The 8 November 2011 medicane event: the roles of model physical parameterizations and upper-level dynamical forcing

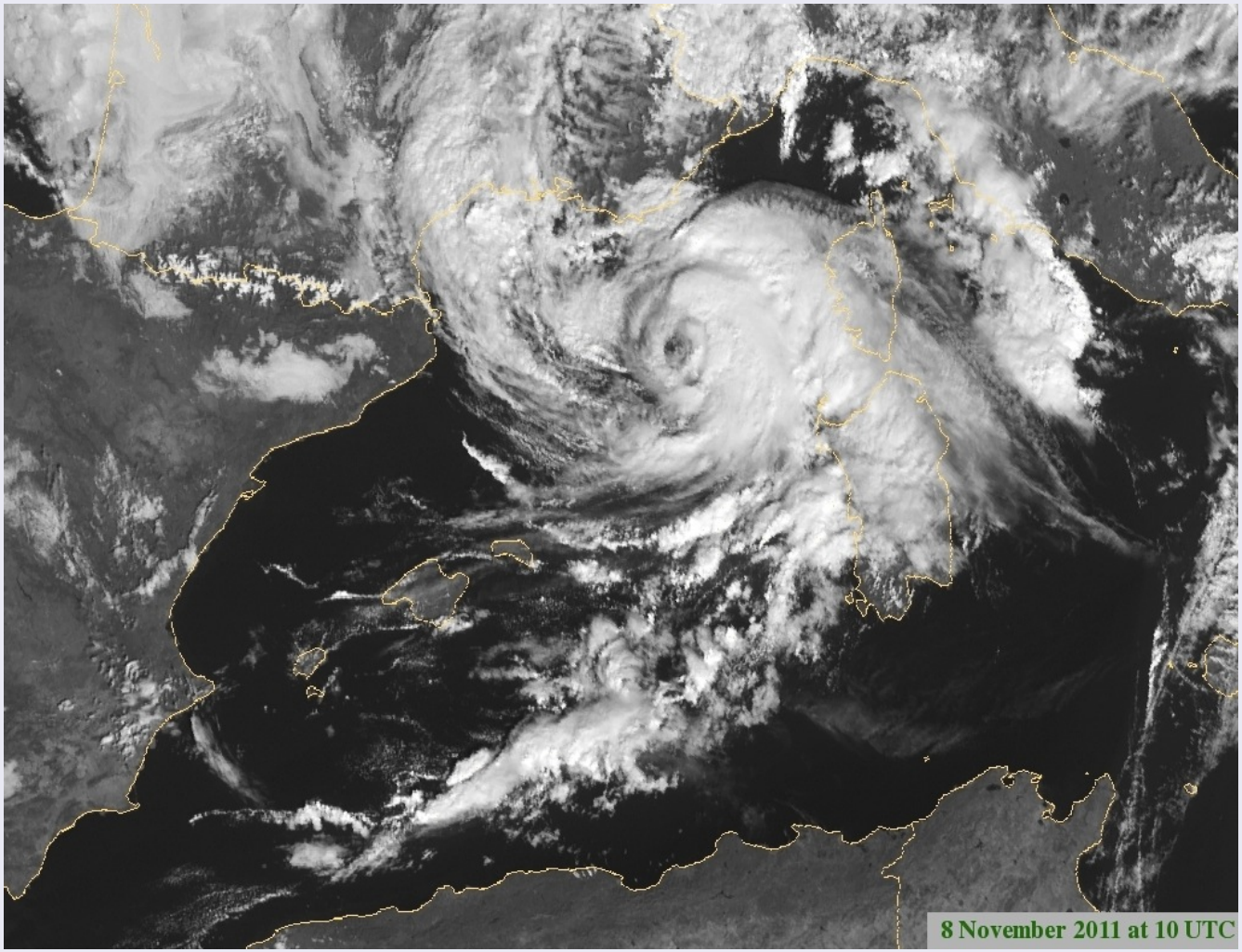
Maria-del-Mar Vich

Romualdo Romero and Maria Tous

Meteorology Group, Universitat de les Illes Balears, Spain

The 8 November 2011 medicane event

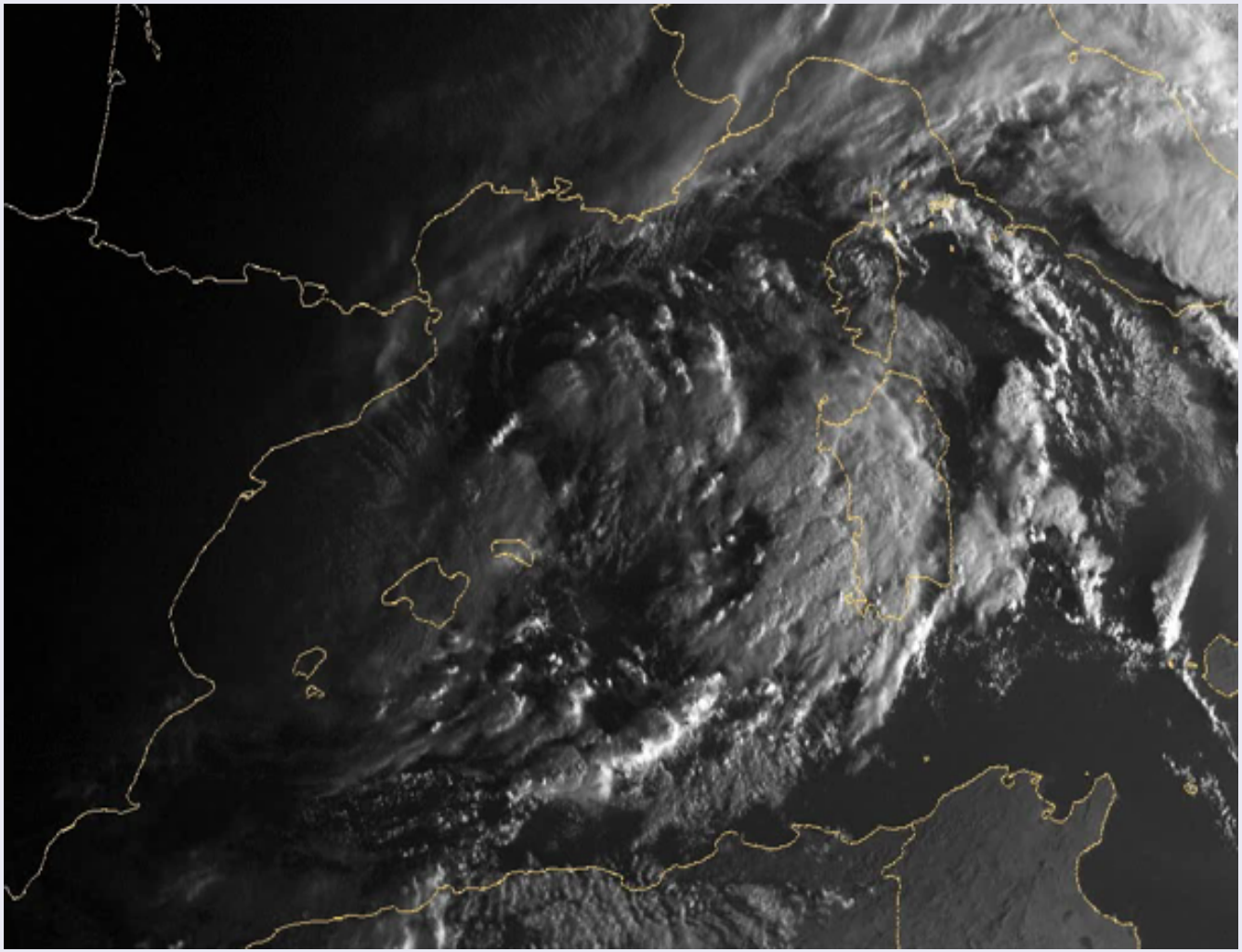
EUTMETSAT Met-8, High-resolution visible band



