

Analyzing targeting guidance for a DTS-MEDEX-2009 case study: misleading sensitivity products



Lorena Garcies

Víctor Homar

Victor.Homar@uib.cat



Project Part-Financed
by the European Union

European Regional
Development Fund



7th European Conference on Severe Storms. 3-7 June 2013. Helsinki

Collaborators



A. Jansà, J. Campins, M. A. Picornell,
A. Genovés, J.A. García-Moya, A. Callado, P. Escribà



J. Caughey, S. Klink



D. Richardson, C. Sahin

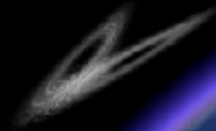
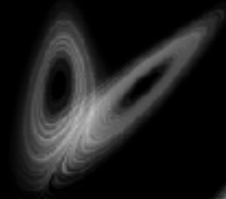


A. Doerenbecher, P. Arbogast, E. Richard



Sensitivity Analysis of Mediterranean High Impact Weather: from the climatological to the operational targeting campaign perspectives

Lorena Garcies Artigues



Universitat de les Illes Balears
Departament de Física
Grup de Meteorologia





More informative title

Targeting for Severe Weather...
WTF?

The title

Can we target observations
betting on forecast sensitivity
fields of Mediterranean severe
weather?

Outline

- What are forecast sensitivities?
- Are they good for anything?
- Really...?
- Fundamental thoughts



What are *forecast sensitivities*?

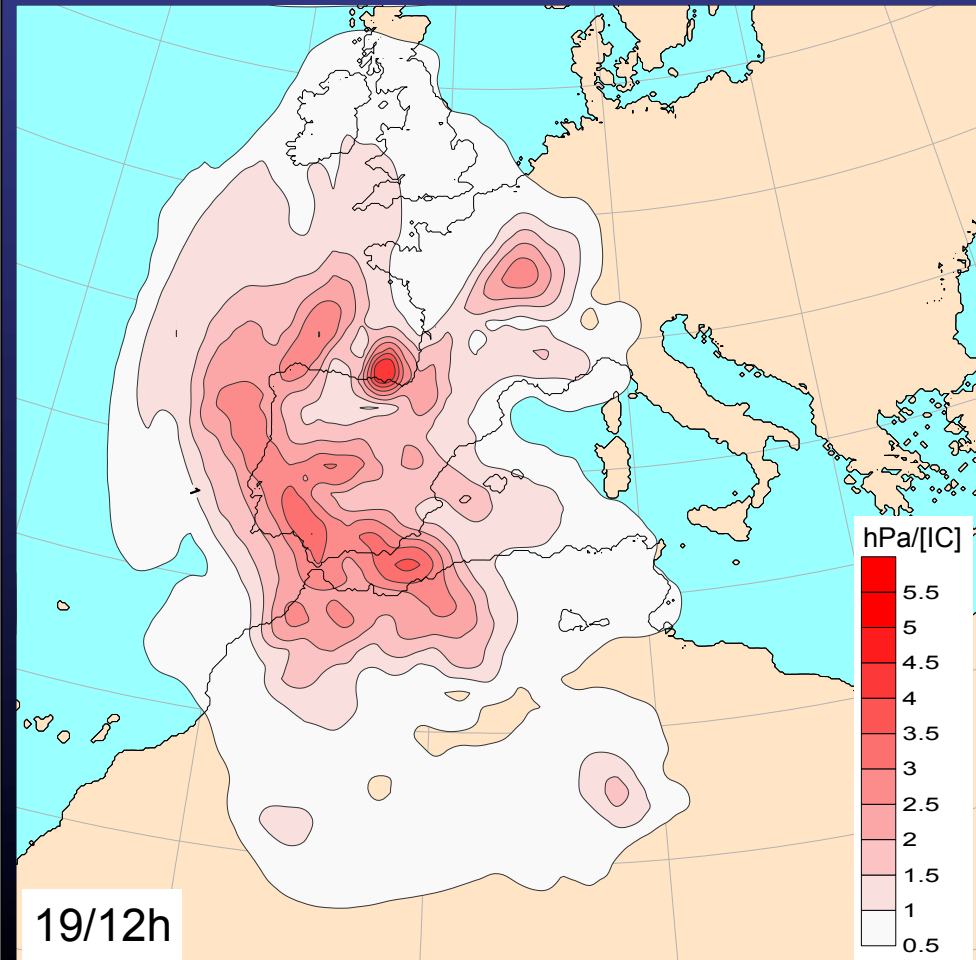
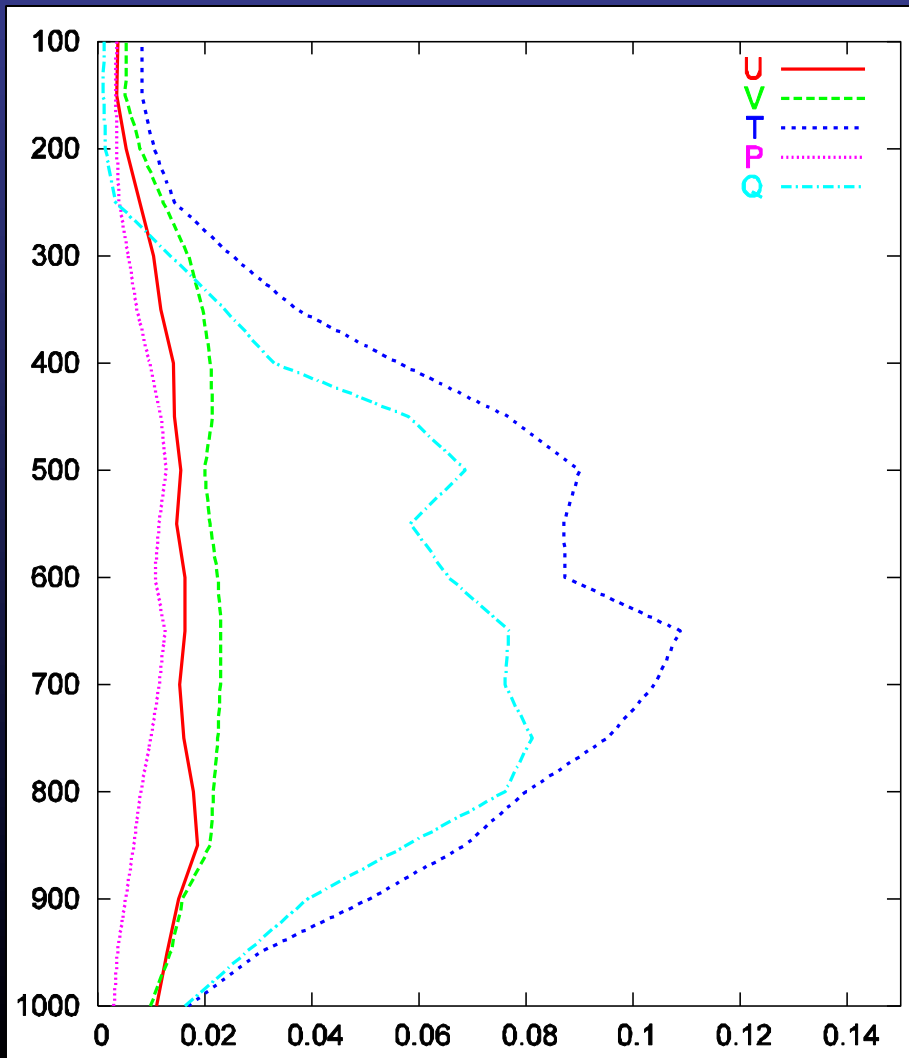
Underlying idea

Imagine we have a forecast of potentially hazardous weather:



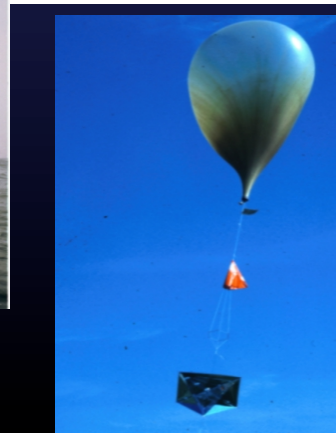
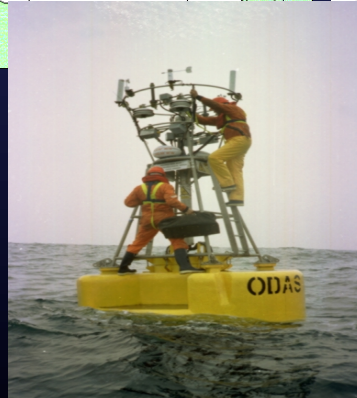
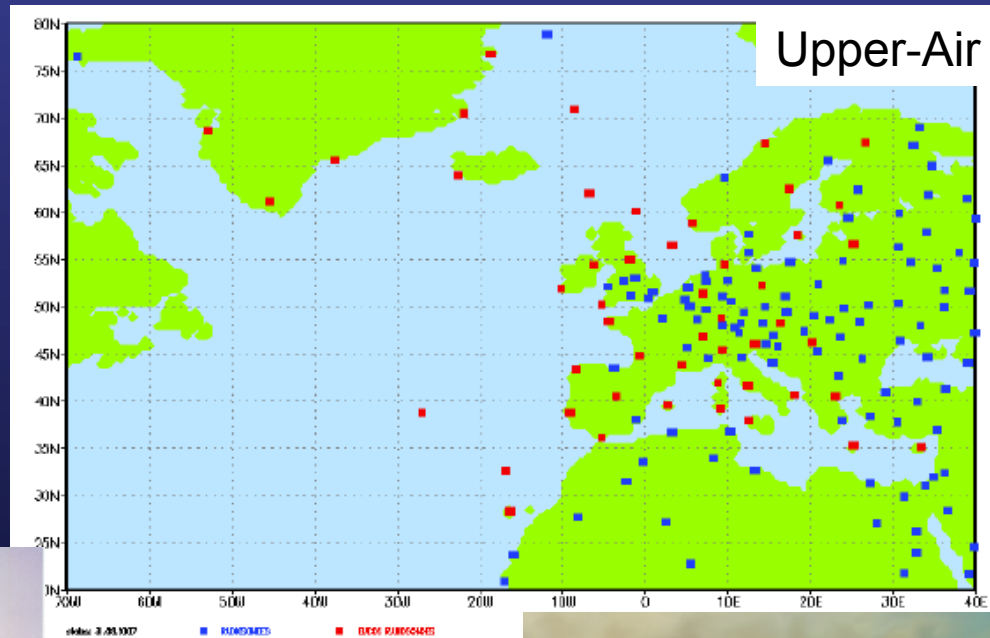
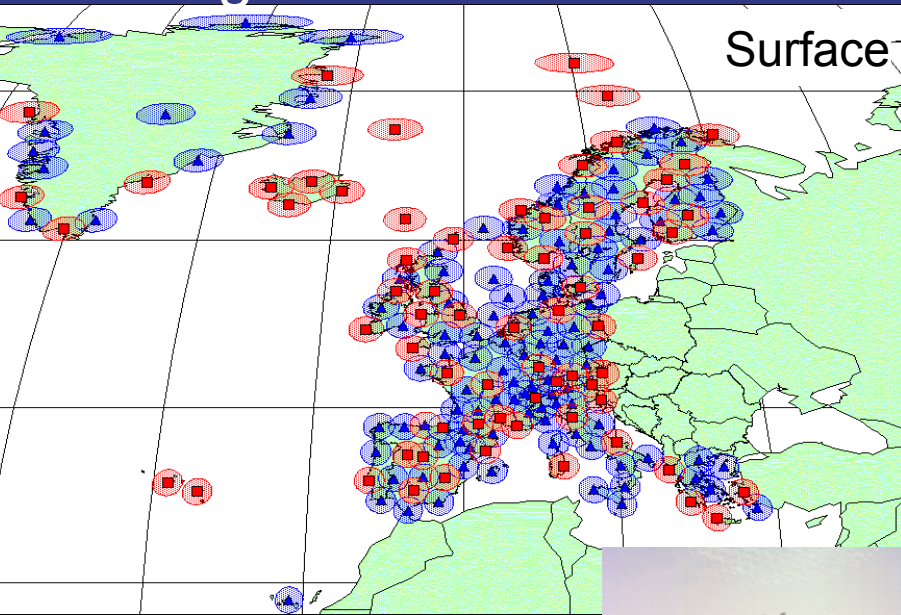
Underlying idea

