INM/AEMET Short Range Ensemble Prediction System: Tropical Storm Delta

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Predictability Group

Workshop on subtropical cyclones and extratropical transitions.
Madrid,8-9 May 2008

INTRODUCTION

- The theoretical and numerical formulations of a probabilistic approach to weather forecasting have been developed by Epstein (1969), Gleeson (1970), Fleming (1971a,b) and Leith (1974).
- Probabilistic weather predictions by means EPS have been produced on the global scale at NCEP(Toth and Kalnay,1993), at the ECMWF (Molteni et al., 1996) and at the RPN (Houtekamer et al., 1996).
- The successful application of the EPS technique to estimate the time evolution of the PDFs of plausible individual atmospheric states on the global and medium-range scales, has motivated exploration of ensemble forecasting for shorter lead times on the mesoscale.

INTRODUCTION

- Multimodel short-range ensemble prediction systems have been tested at NCEP (Hamill and Colucci, 1997, 1998; Stensrud et al., 1999; Du and Tracton, 2001, Wandishin et al., 2001) also by a research community during Storm and Mesoscale Ensemble Experiment (SAMEX, Hou et al., 2001) over United States. Also, over the Pacific North West (Grimit and Mass, 2002) and over the Northeast (Jones et al., 2007) probabilistic forecasts have been produced.

- A combined multimodel multianalisys technique has been part of the operational NCEP´s production suite (Du and Tracton, 2001) and the main idea of the University of Washington SREPS (Grimit and Mass, 2002).

- AEMET is producing probabilistic forecasts by means of a short range multimodel multianalysis ensemble.

INM/AEMET-SREPS

- SREPS is multi-model multi-analysis system
- The system is running twice a day at 00 and 12 UTC with 72-hours forecast lead time

GFS **IFS** **GME** **UM**

HIRLAM

HRM

MM5

UM

COSMO

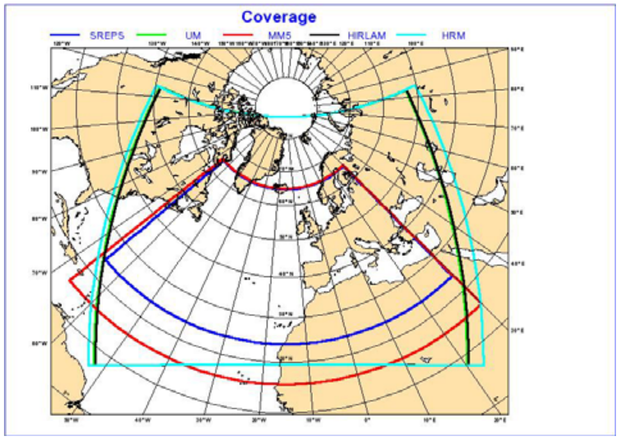
5 LAM

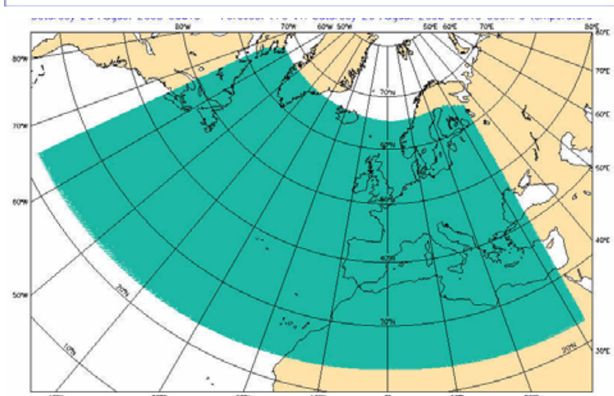
4 IC´s & BC´s from Global models

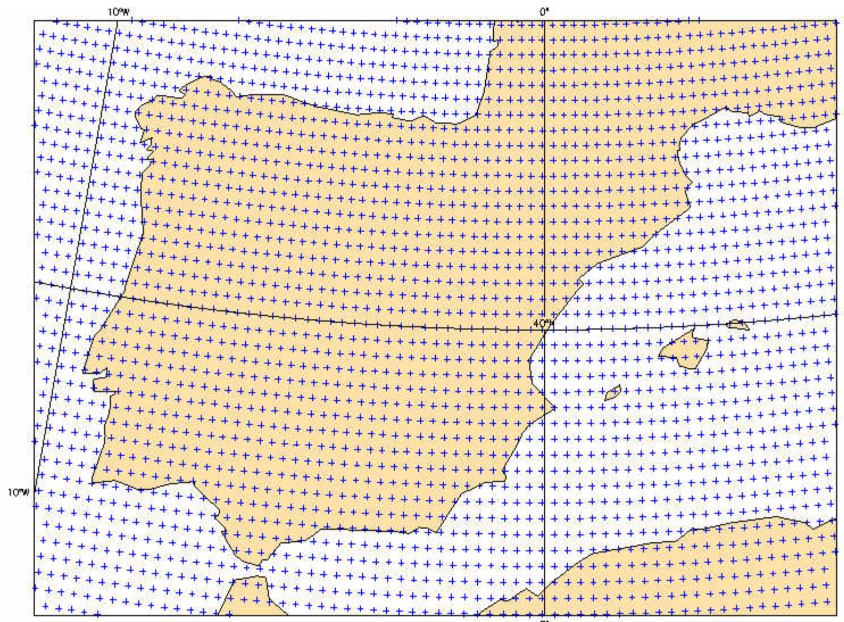
20 ensemble members

INM/AEMET-SREPS

- 0.25 º horizontal resolution and 40 vertical levels
- Model output is codified in GRIB

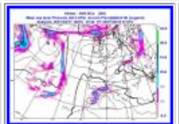
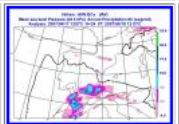
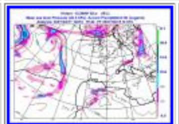
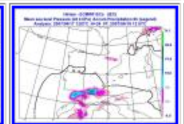
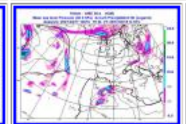
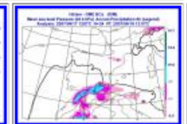
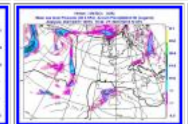
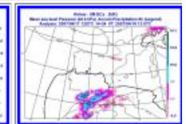
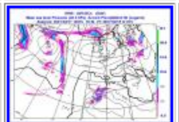
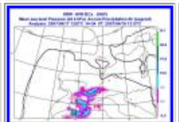
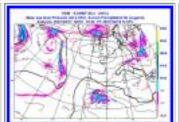
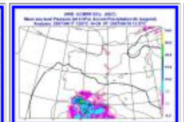
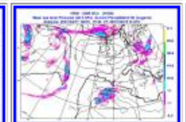
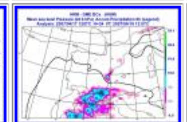
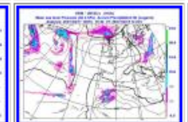
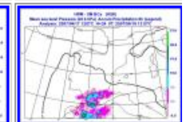
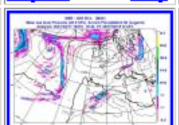
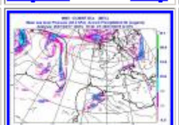
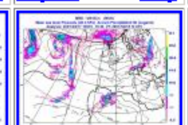
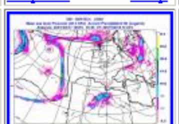
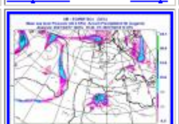
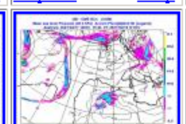
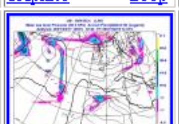
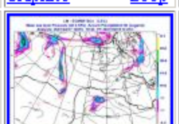