6 November 06:30 - 9 November 16:30 UTC

The 8 November 2011 medicane event

EUTMETSAT Met-8, High-resolution visible band



6 November 06:30 - 9 November 16:30 UTC

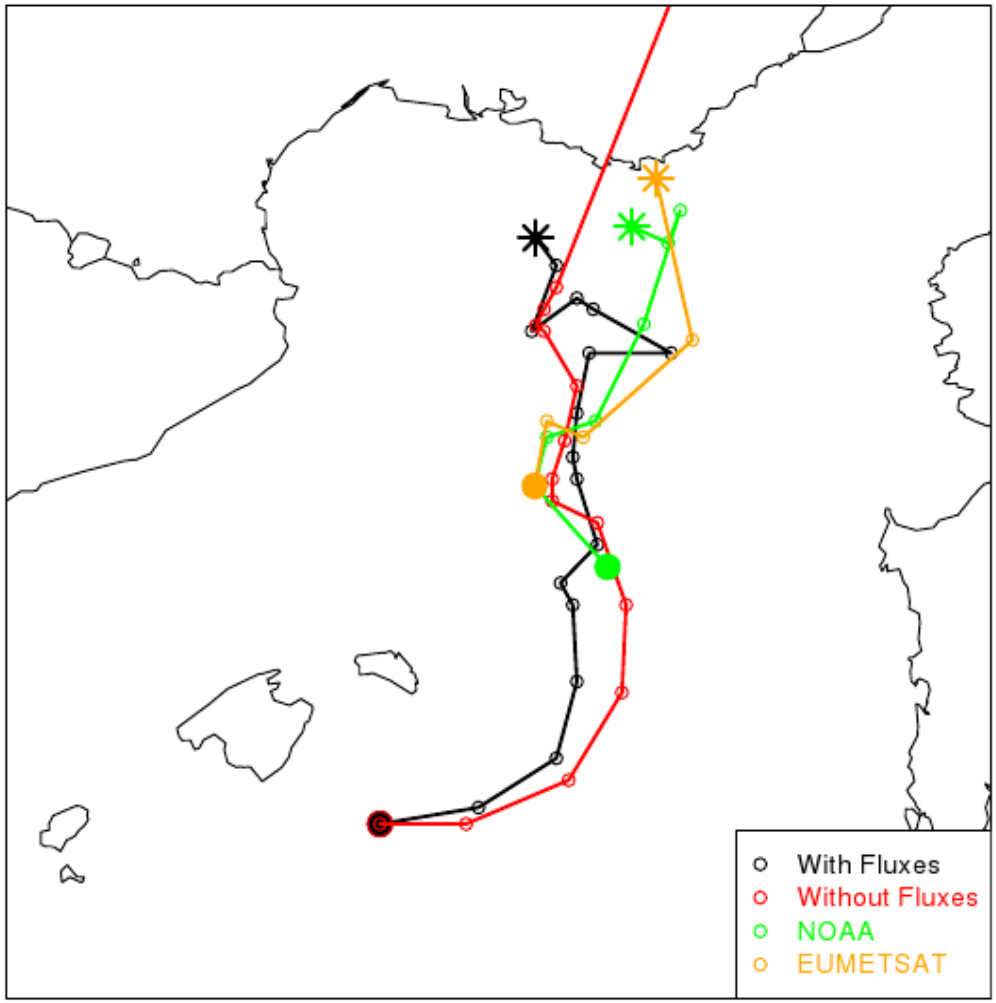
Medicanes are mainly driven by dynamical forcing and thermodynamical disequilibrium between the sea and the atmosphere.

So,...

How do surface heat fluxes influence medicanes properties?