If we knew where should we improve the observational datasets to obtain better NWP forecasts ...



Underlying idea

... we could make informed decisions about observational strategies at both daily basis and long-term network configuration.



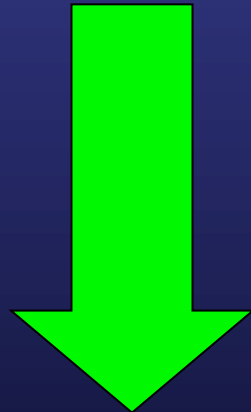
Sensitivities

BUT how do we...

“...know where should we improve the observational datasets in order to obtain better NWP forecasts”

BUT how do we...

“...know **where** should we improve the observational datasets in order to obtain better NWP forecasts”



Forecast Sensitivity information

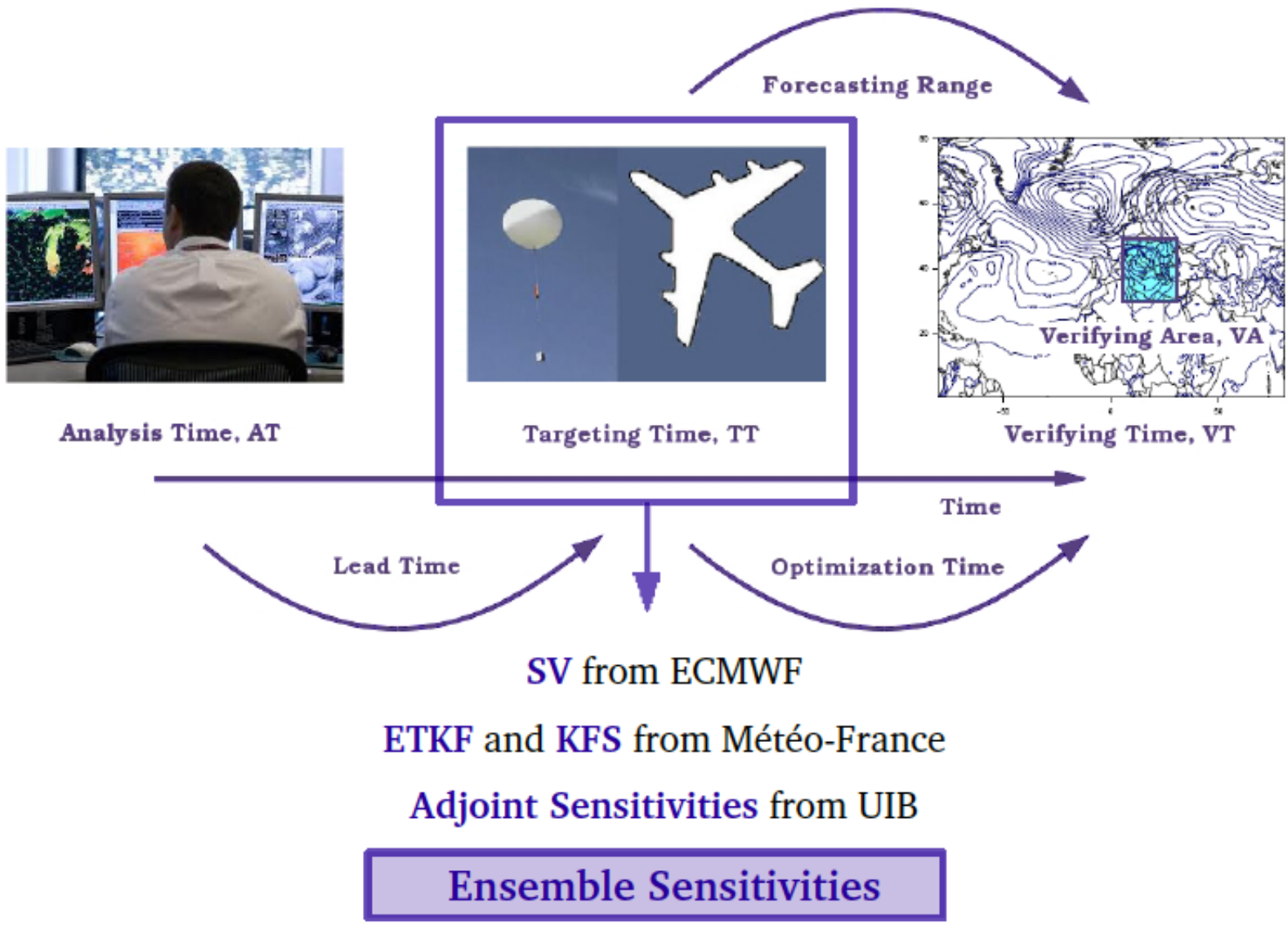
(Adjoint models, Ensemble sensitivities, inverse models, ET, ETKF)

Are forecast sensitivities good for anything? Really...?

(Helpful in Targeting Campaigns?)



DTS-MEDEX-2009 is an observational targeting campaign focused on Mediterranean HIW



Which sensitivity method should the lead user in the HOC trust?

HyMeX *HyMeX Operation Center (HOC), aircraft base*

Main Centre

- 7/7 meteorological forecast and monitoring – IOP decision, pre-alert and alert notification
- ENAC Montpellier - co-located with the French research aircraft and near Candillargues



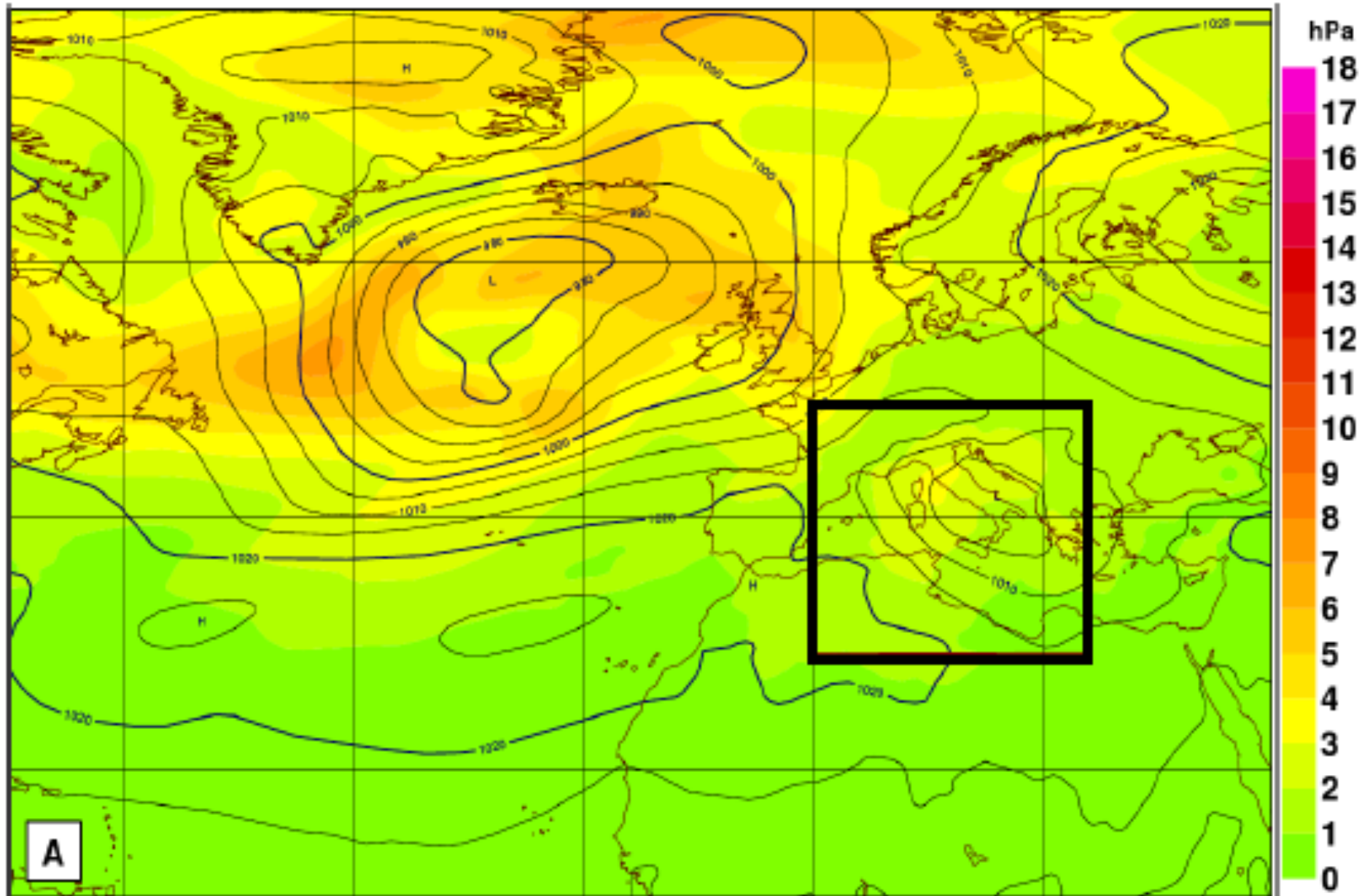
- 7/7 Météo-France and AEMET forecasters
- Scientific PI and aircraft pilots
- 3 forecaster workstations
- Visioconference facilities for the morning briefing
- Access to the HyMeX SOP website

