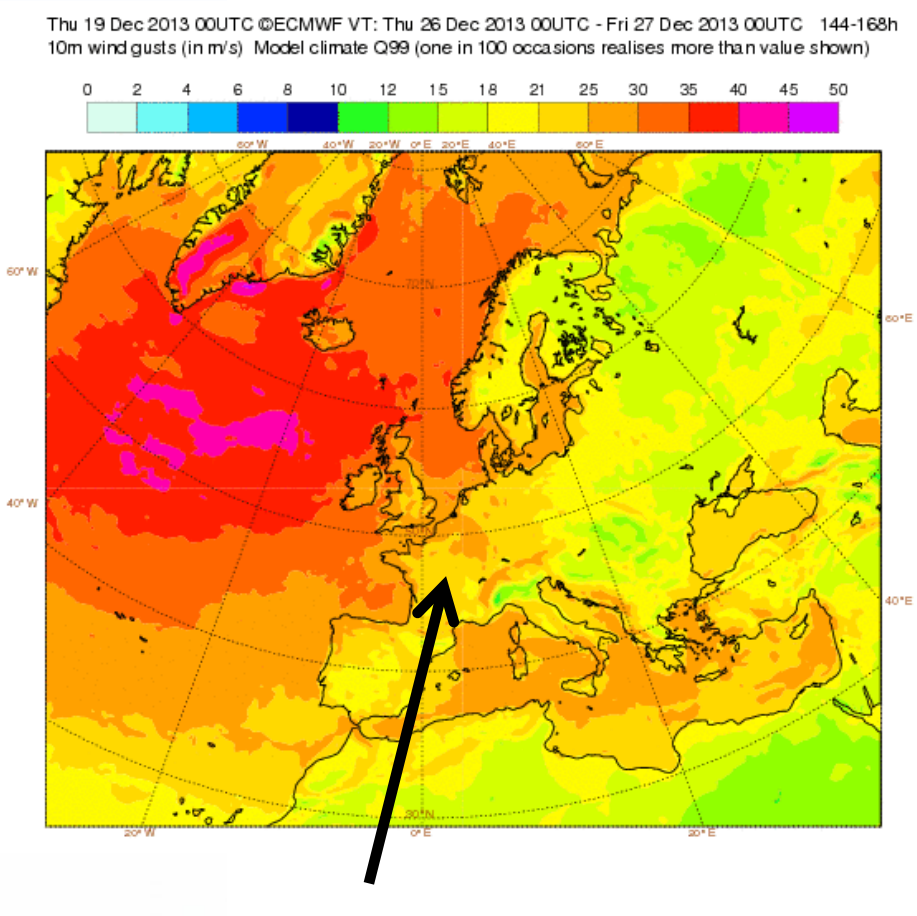
99th percentile of climate (24-hour max. wind gusts)