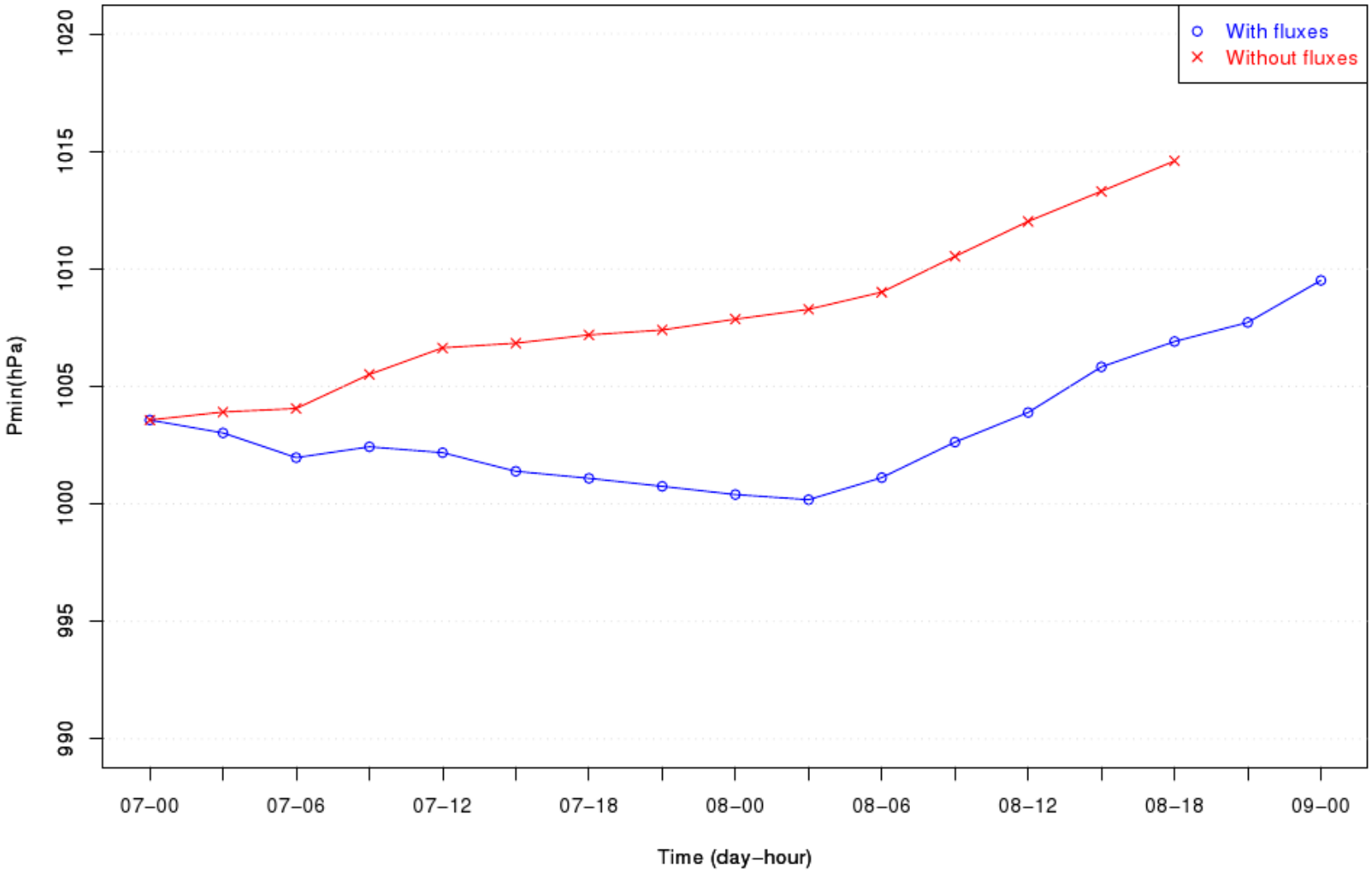
Influence of surface heat fluxes

Trajectory



Influence of surface heat fluxes

Central pressure



Influence of surface heat fluxes

- The surface heat fluxes play an important part in the deepening of the medicane low.

- The suppression of the surface heat fluxes causes a track deviation.

Ensemble Prediction Systems

A probabilistic framework allows to further study the role of the physical processes and the dynamical forcing involved.

We use two ensemble prediction systems based on

1. combining different sets of model physical parameterizations
2. perturbing initial and boundary conditions through three-dimensional PV structure

EPSs generation

The Multiphysics ensemble:

Different combinations of
MM5 physics parameterization

12 members
+
control member

- Explicit Moisture Schemes
  - Goddard microphysics
  - Reisner graupel
  - Schultz microphysics
- Cumulus Parameterizations
  - Grell
  - Kain-Fritsch
- PBL Schemes
  - Eta
  - MRF

EPSs generation

The PV-perturbed ensemble

To perturb the initial and boundary conditions
by
perturbing the 3-D structure of the PV field

- Why to perturb the PV field?
  1. PV inversion technique $\rightarrow$ perturb the T and Wind fields
  2. precursor upper-level PV structures $\rightarrow$ mid-latitude cyclonic situations
- Perturb: *how much* and *where*?

EPSs generation: The PV-perturbed ensemble

How much?

PV error climatology

Comparing the PV fields of

ECMWF analysis $\longleftrightarrow$ ECMWF 24 h forecast,

of a large collection of MEDEX cyclones, one can define:

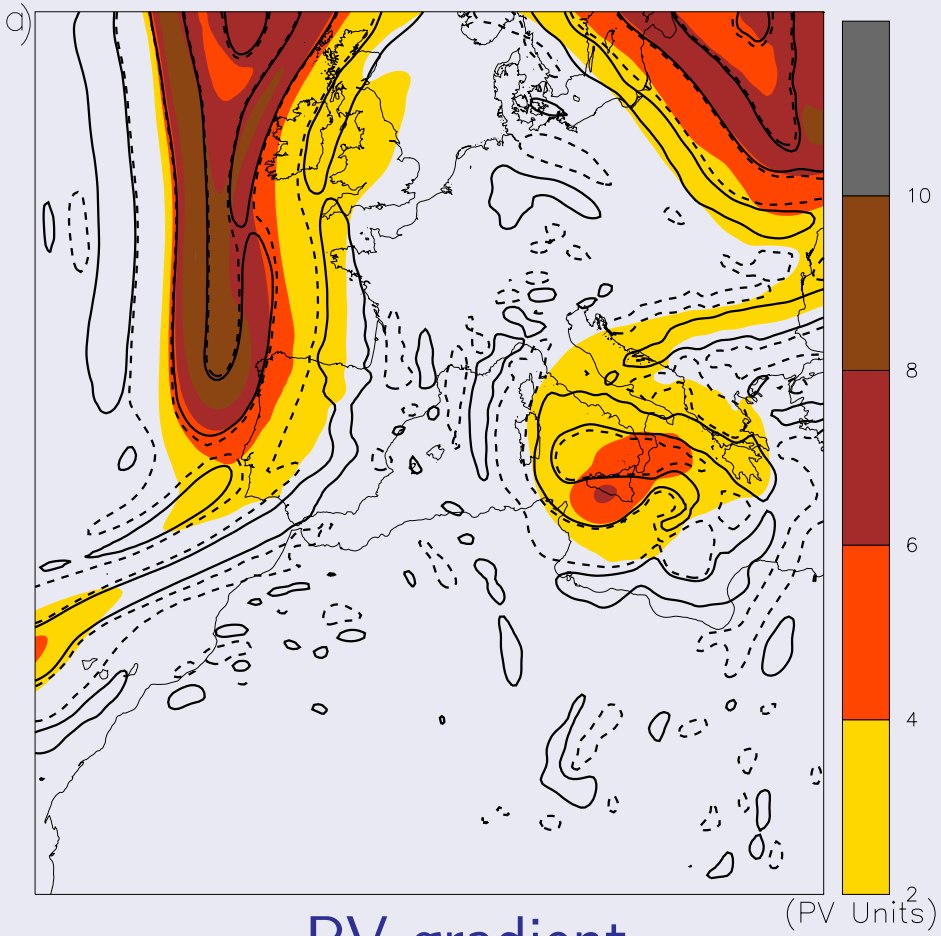
- The displacement error (DE): the minimum displacement of the 24 h forecast PV field showing local maximum correlation with the analysis PV field
- The intensity error (IE): the difference between the displaced 24 h forecast PV field and analysis PV field relative to the analysis PV average

MEDEX: Mediterranean Experiment on Cyclones that produce High Impact Weather in the Mediterranean

EPSs generation: The PV-perturbed ensemble

Where?

The most intense values and gradients PV zones at 300 hPa

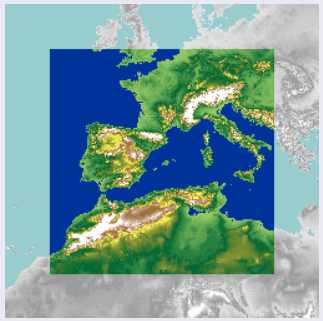


PV-gradient

EPSs generation

Simulations characteristics

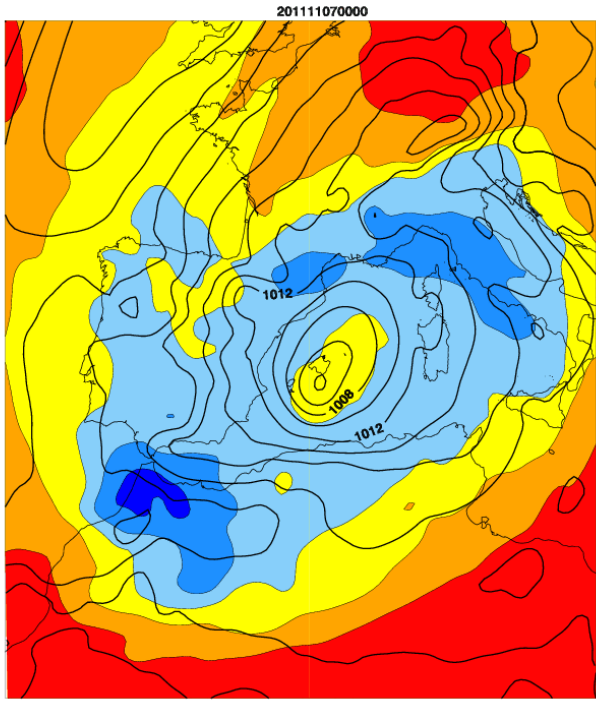
- Domain characteristics:
  - Resolution: 22.5 km
  - Center: 39.8 lat and 2.4 lon
  - Area: 120x120 grid
- Forecasting period is 54 h.