SREPS EXPERIMENTAL PRODUCTS

- Run: D-7, 12UTC , H+00 , H+06 , H+12 , H+18 , **H+24** , H+30 , H+36 , H+42 , H+48 , H+54 , H+60 , H+66 , H+72
  MSL Pressure & 6h Accumulated Precipitation
  Models X Boundaries

Models / Boundaries	GFS-BCs		ECMWF-BCs		GME-BCs		UM-BCs	
Hirlam	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop
HRM	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop
MM5	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop
UM	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop
LM	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop	 HH+24 Graphics Loop

SREPS EXPERIMENTAL PRODUCTS

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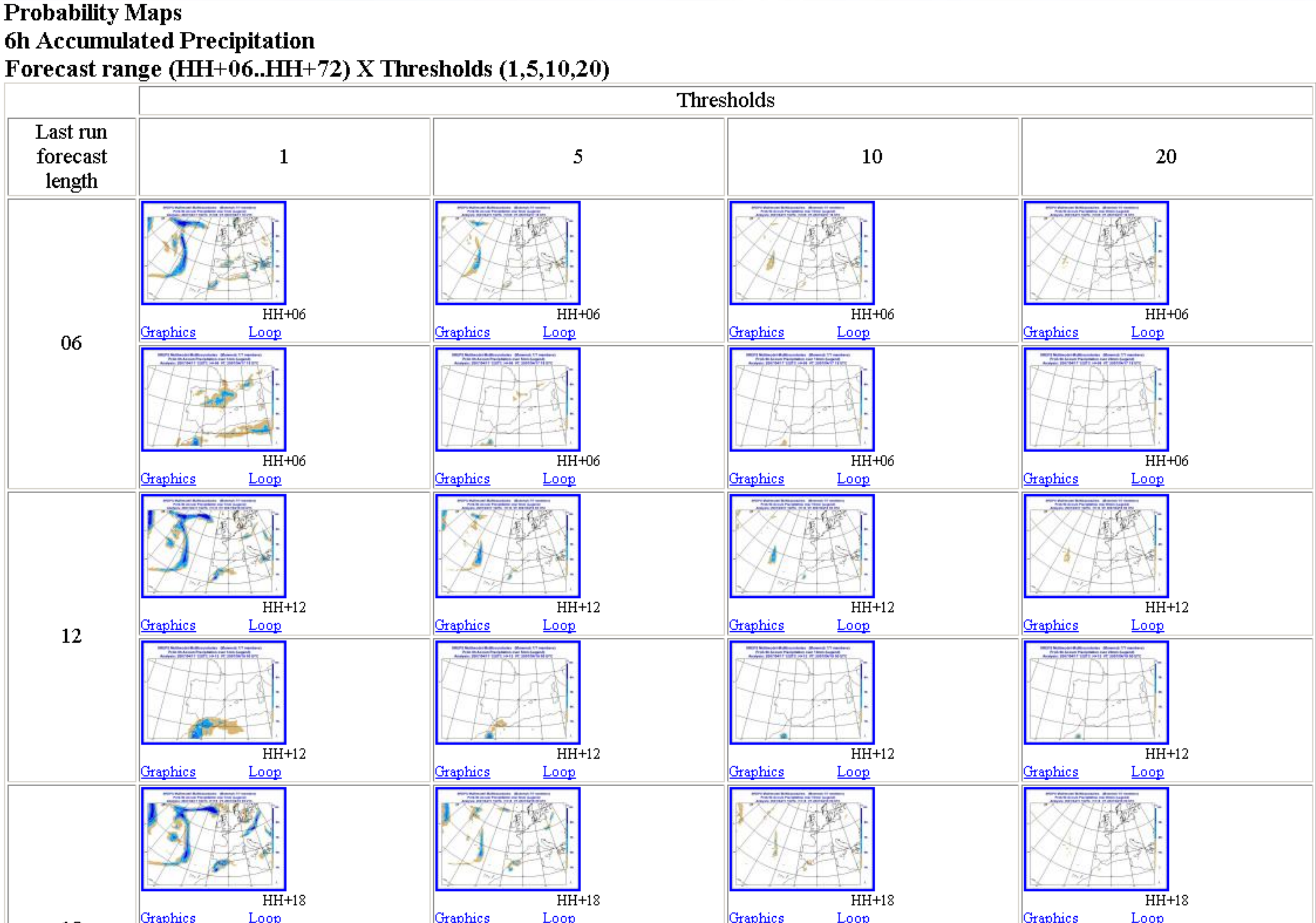
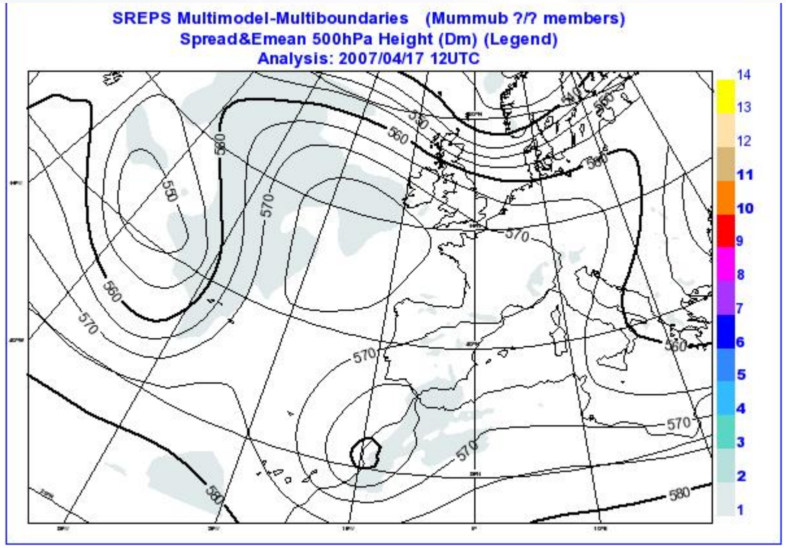


Probability Maps
6h Accumulated Precipitation
Forecast range (HH+06..HH+72) X Thresholds (1,5,10,20)

	Thresholds			
Last run forecast length	1	5	10	20
06	HH+06 Graphics Loop	HH+06 Graphics Loop	HH+06 Graphics Loop	HH+06 Graphics Loop
	HH+06 Graphics Loop	HH+06 Graphics Loop	HH+06 Graphics Loop	HH+06 Graphics Loop
12	HH+12 Graphics Loop	HH+12 Graphics Loop	HH+12 Graphics Loop	HH+12 Graphics Loop
	HH+12 Graphics Loop	HH+12 Graphics Loop	HH+12 Graphics Loop	HH+12 Graphics Loop
18	HH+18 Graphics Loop	HH+18 Graphics Loop	HH+18 Graphics Loop	HH+18 Graphics Loop