Day 1



30-35 m/s

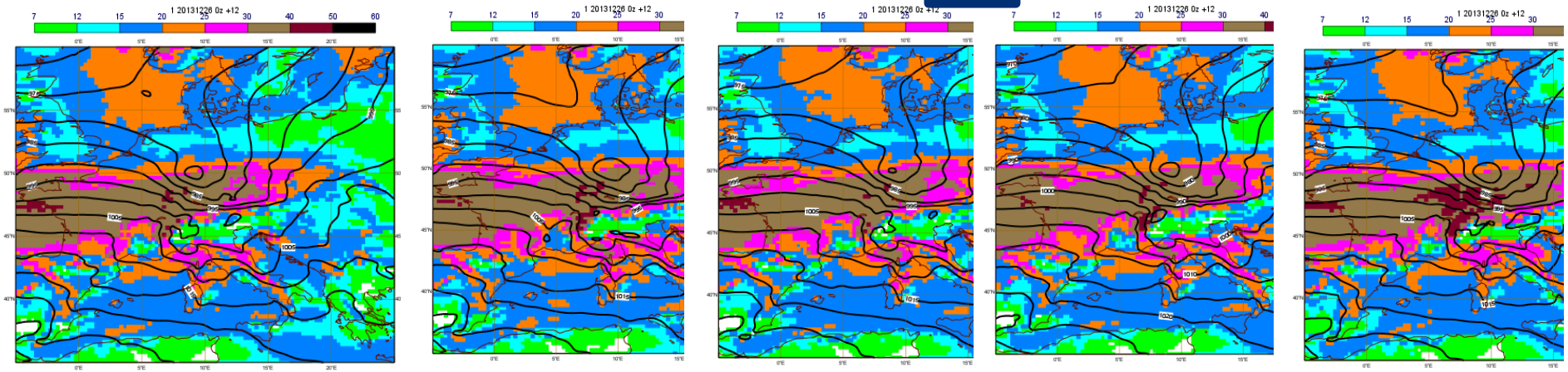
Day 7



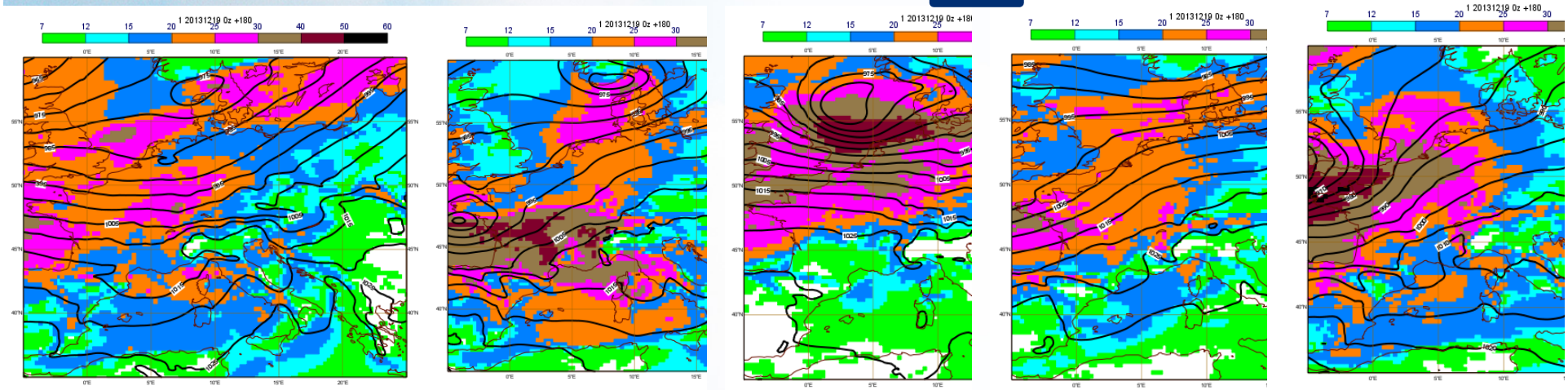
21-25 m/s

Reforecasts valid 26 December 1999 (Max. wind gusts and MSLP)