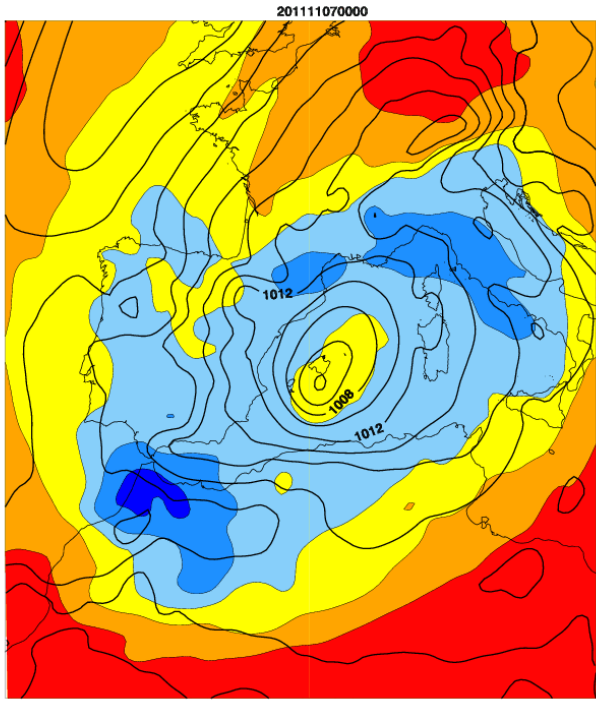
EPSs results

Simulations initialized on 7 Nov 2011 at 00UTC

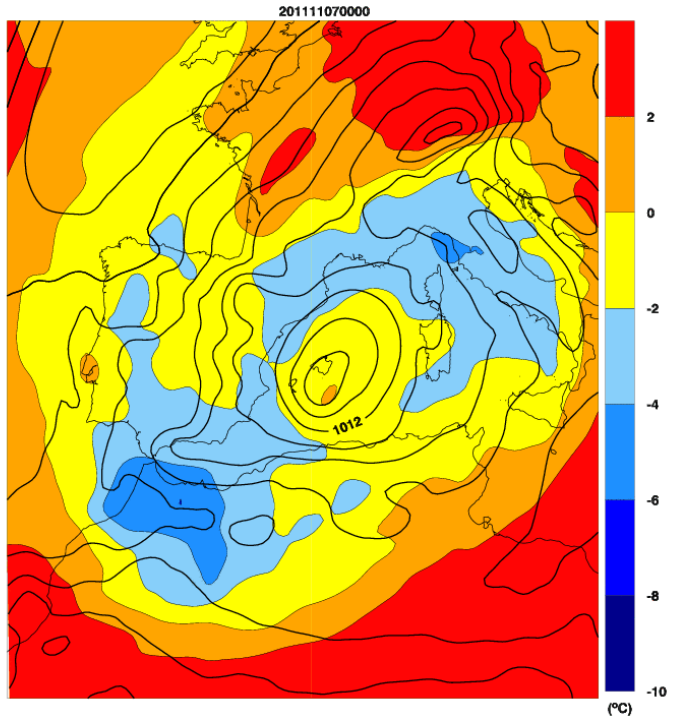
Control



Multiphysics

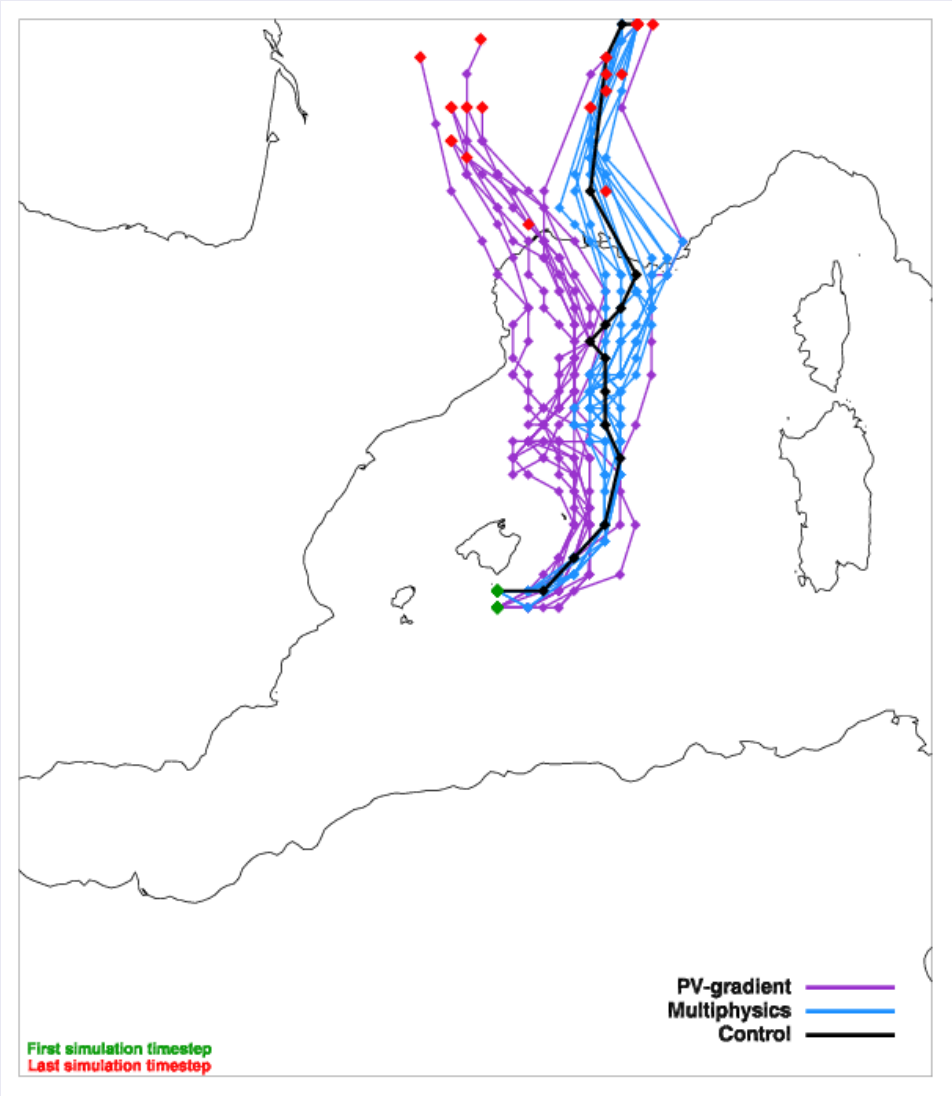


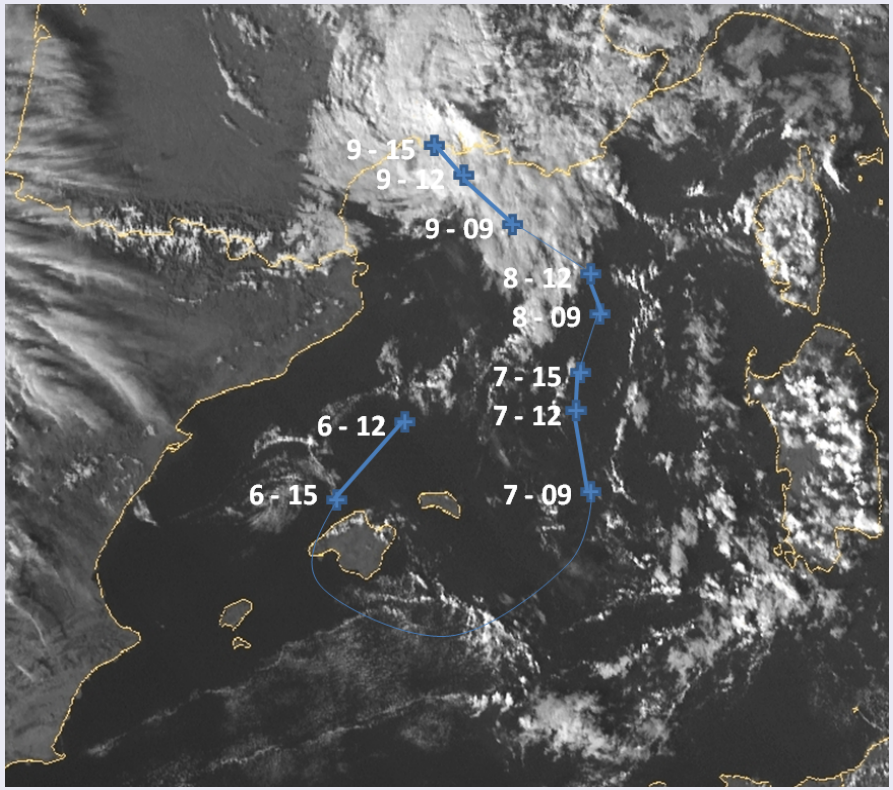
PV-gradient



EPSs results