Secondary Centers

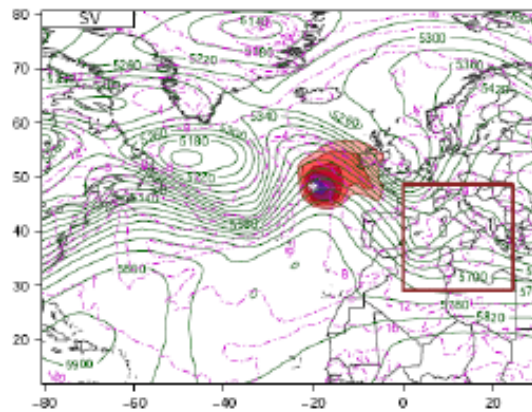
- Palma – AEMET
- Corse - INRA / DO 128 at the military base in Solenzara
- Italy - ENAV
- Toulouse – Météo-France/Ecole Nationale de la Météorologie



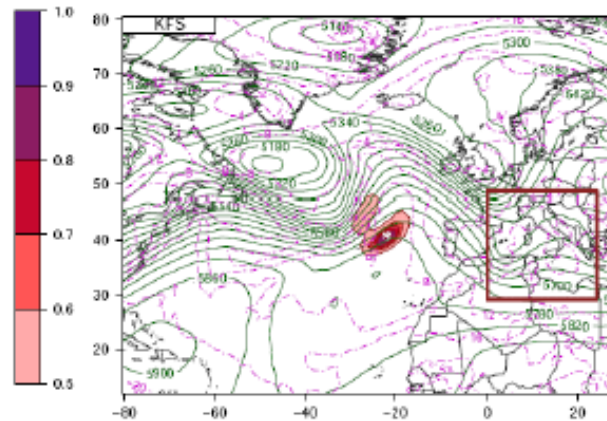
The DTS GAME (Dec 2 2009)



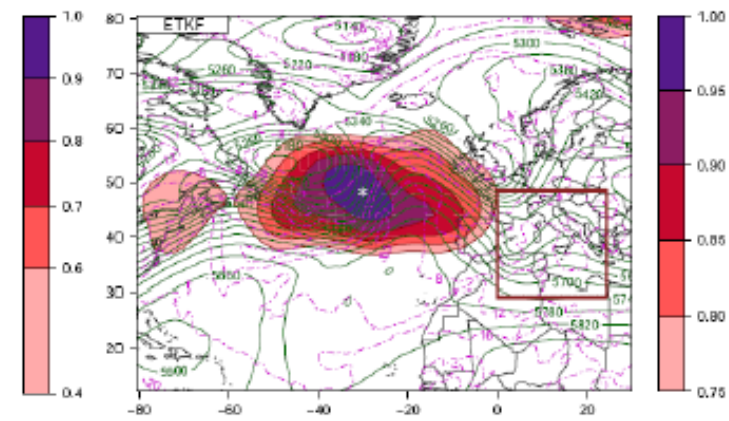
ECMWF: SV



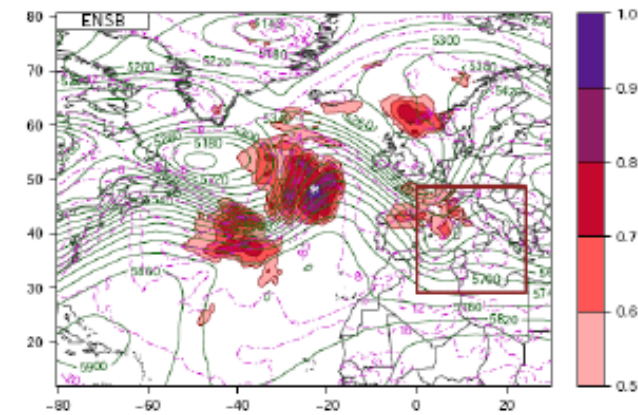
MétéoFrance: KFS



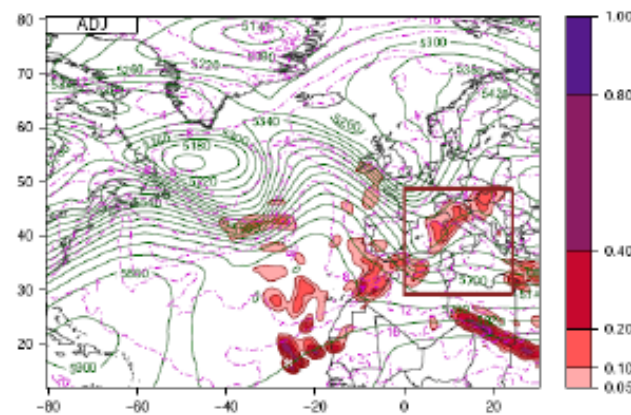
MétéoFrance: ETKF



UIB: ENSB



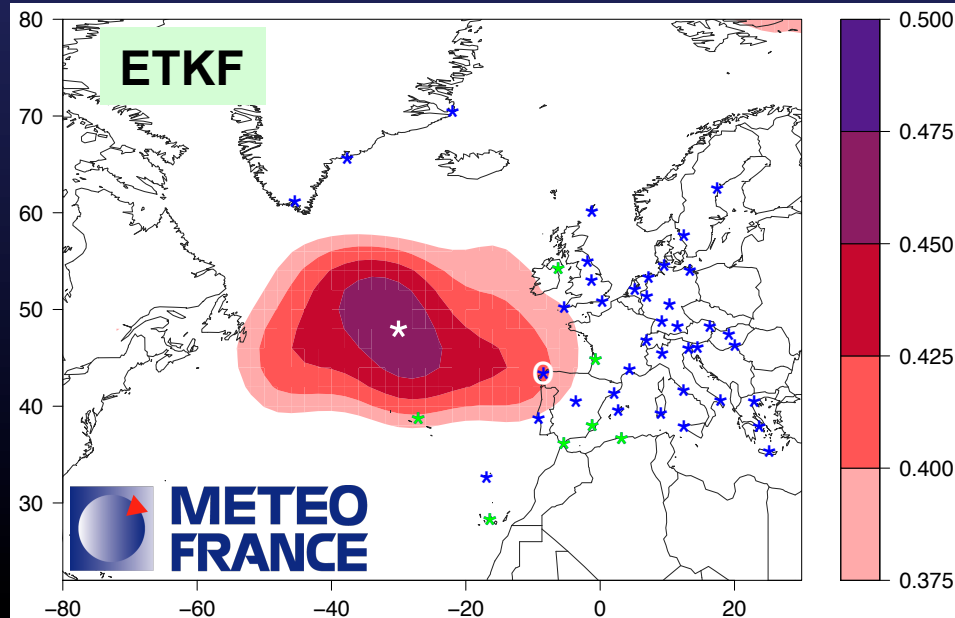
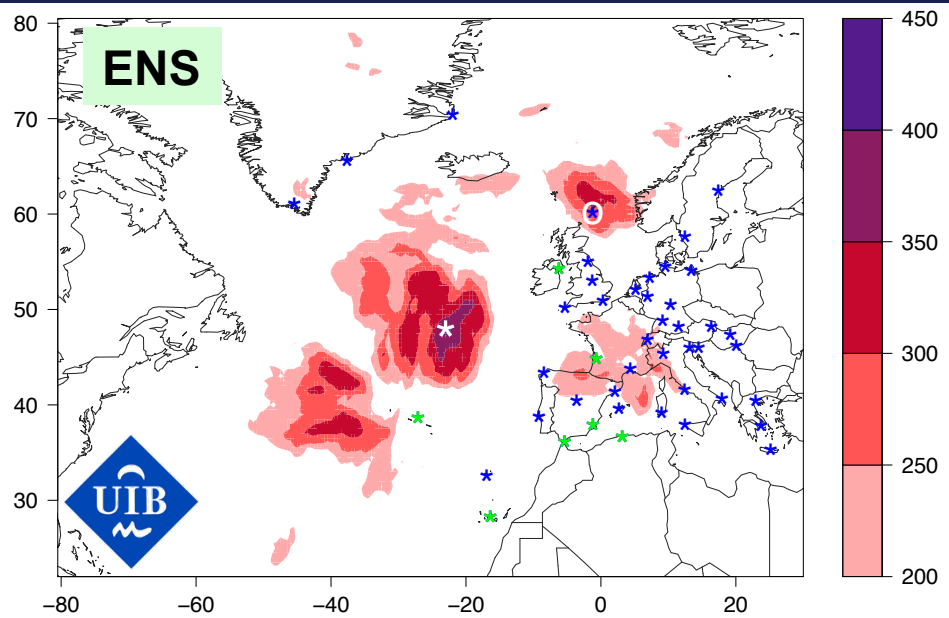
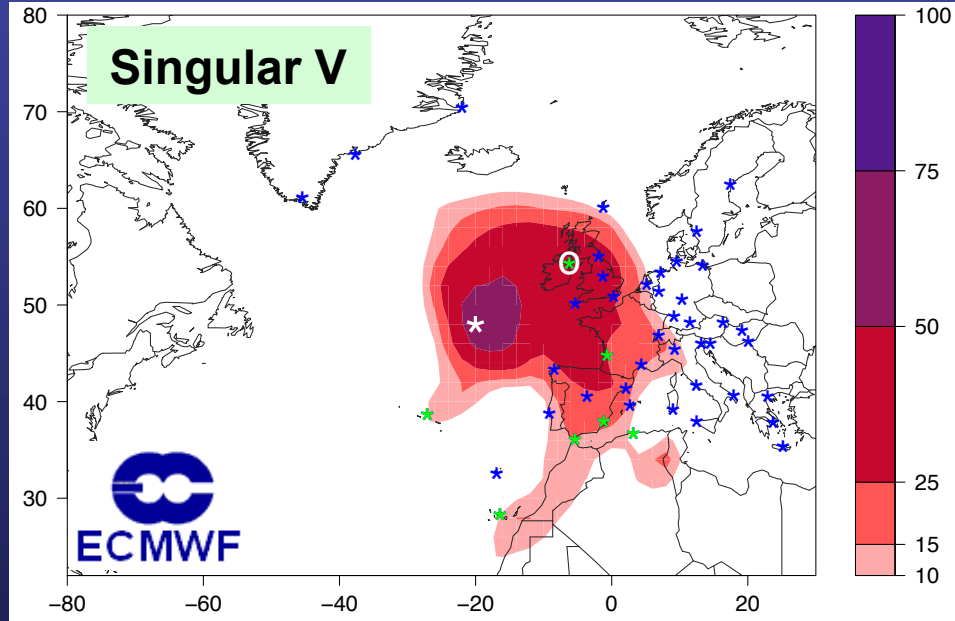
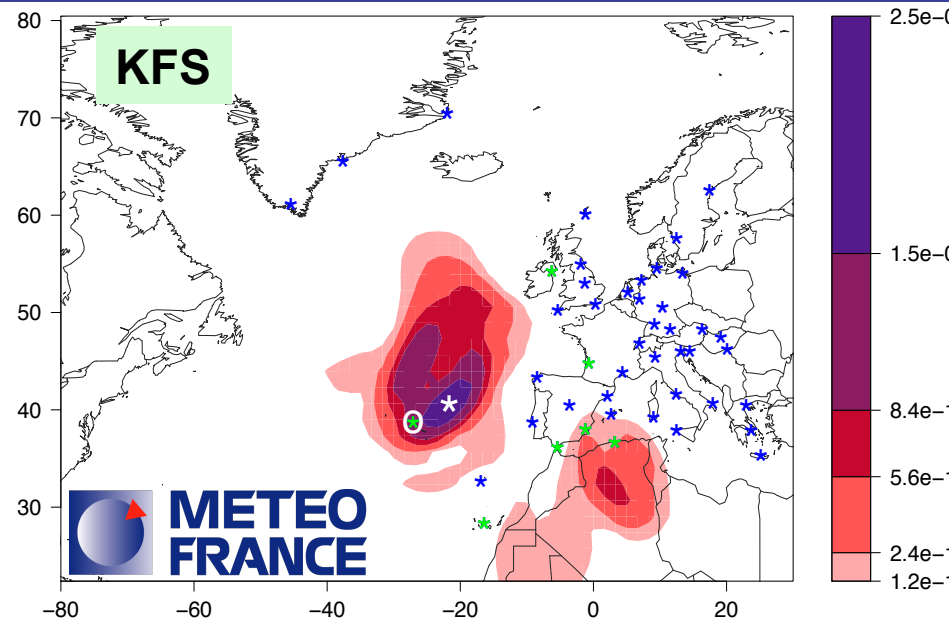
UIB: ADJ