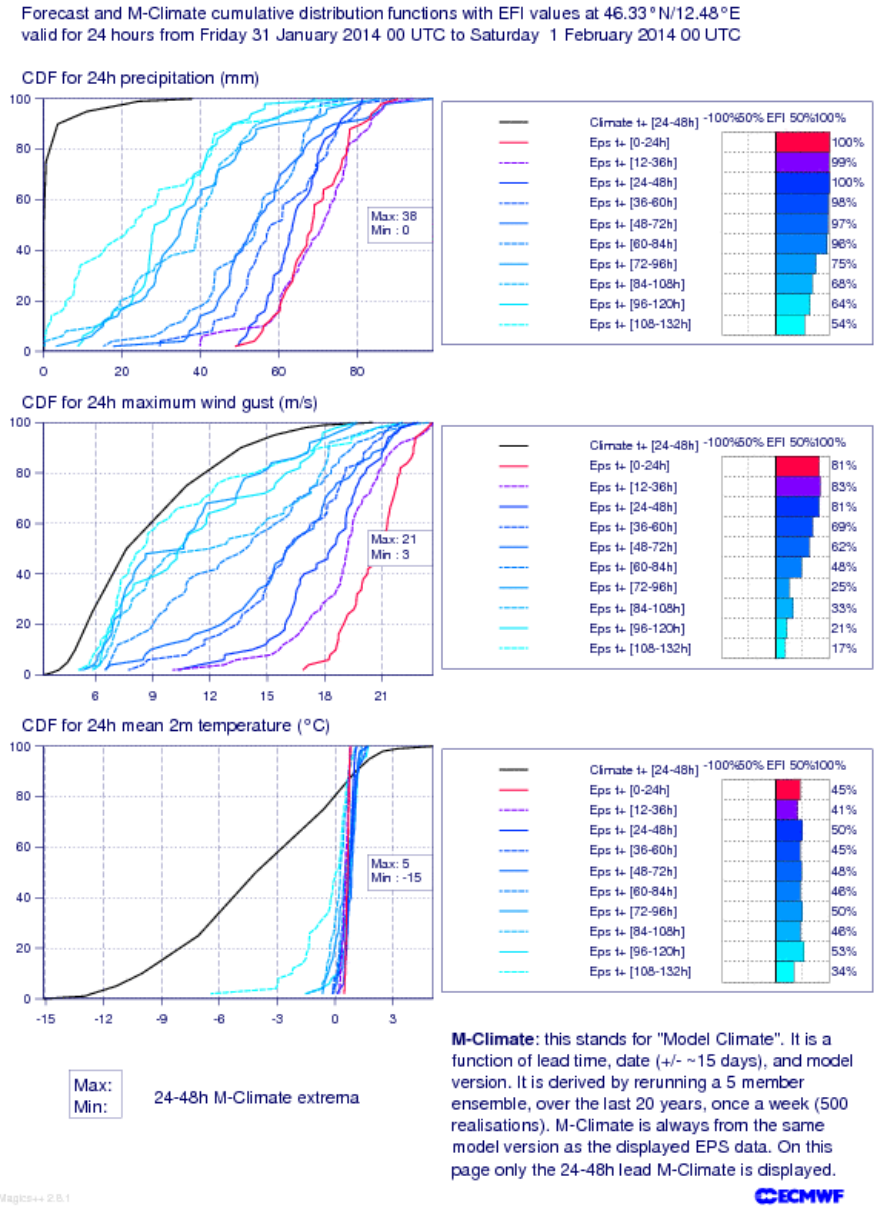
From 26 December 1999 +12h



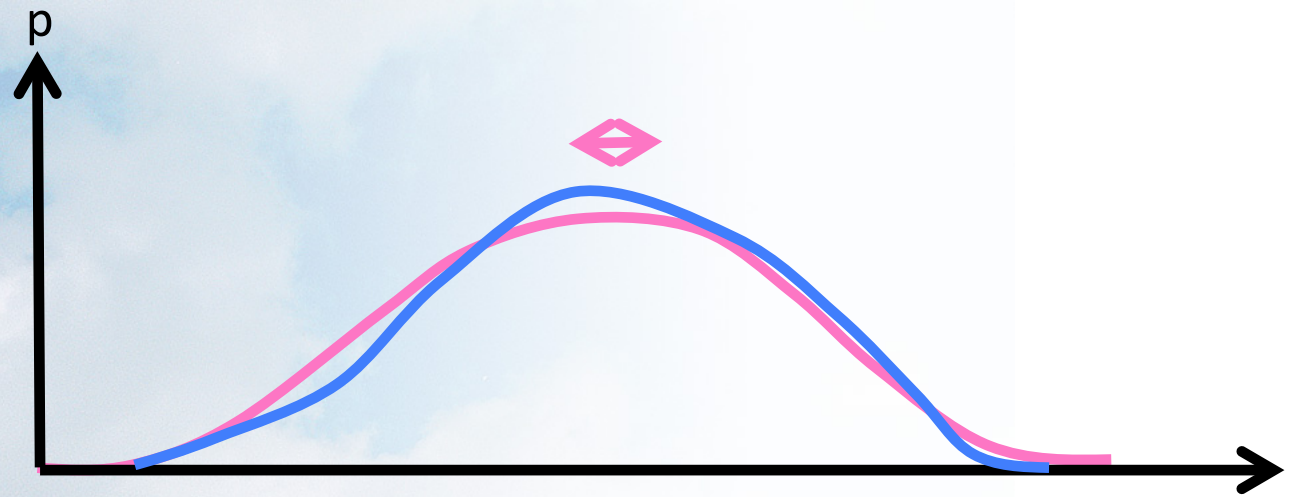
From 19 December 1999 +180h



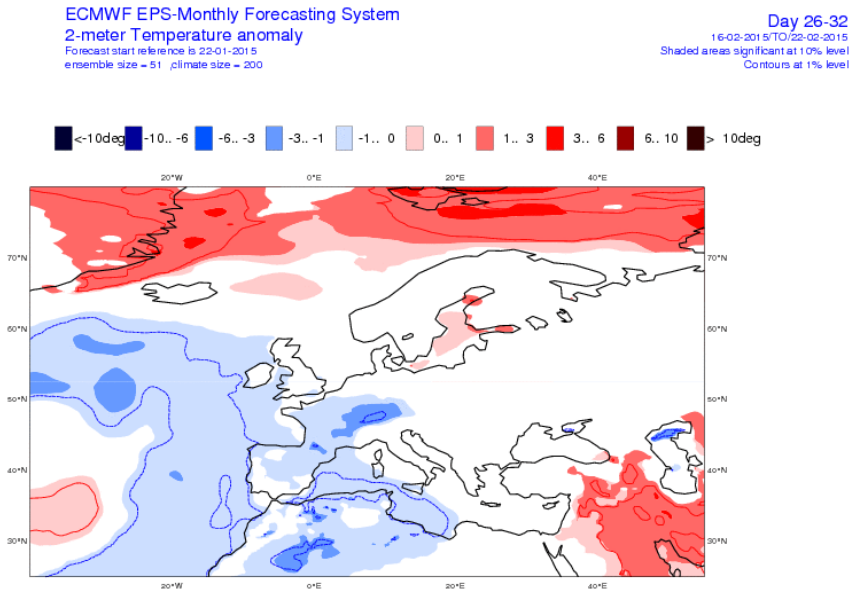
Forecast outside the model climate:



Long forecast (monthly, seasonal)

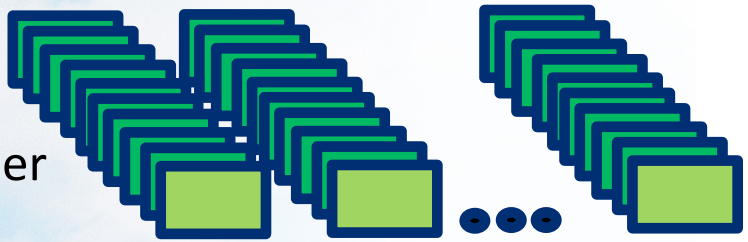


Normally weak signals



Sampling issues: Monthly forecasts

- Need to sample the mean
- Model drift
- Sensitive to subtile difference between real time forecast and reforecast configuration