Medicane track



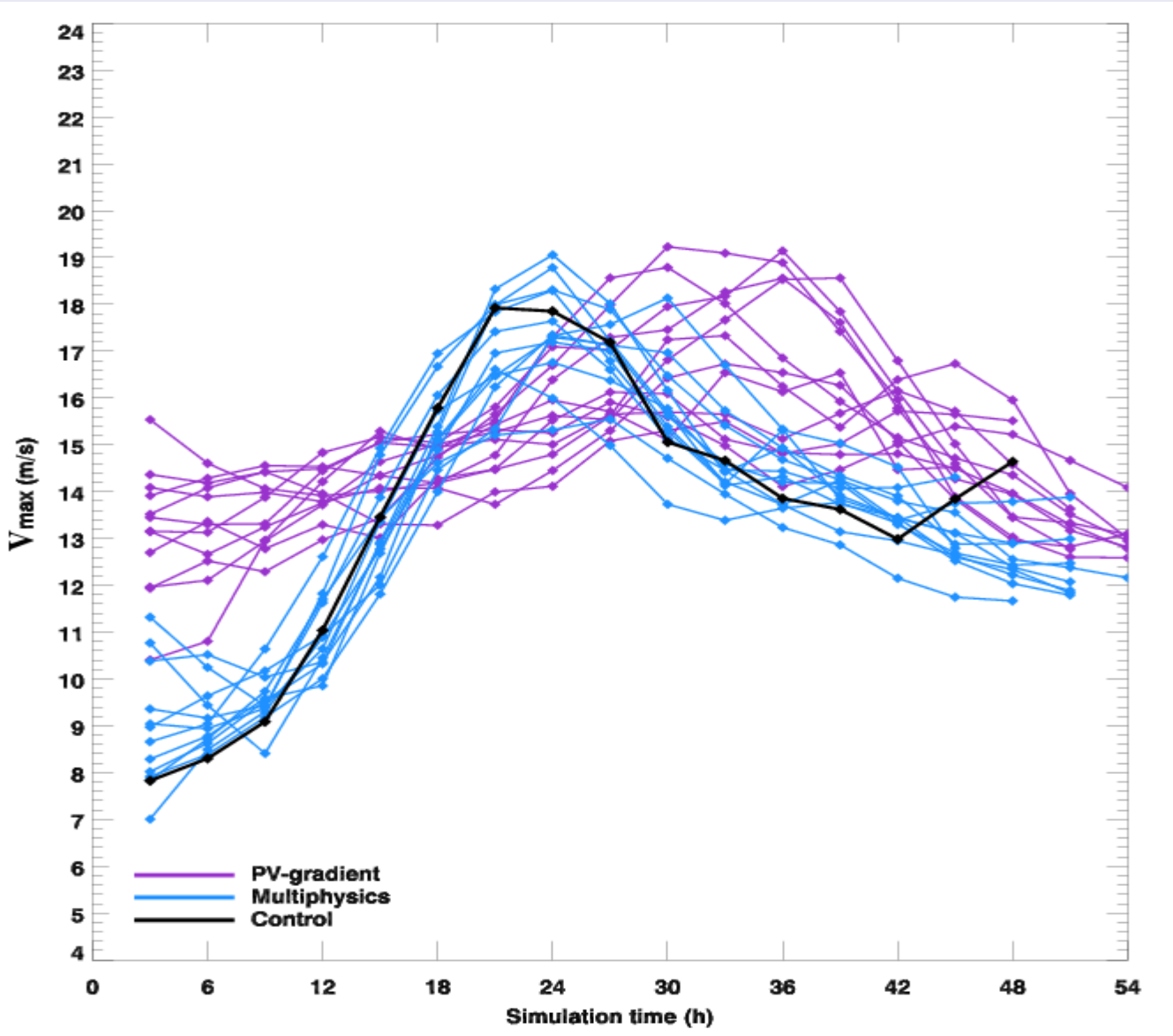


EPSs results

EUMETSAT

EPSs results

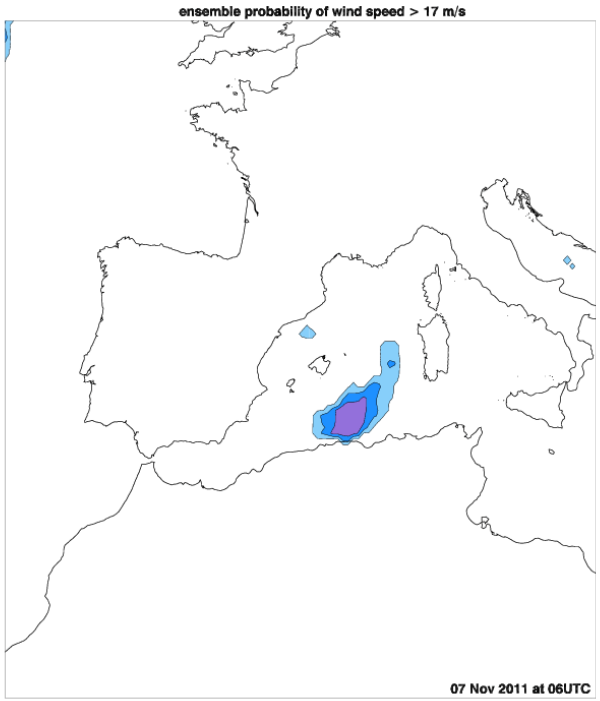
Medicane maximum wind speed



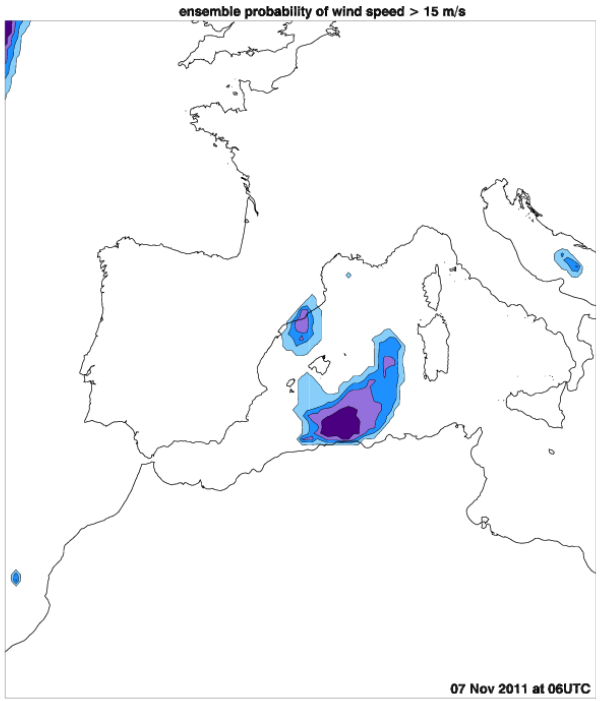
EPSs results

ensemble probability of wind speed over

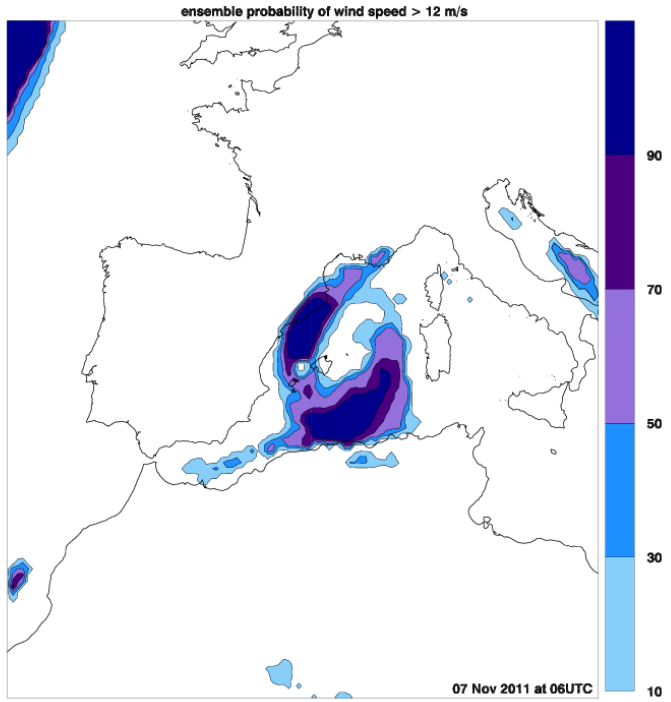