HUMAN

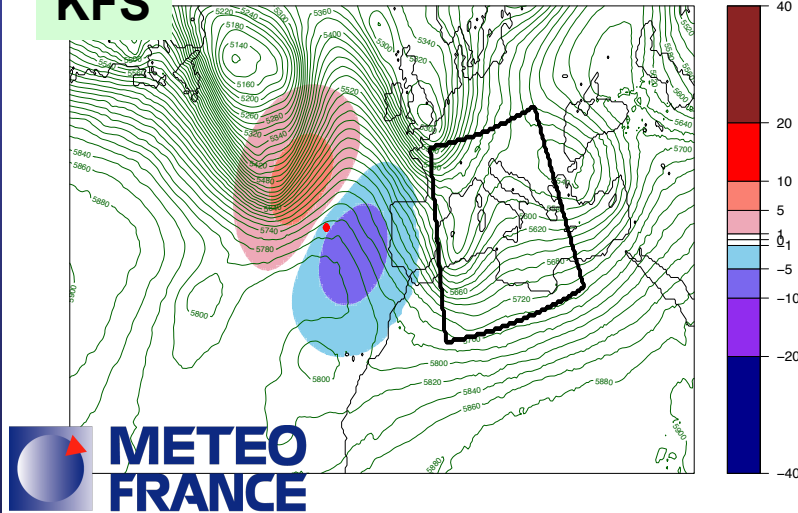


The DTS GAME (Dec 2 2009)

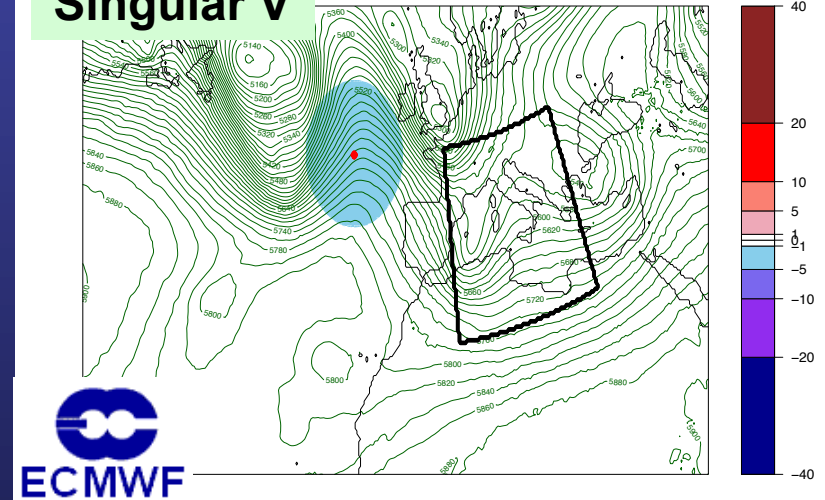


The DTS GAME (Dec 2 2009)