SREPS EXPERIMENTAL PRODUCTS

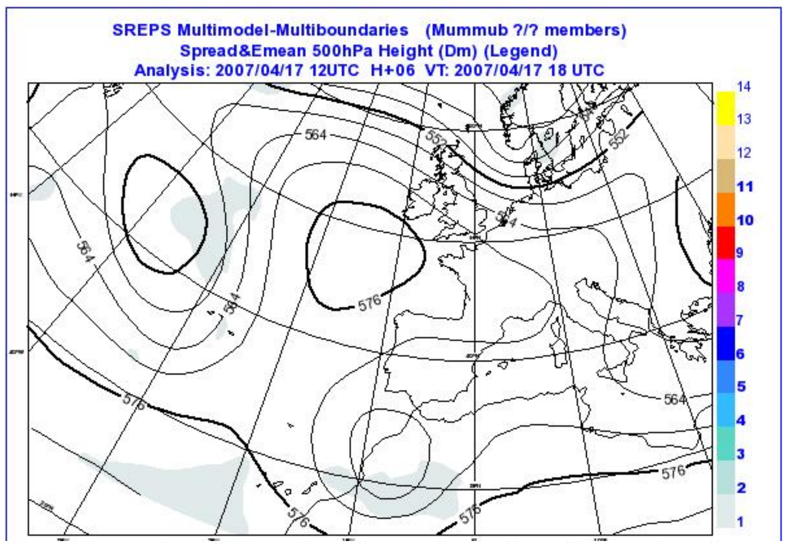
- EXPERIMEN 

ıtranet):

  3. Spread & E

    - 500 hPa

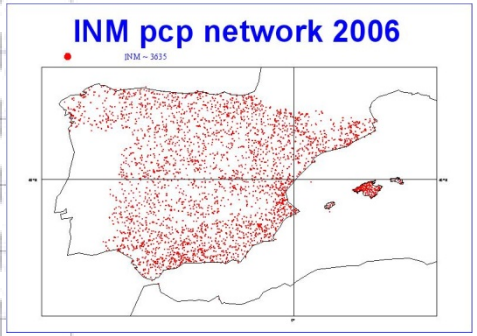
    - MSL Pr



SREPS PERFORMANCE

- 24h accumulated precipitation forecast 06UTC-06UTC against observed 07UTC-07UTC
  - Checked in HH+030 and HH+054
  - 90 days (Apr1 to Jun30 2006)
  - References:
  - INM network
  - European network
- Verification method
  - Interpolation to observation points
- Verification software
  - ~ ECMWF Metview + Local developments
- Performance scores
  - ECMWF recommendations