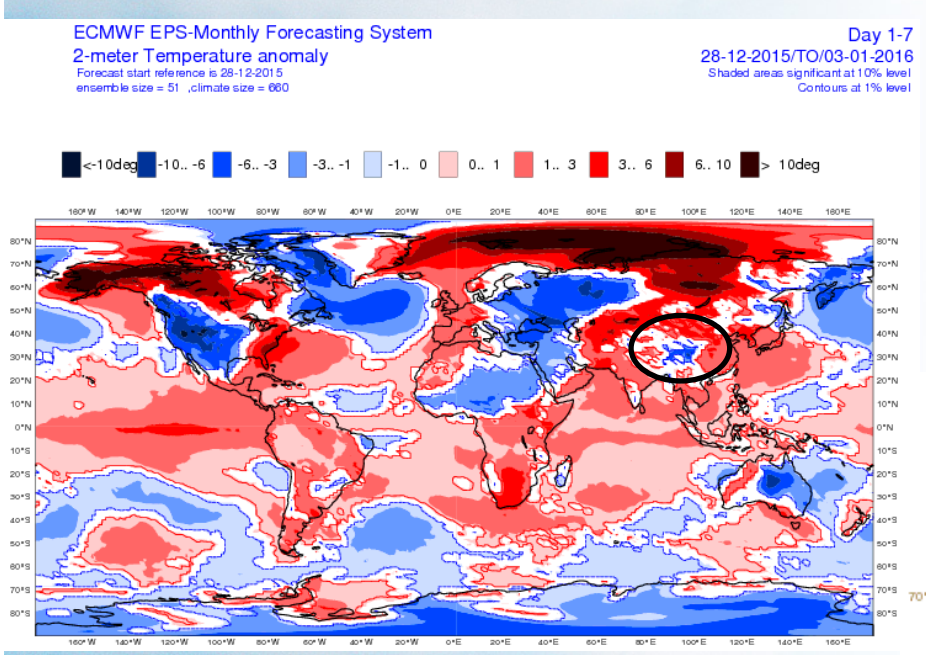
12 December  = 11 x 20 = 220 fields

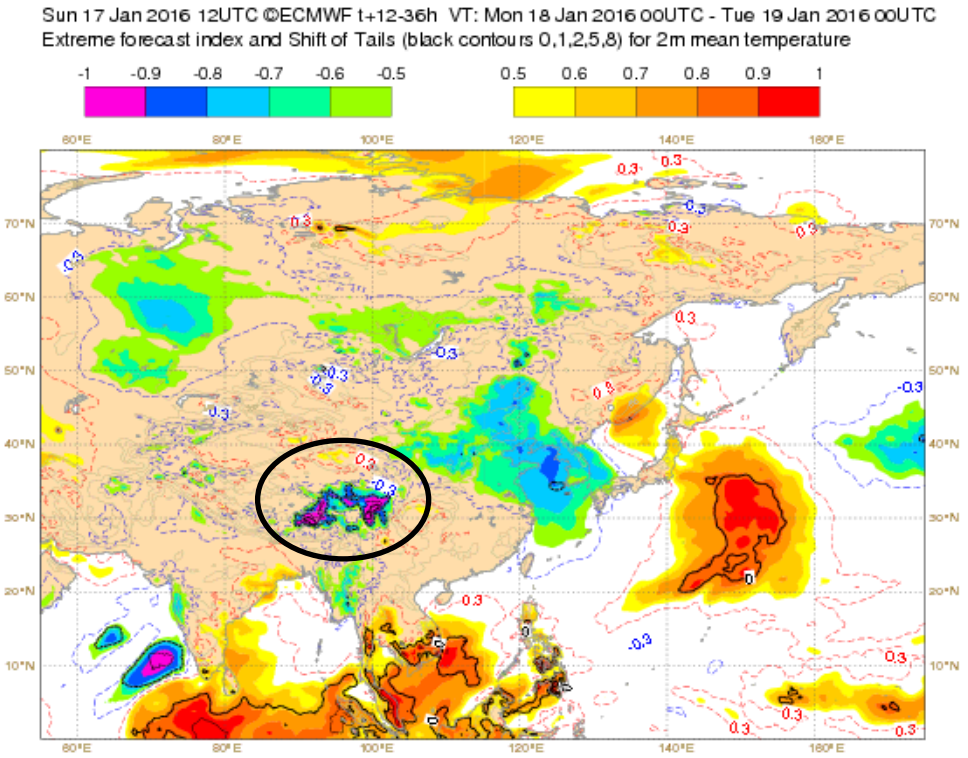
Monthly forecast anomalies

20 years x 11 forecasts x 3 dates = 660 forecasts

Difficulties in constructing reforecasts

Aim: Simulate climate of the real time forecasts…





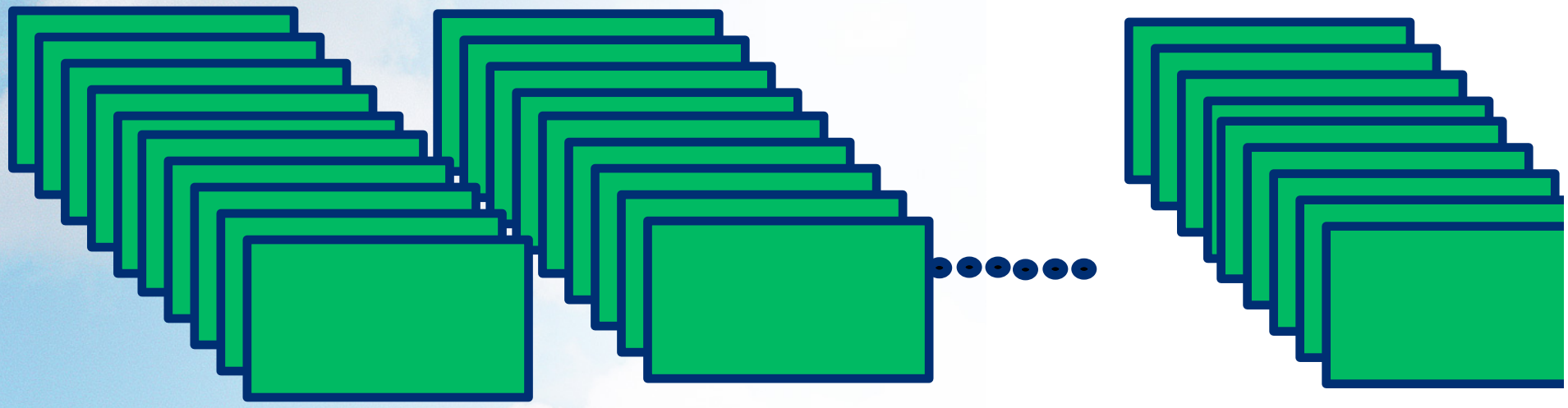
Configuration of reforecasts for seasonal forecasts

Example: 1 November

1 November 1981:

1 November 1982:

1 November 2010:



30 years x 15 forecasts = 450 forecasts
Run once for System 4, Initialised from ERA Interim

Bias correction and estimate of skill

Summary

- The model climate can be different from the observed climate
- We need the model climate to determine whether the forecast is anomalous
- Once (twice) a week, forecasts for the 20 last years are rerun to build up the model climate
- Used for several forecast products