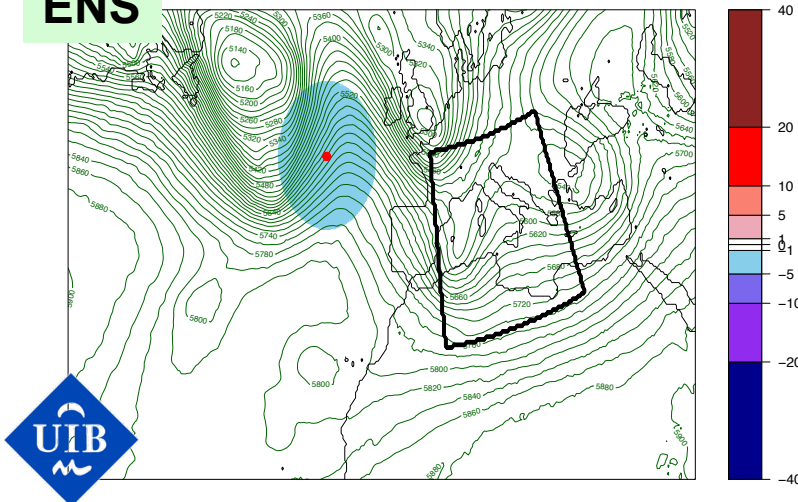
KFS



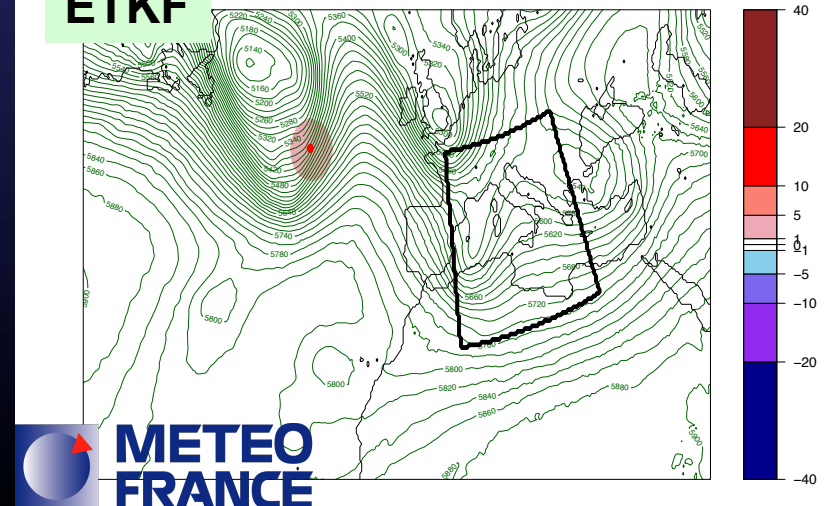
Singular V



ENS

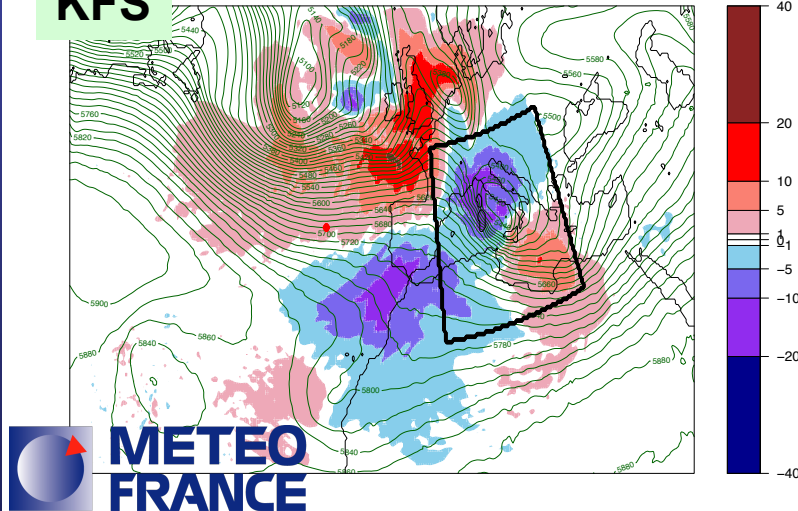


ETKF

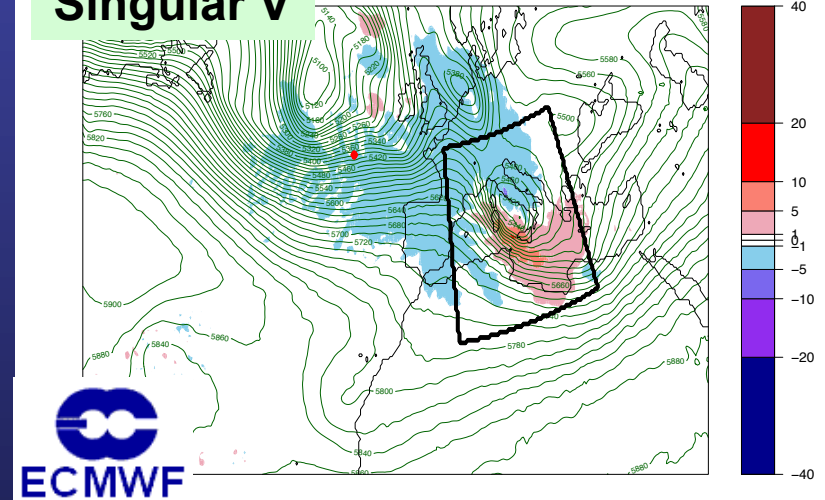


The DTS GAME (Dec 2 2009)

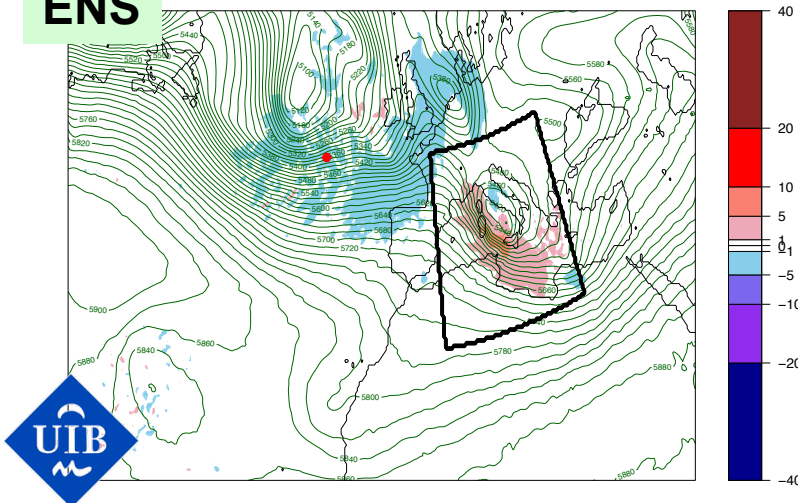
KFS



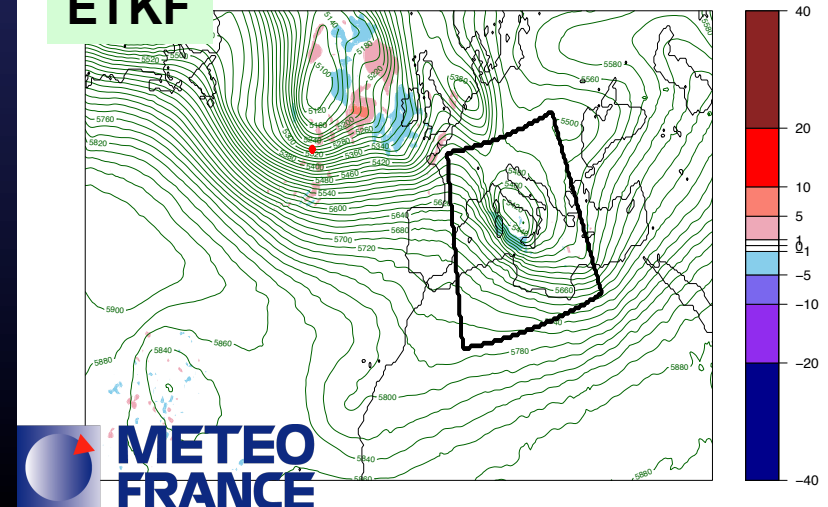
Singular V



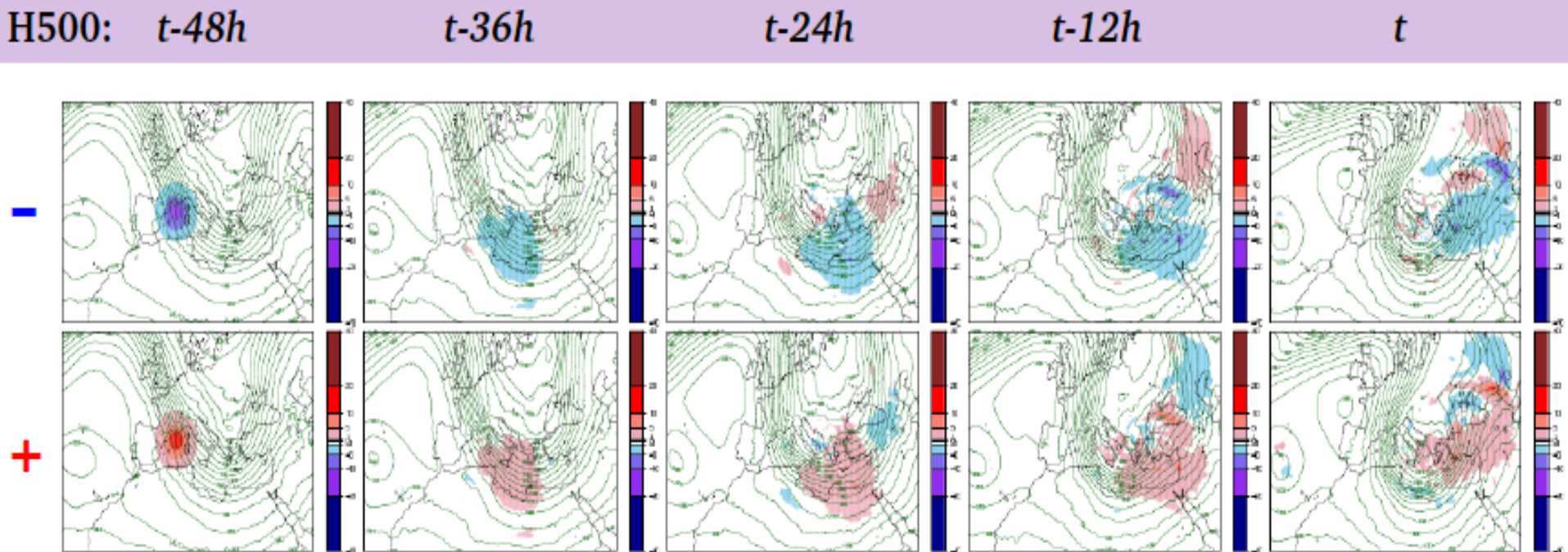
ENS



ETKF



Linear evolution of perturbations?



✓ To quantify the duration of the linear regime we use the spatial correlation and the relative linearity (Gilmour et al., 2001):

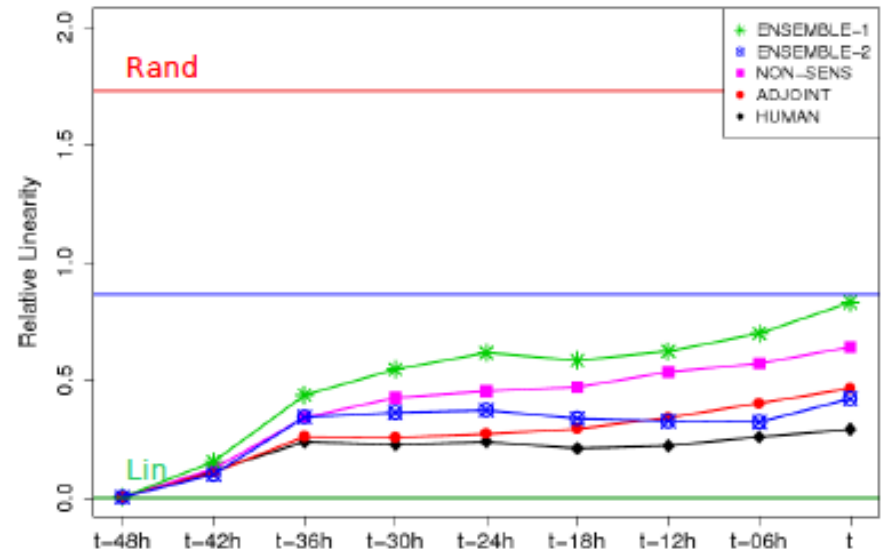
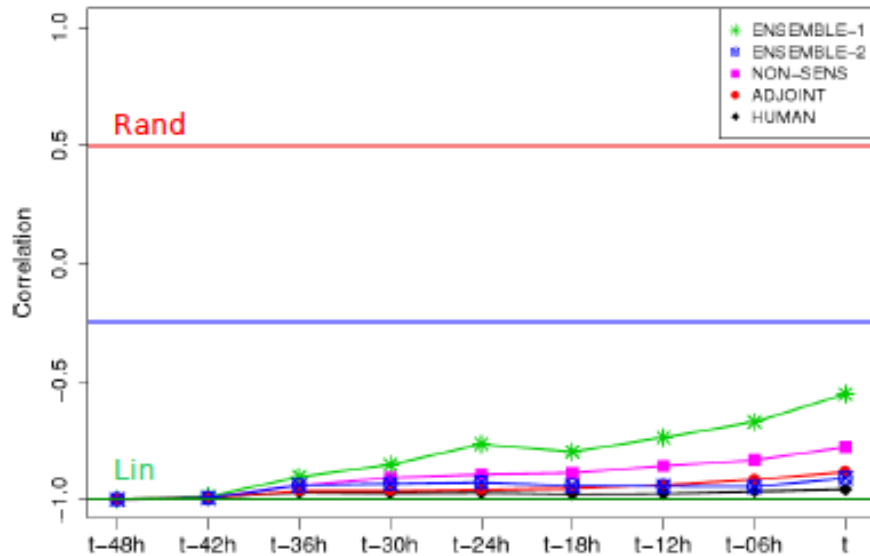
$$r = \frac{Cov\langle\delta^+, \delta^-\rangle}{\sqrt{Var\langle\delta^+\rangle Var\langle\delta^-\rangle}}$$

$$\theta = 2 \frac{\|\delta^+ + \delta^-\|}{\|\delta^+\| + \|\delta^-\|}$$

- | | | |
|----------------------------------|---|----------------------------|
| $r = 0.5, \theta = \sqrt{3}$ | → | Random evolution |
| $r = -0.25, \theta = \sqrt{3}/2$ | → | Breakdown of linear regime |
| $r = -1, \theta = 0$ | → | Perfect linear evolution |