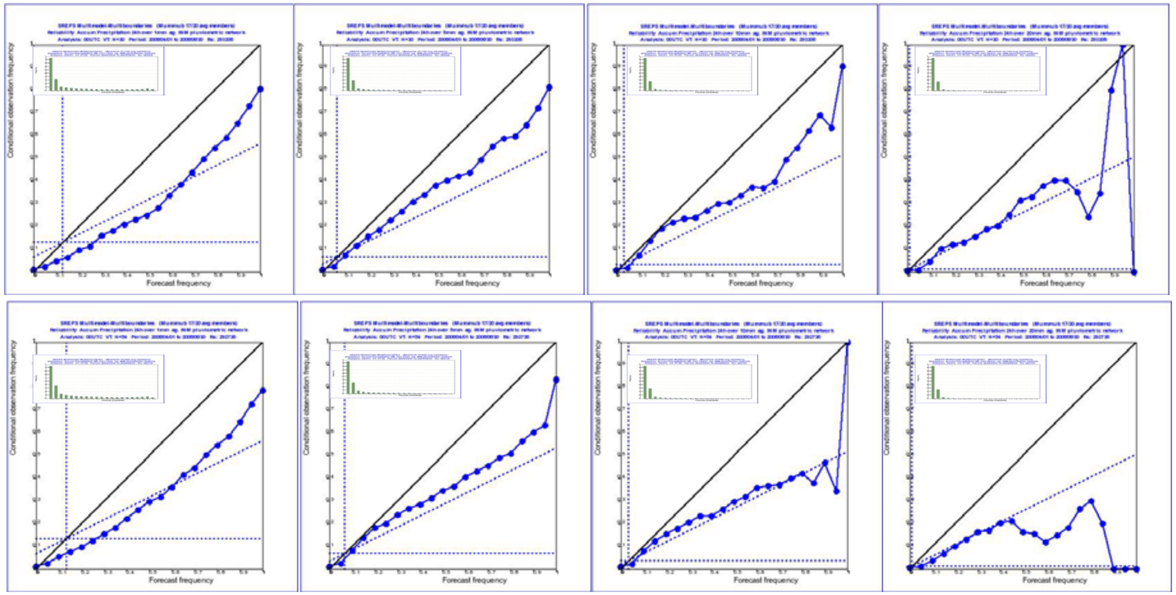
SREPS PERFORMANCE

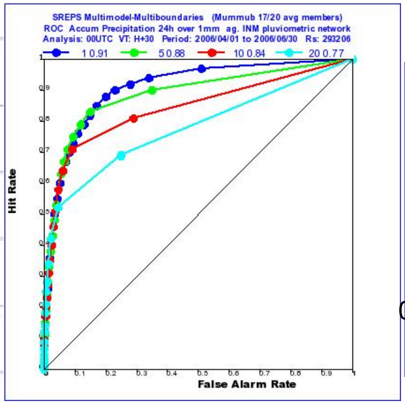


>=1mm >=5mm >=10mm >=20mm

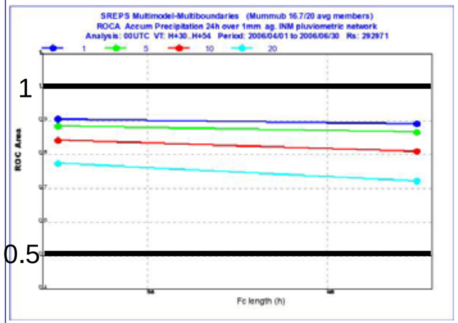
HH+30

HH+54

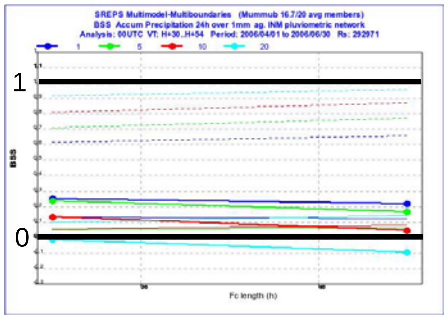




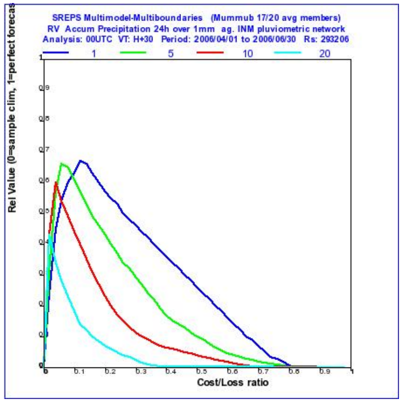
ROC



ROCA

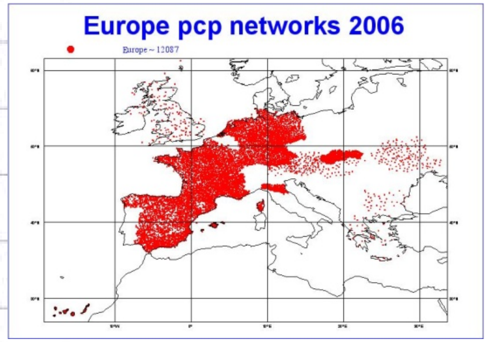


BSS



Relative Value

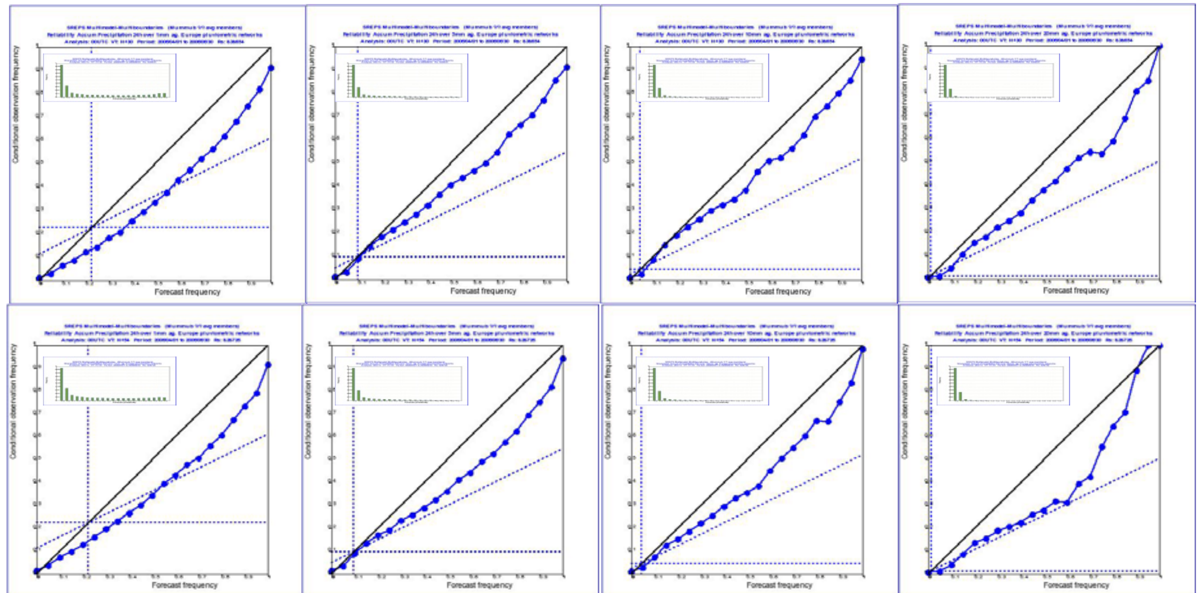
SREPS PERFORMANCE

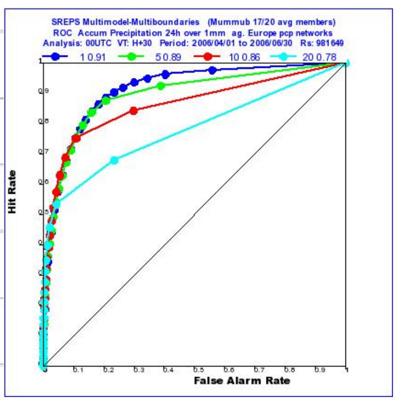


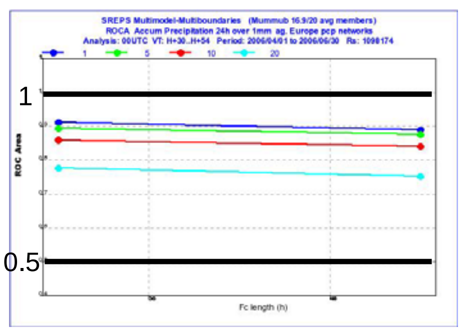
HH+30

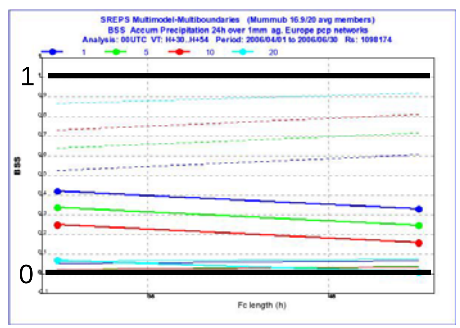
HH+54

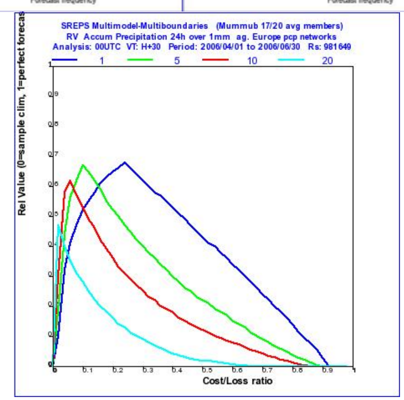
>=1mm >=5mm >=10mm >=20mm











ROC ROCA BSS Relative Value

SREPS CALIBRATION

- Bayesian Model Averaging technique has been tested trying to improve the SREPS performance.
- The BMA predictive PDF of any quantity of interest is a weighted average of PDFs centered on the individual bias-corrected forecasts, where the weights are equal to posterior probabilities of the models generating the forecasts and reflect the models' relative contributions to predictive skill over the training period (Raftery et al, 2005).