17 m/s



15 m/s



12 m/s



surface wind speed > 17 m/s

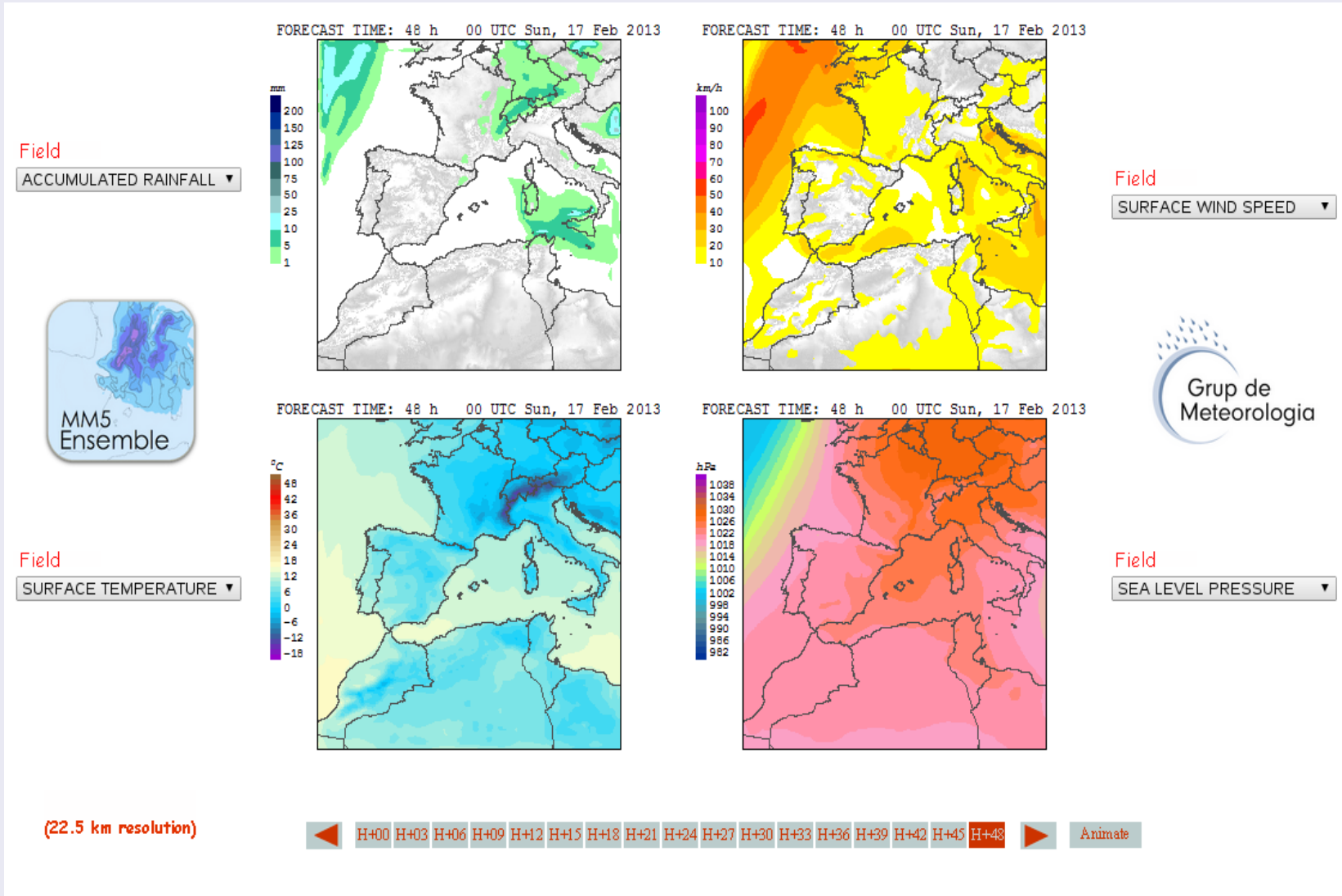
tropical storm

Conclusions

- The ensembles capture the medicane track.
- The PV-gradient ensemble has more spread, both in medicane intensity and track, than the multiphysics EPS.