(Hohenegger and Schär, 2007)

Linear evolution of perturbations?



$$r = \frac{Cov\langle\delta^+, \delta^-\rangle}{\sqrt{Var\langle\delta^+\rangle Var\langle\delta^-\rangle}}$$

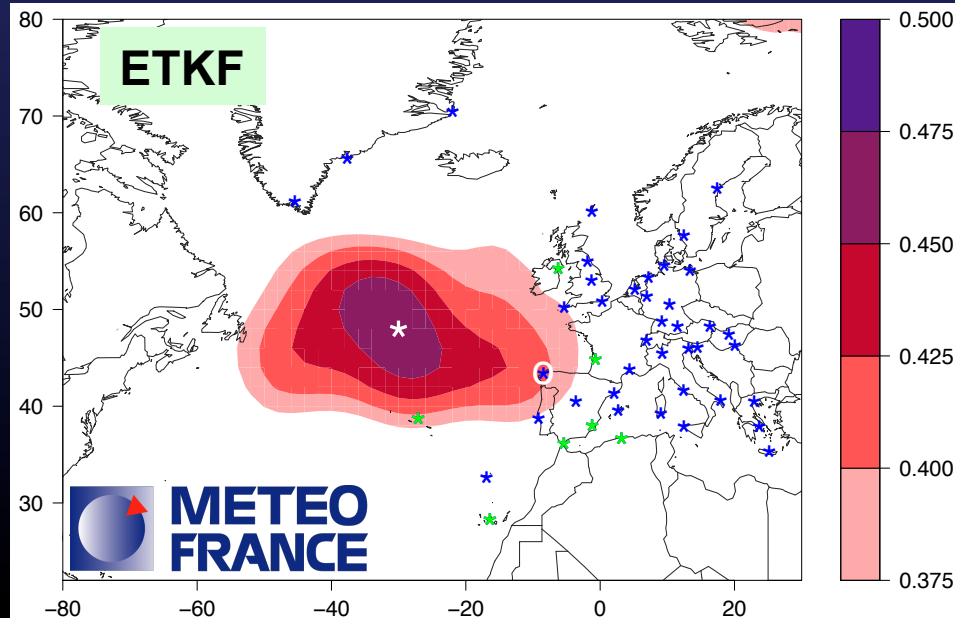
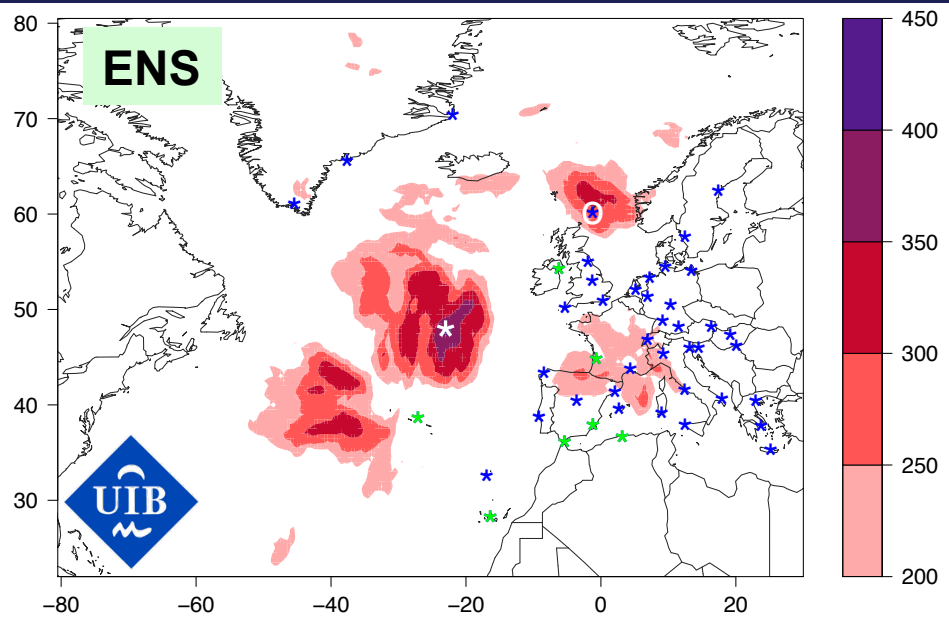
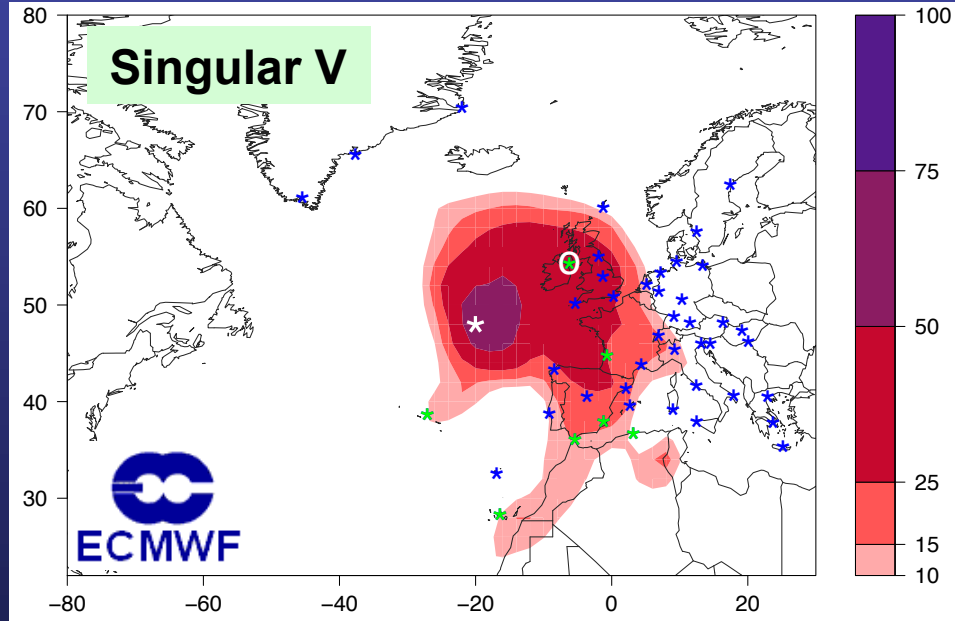
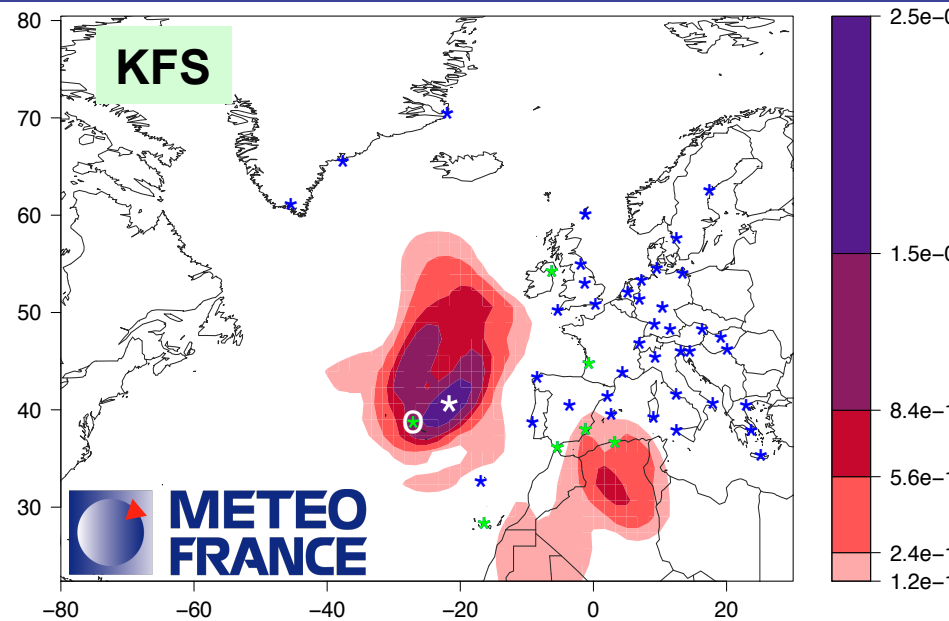
$$\theta = 2 \frac{\|\delta^+ + \delta^-\|}{\|\delta^+\| + \|\delta^-\|}$$