SREPS CALIBRATION

- 10m Wind Speed

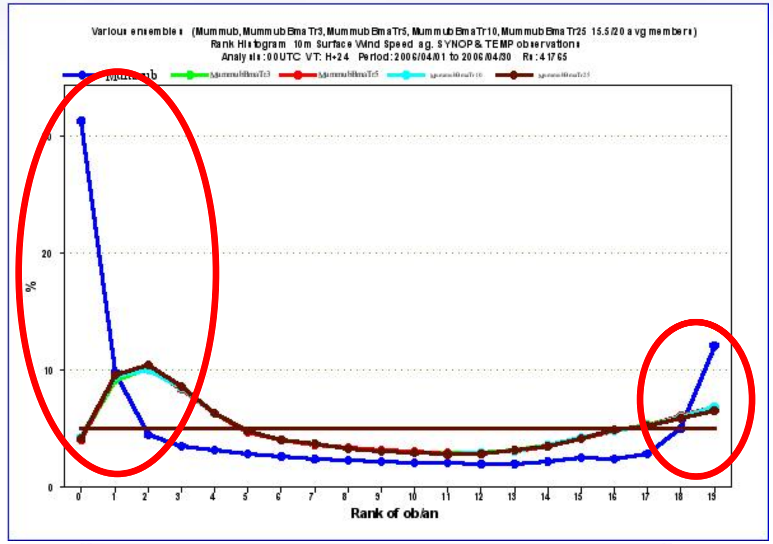
MULTIMODEL

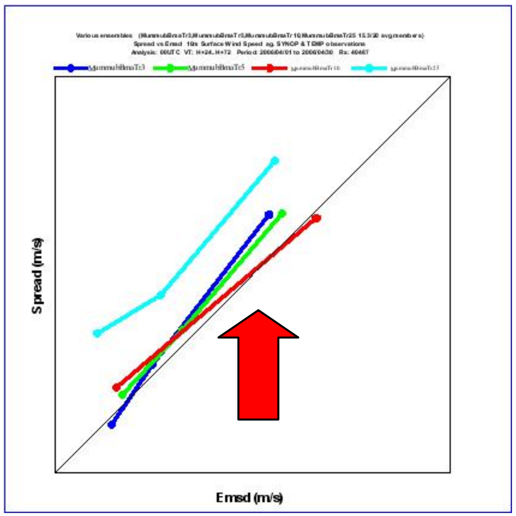
BMA 3 T. DAYS

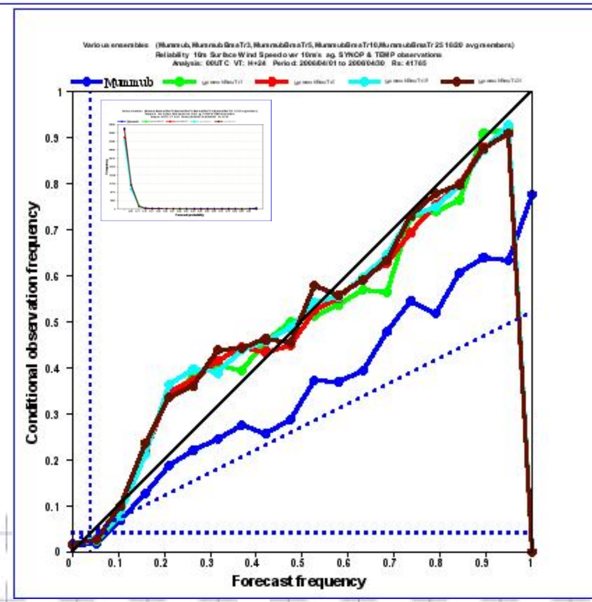
BMA 5 T. DAYS

BMA 10 T. DAYS

BMA 25 T. DAYS







>=10m/s

TROPICAL STORM DELTA

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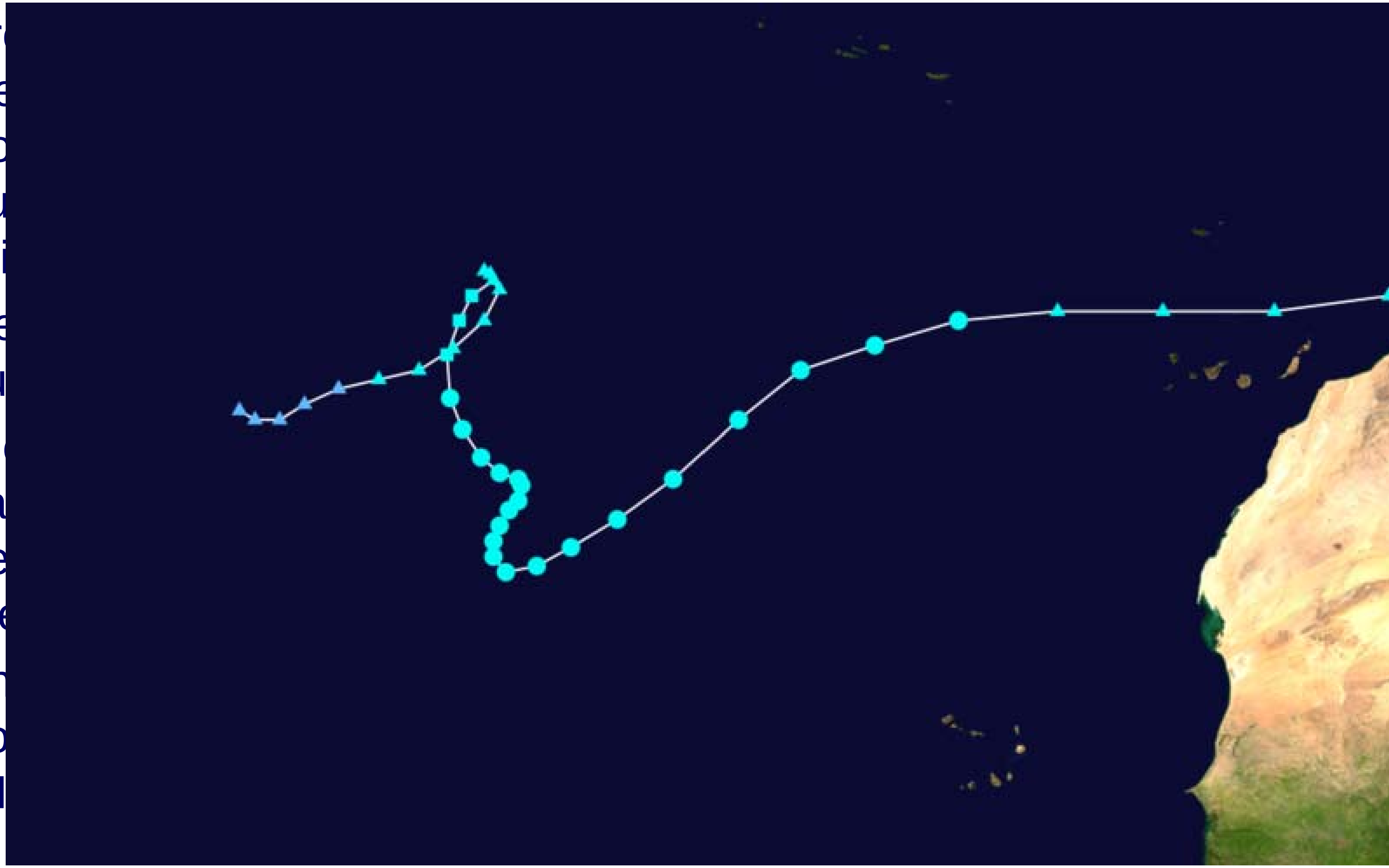
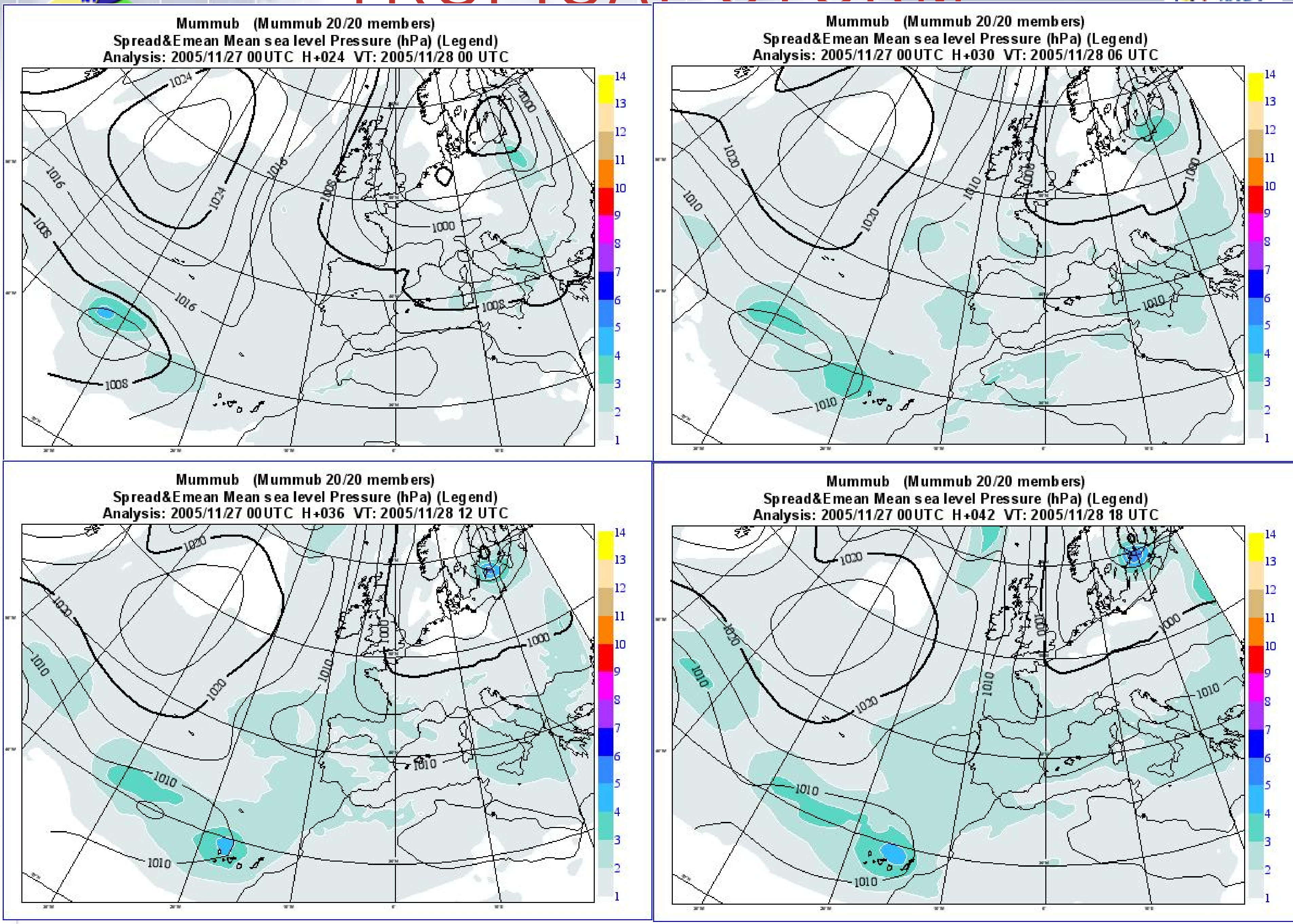