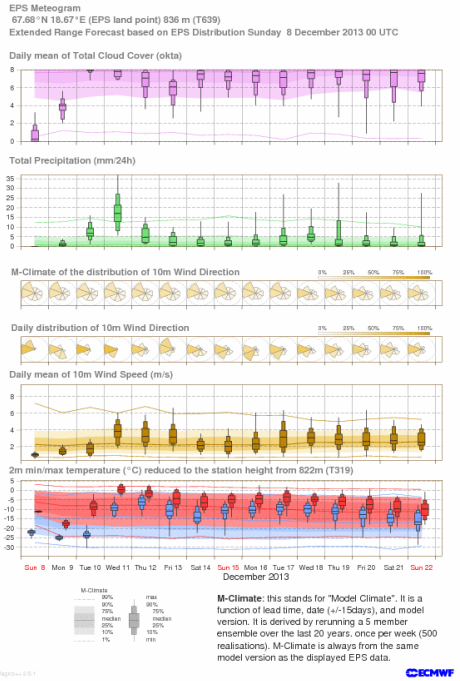
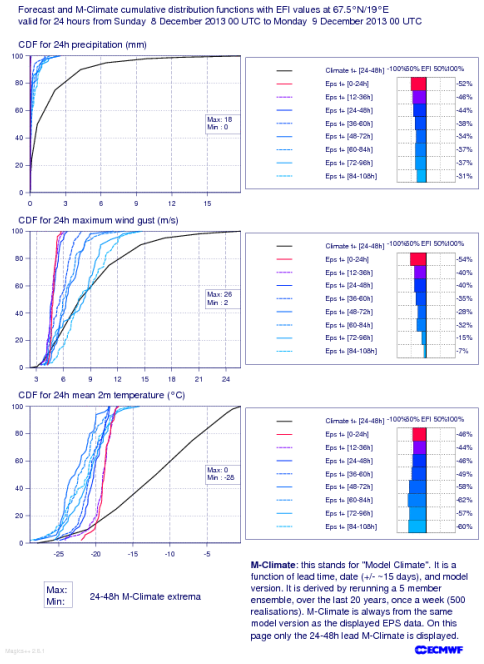
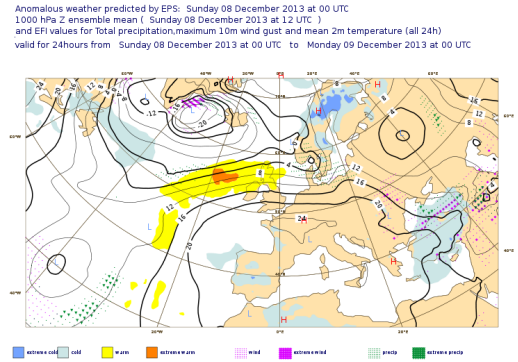
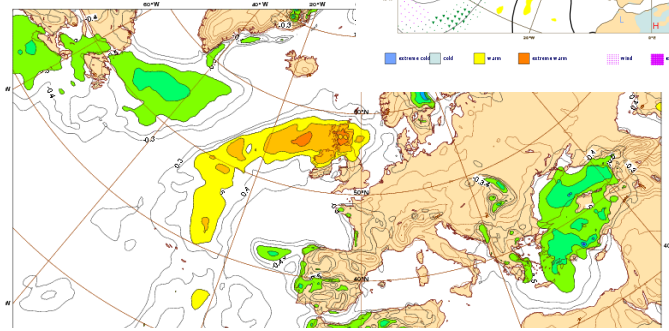
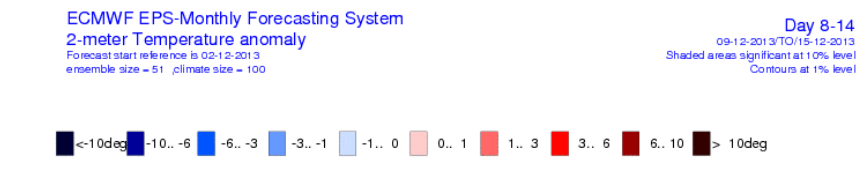
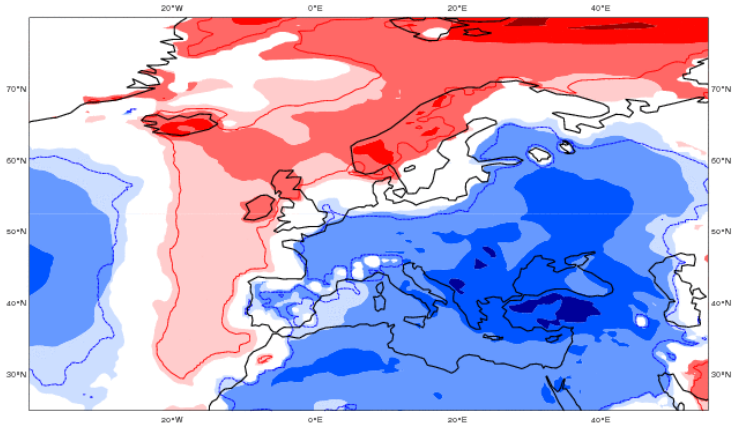
Configuration of reforecasts

Example: Thursday 12 December 2013:

12 December 1993:

12 December 1994:

12 December 2012:

20 years x 5 forecasts = 100 forecasts
Present model version
Ensemble configuration to 32 days
Initialised from ERA Interim

Model climate from reforecasts