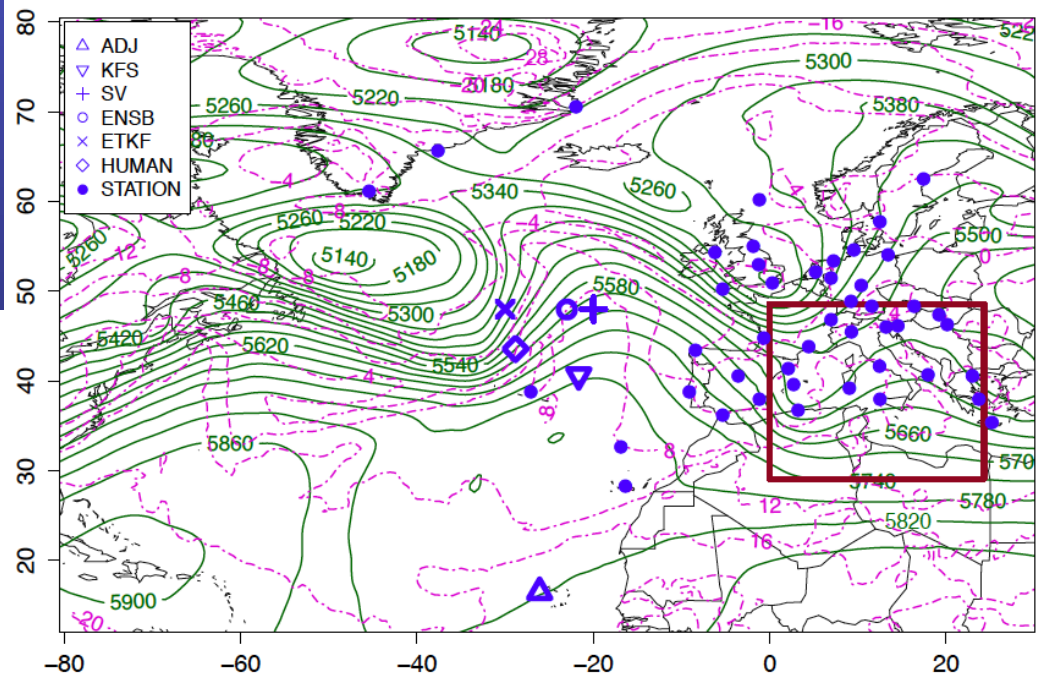
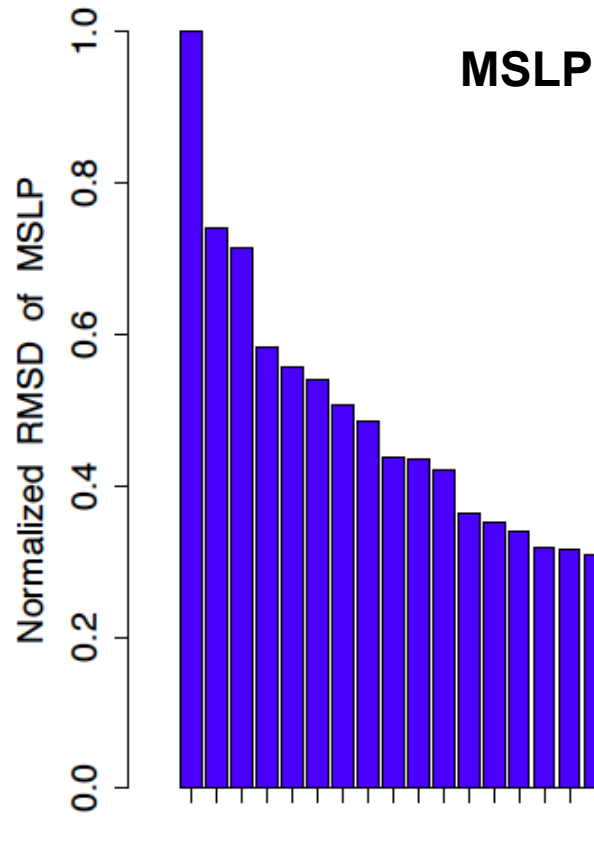
$r = 0.5, \theta = \sqrt{3}$ → Random evolution

$r = -0.25, \theta = \sqrt{3}/2$ → Breakdown of linear regime

$r = -1, \theta = 0$ → Perfect linear evolution

The DTS GAME (Dec 2 2009)



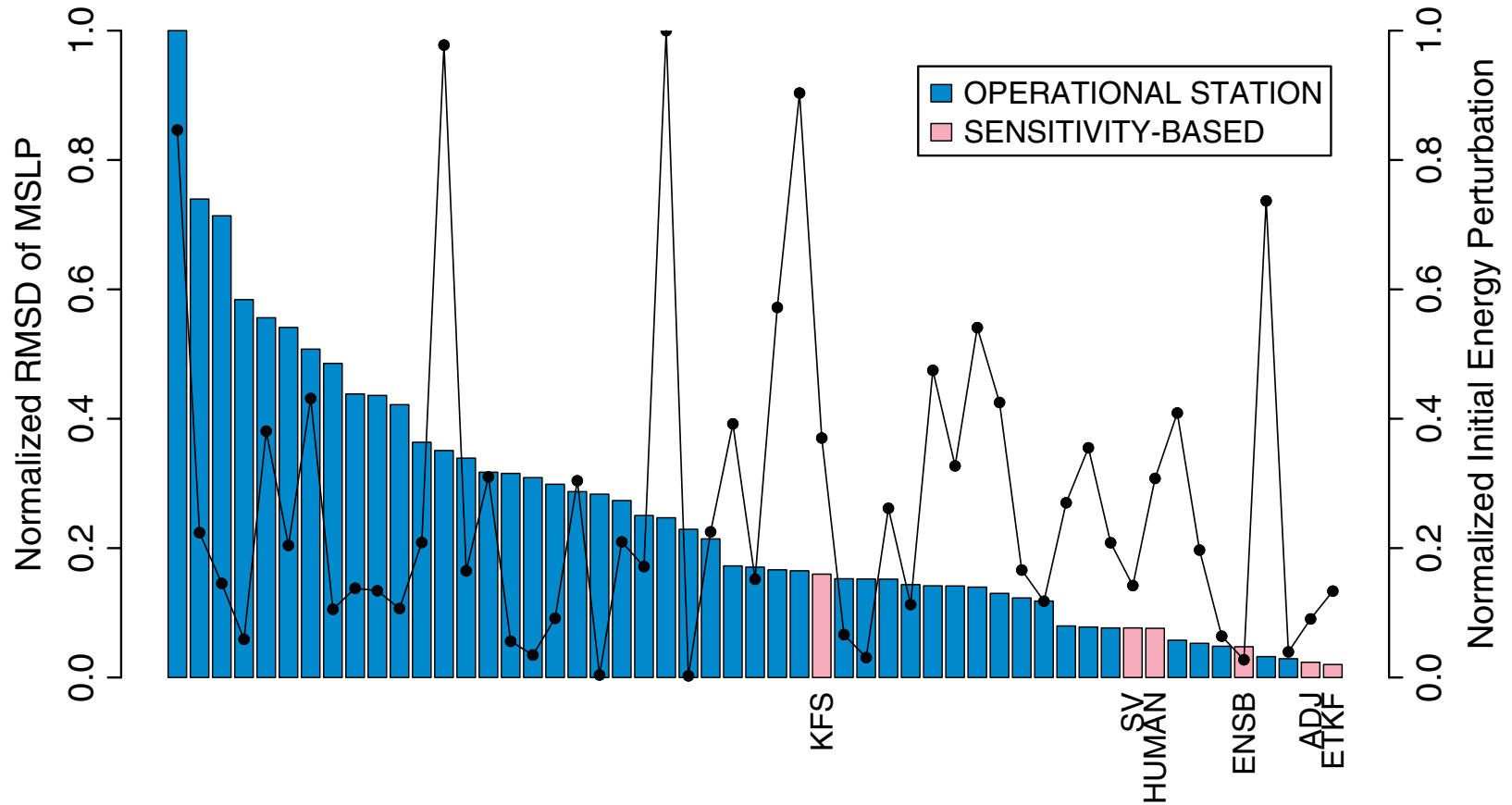


Are current sensitivity products sufficiently informative in targeting campaigns? A DTS-MEDEX-2009 case study.

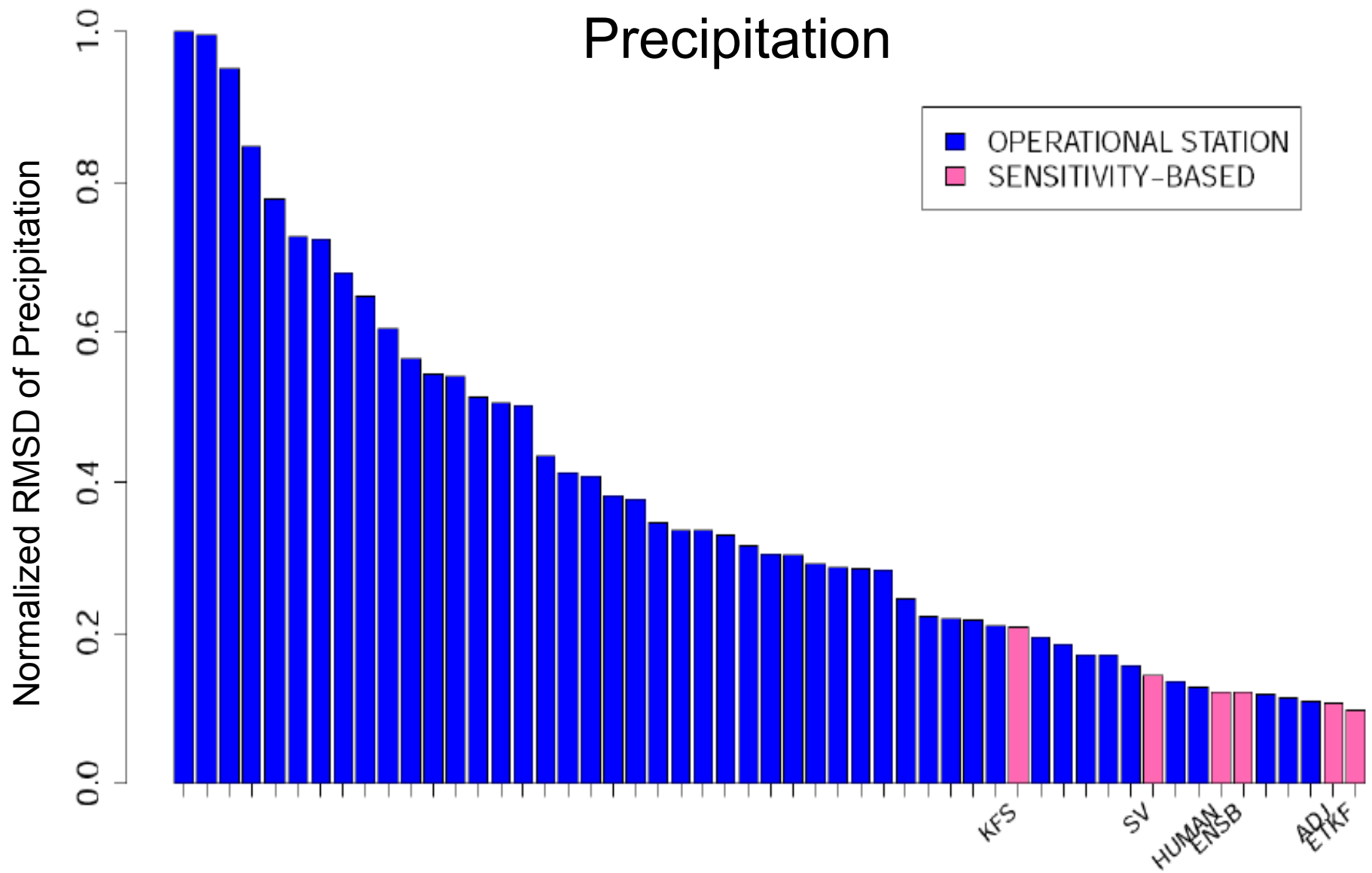
QJRMS (2013)