TROPICAL STORM DELTA

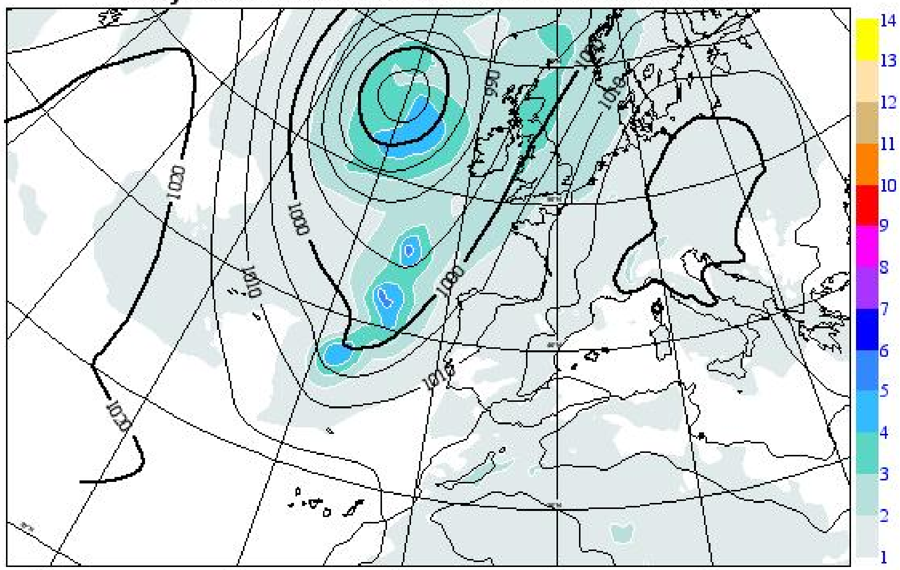
TROPICAL STORM DELTA

- The SREPS has been re-run using the current configuration of the system for 27-29 November 2005 period. (HINDCAST).
- Global models underestimated the central pressure of the cyclone, this led to an insufficient re-intensification of Delta on 27 November.
- Global models quality control refused the observations from the **British Merchant** (call sign VQIB9), which reported 60-kt winds and a pressure of 990.8 mb northwest of the center during the re-intensification of Delta on 27 November.

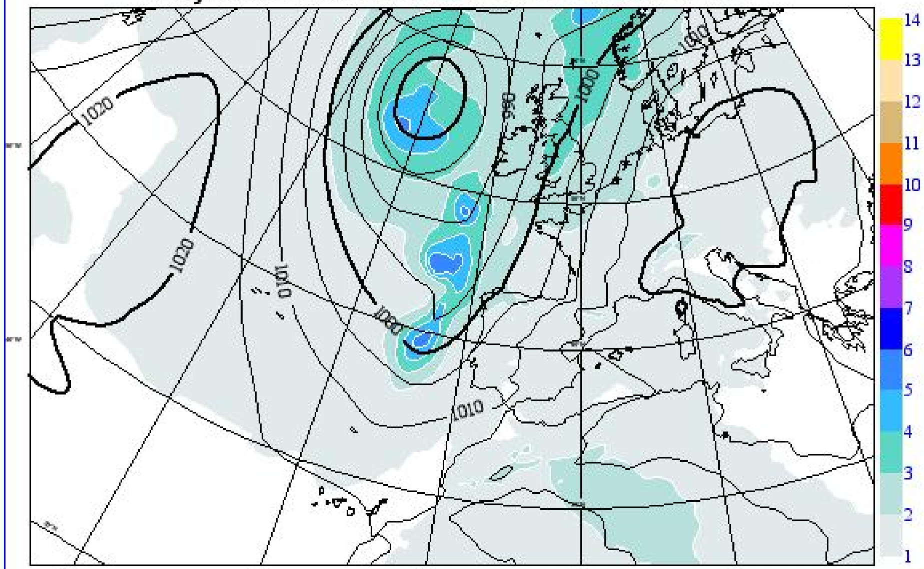
TROPICAL STORM



Mummub (Mummub 19/20 members)
Spread&Emean Mean sea level Pressure (hPa) (Legend)
Analysis: 2006/09/19 00UTC H+048 VT: 2006/09/21 00 UTC