- Ensemble probability of wind speed could become a powerful tool to issue high wind condition warnings.

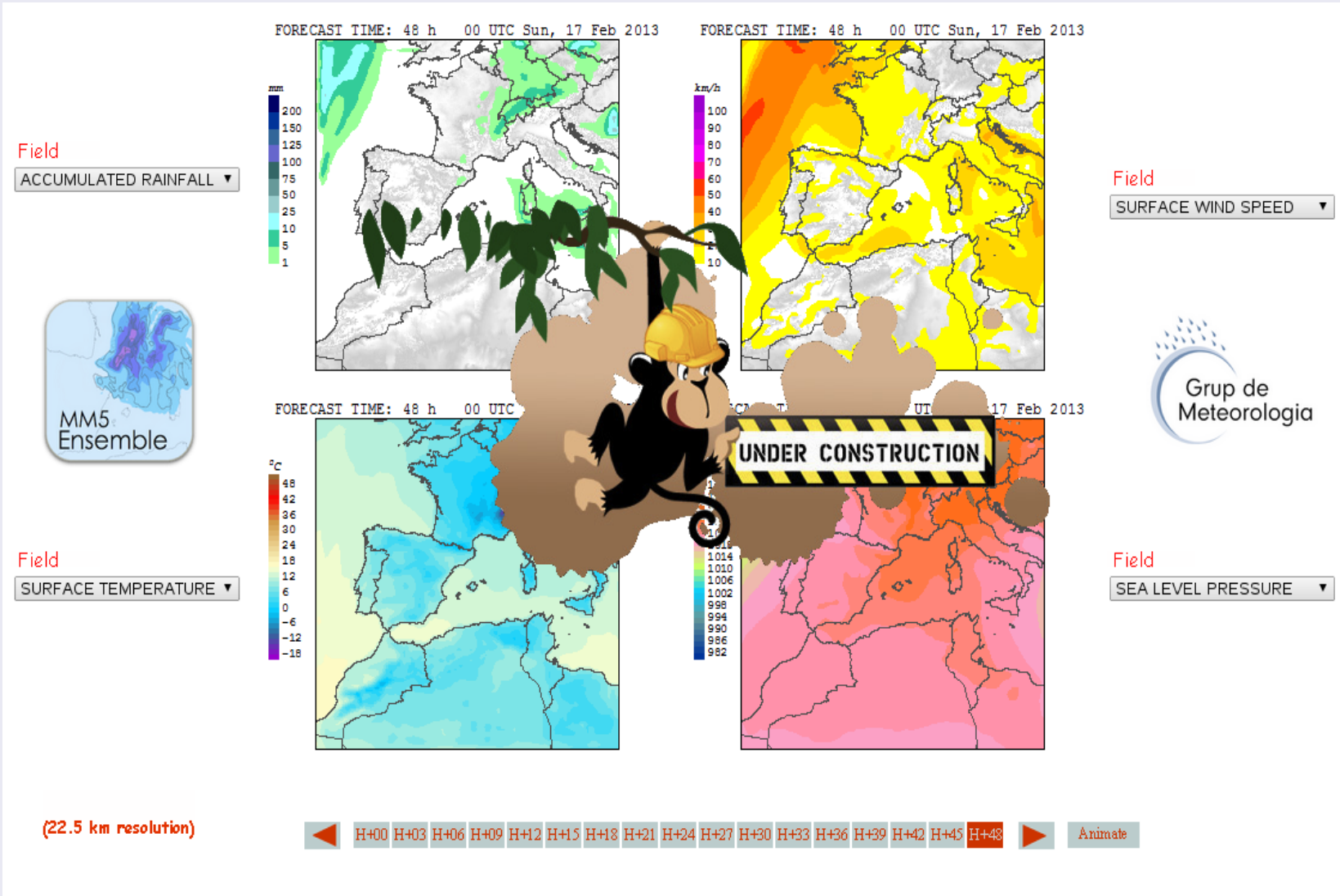
http://mm5ensemble.uib.es

MM5 Ensemble Weather Forecasts



http://mm5ensemble.uib.es

MM5 Ensemble Weather Forecasts



Thank you very much!