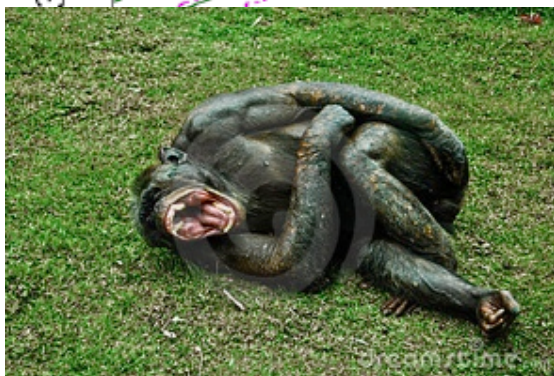
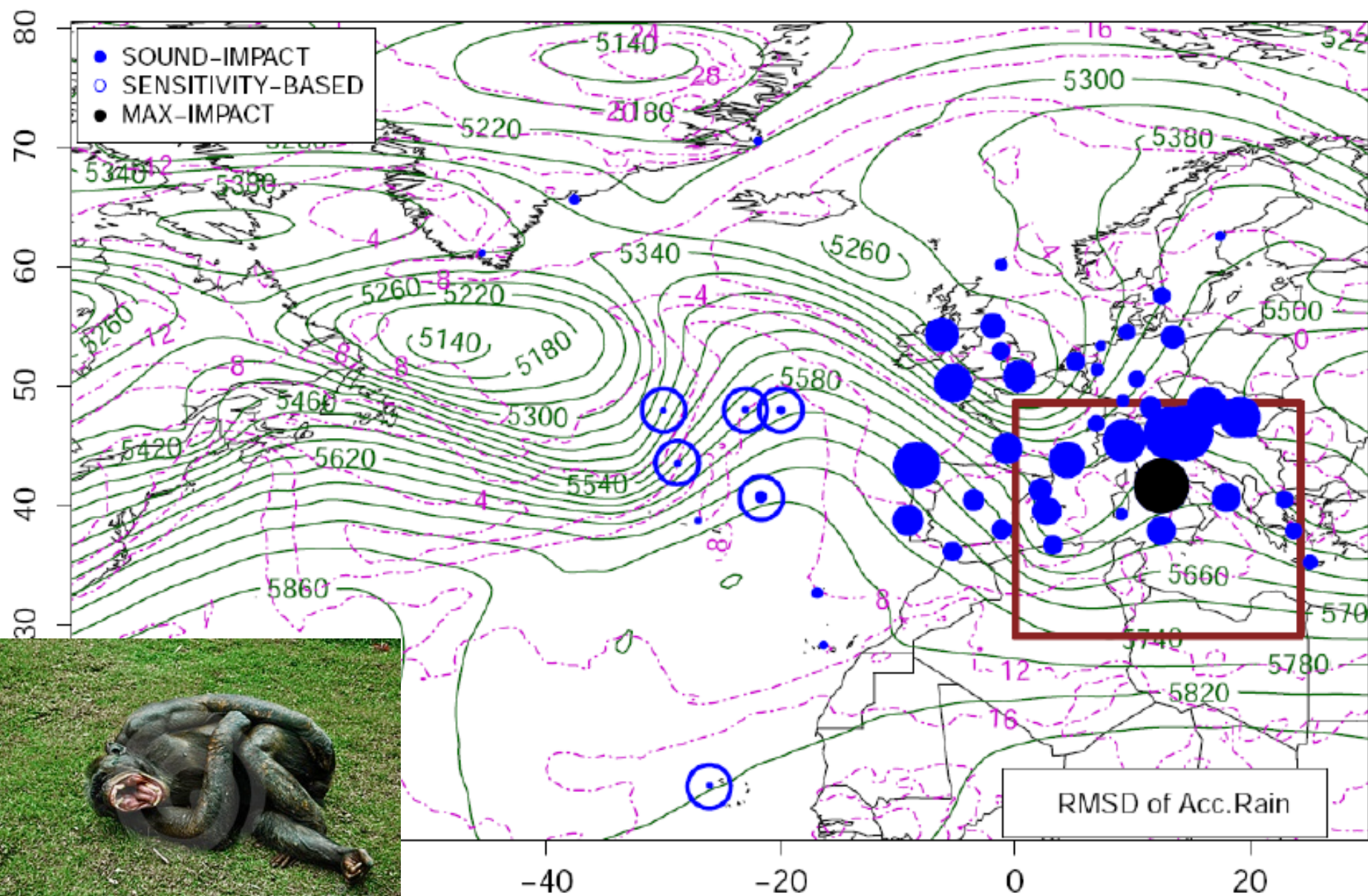
L. Garcies* and V. Homar
 Universitat de les Illes Balears, Dept. Física, Ctra. Valldemossa, km. 7.5, 07122, Palma de Mallorca, Spain.
 *Correspondence to: lorena.garcies@uib.es

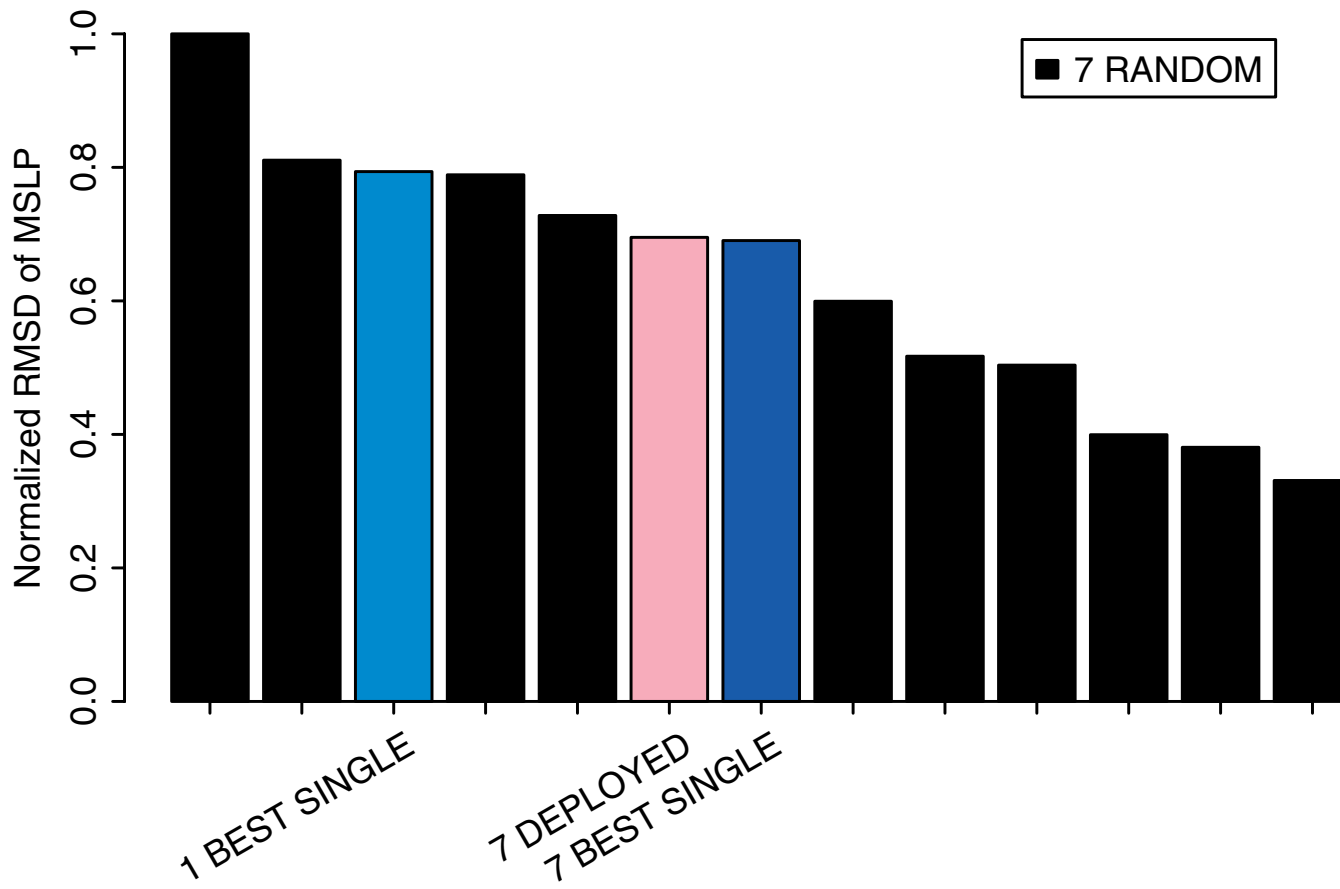
Perturbation response



Precipitation







Thoughts for open discussion

- Do sensitivities even exist?
 - Linear proxies, useful?
 - Not even hammer-like approaches...
 - How do you envision non-linear sensitivity information? Field? Modes?
 - Moving target problem
- How do we support observation policy makers and SOP lead users unequivocally?