Mummub (Mummub 19/20 members)
Spread&Emean Mean sea level Pressure (hPa) (Legend)
Analysis: 2006/09/19 00UTC H+054 VT: 2006/09/21 06 UTC



Mummub (Mummub 19/20 members)
Spread&Emean Mean sea level Pressure (hPa) (Legend)
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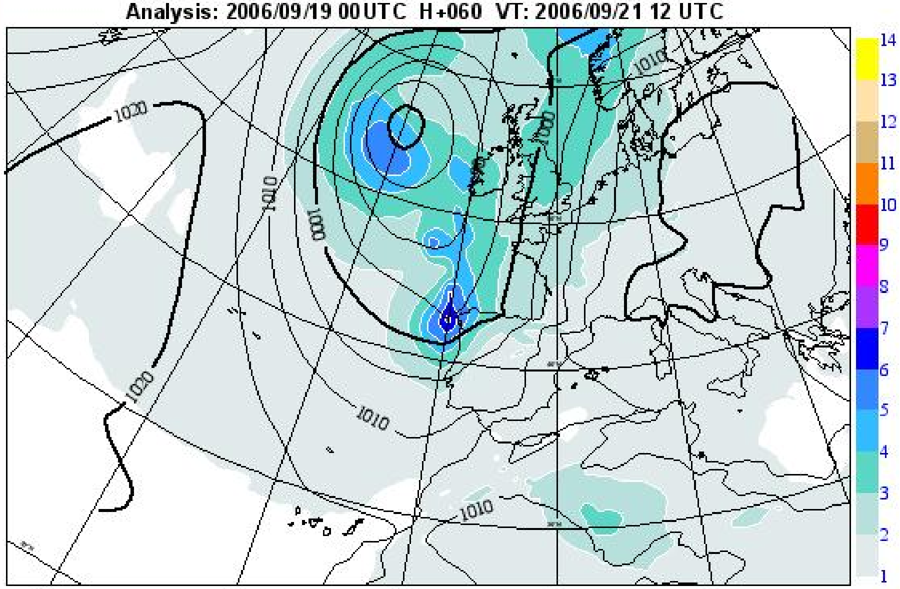
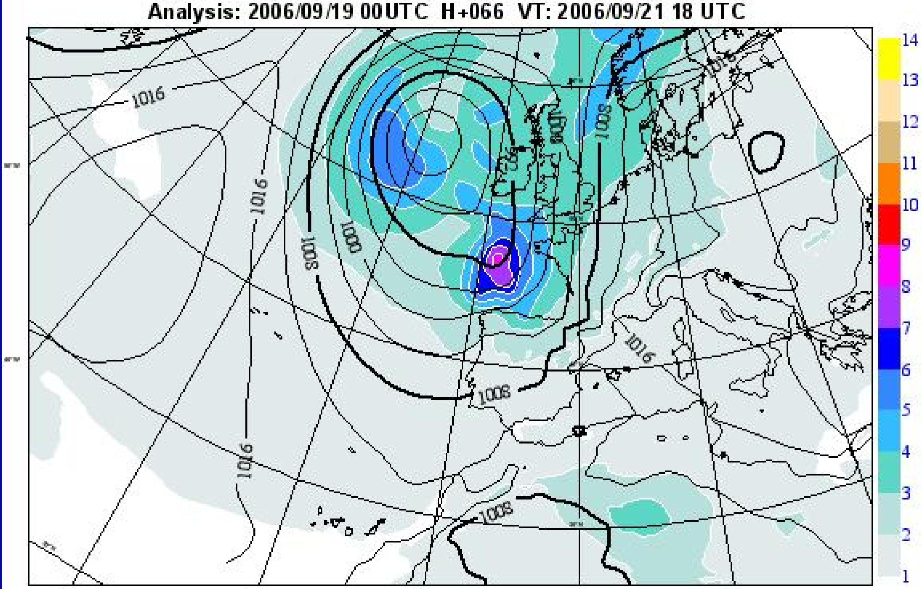
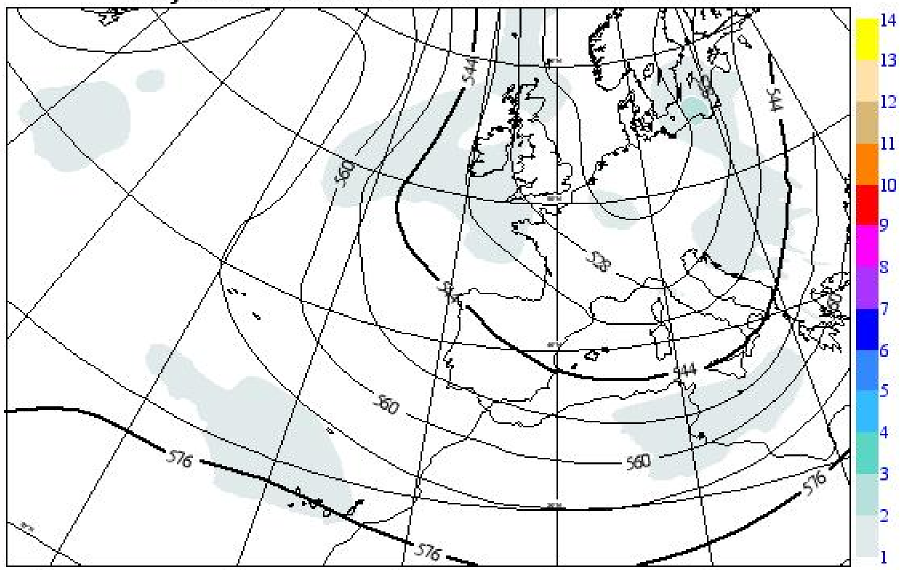


Mummub (Mummub 19/20 members)
Spread&Emean Mean sea level Pressure (hPa) (Legend)
Analysis: 2006/09/19 00UTC H+066 VT: 2006/09/21 18 UTC



TROPICAL STORM

Mummub (Mummub 20/20 members)
Spread&Emean 500hPa Height (Dm) (Legend)
Analysis: 2005/11/27 00UTC H+024 VT: 2005/11/28 00 UTC



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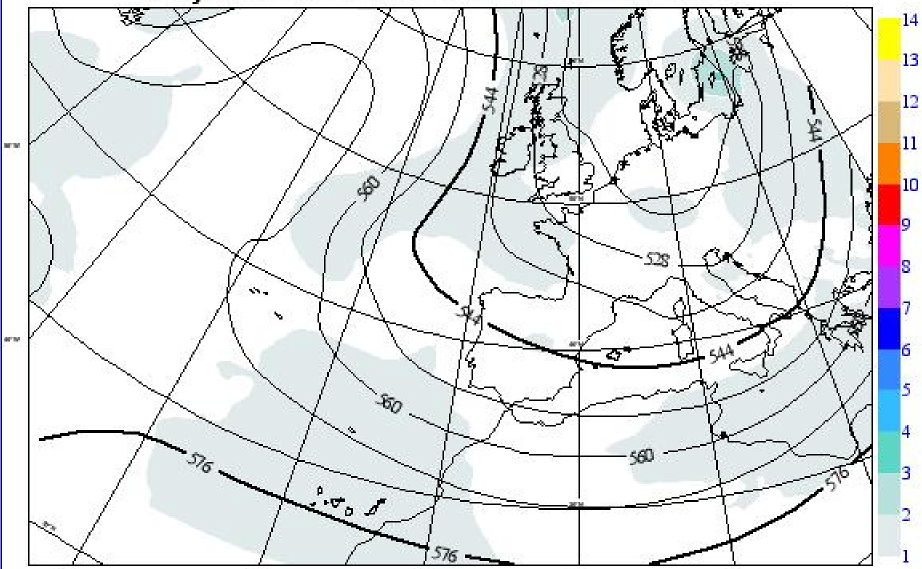

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Spread&Emean 500hPa Height (Dm) (Legend)
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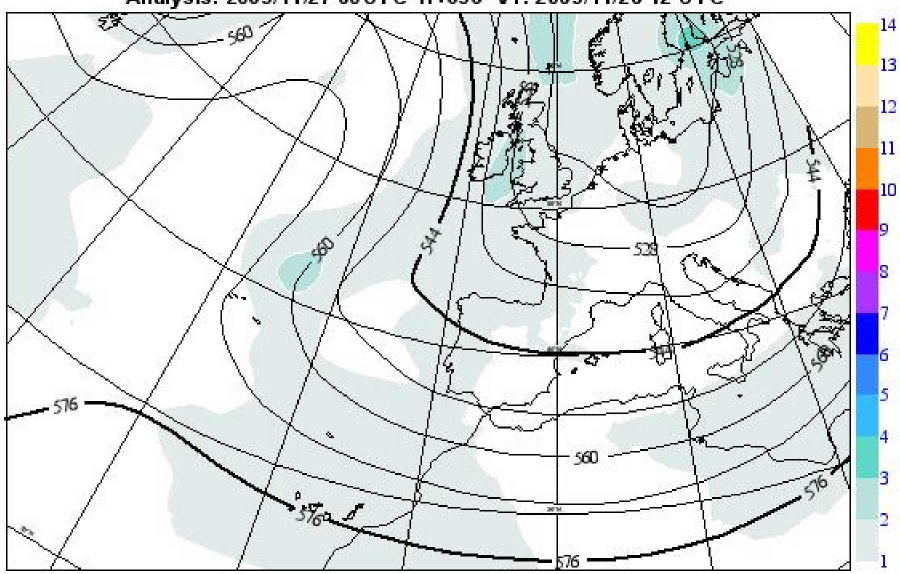
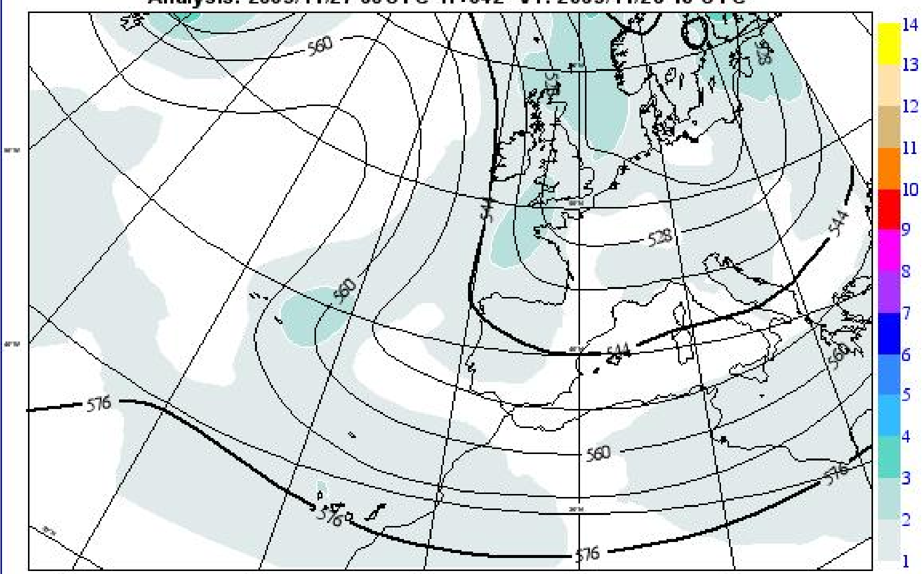


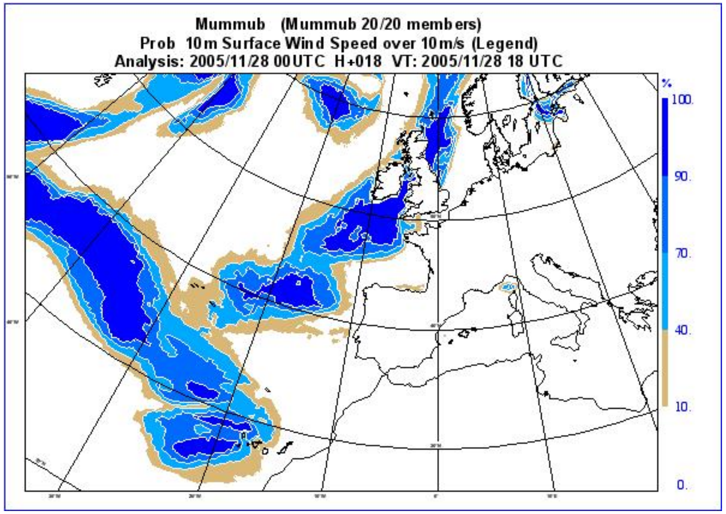
Mummub (Mummub 20/20 members)
Spread&Emean 500hPa Height (Dm) (Legend)
Analysis: 2005/11/27 00UTC H+042 VT: 2005/11/28 18 UTC



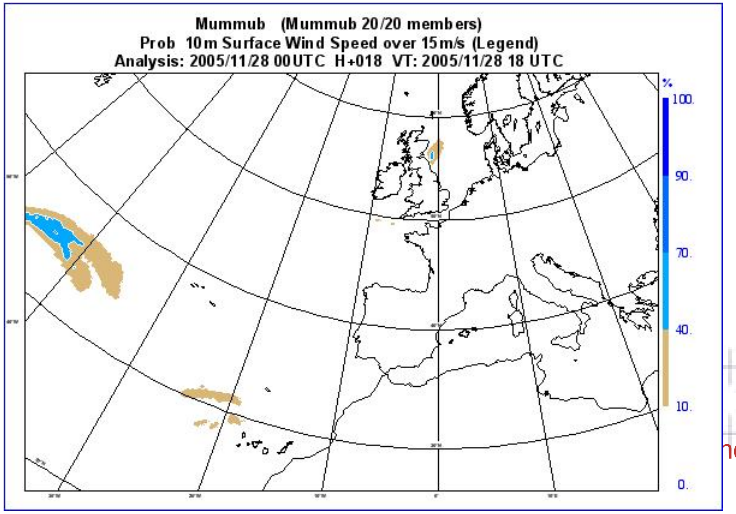
TROPICAL STORM DELTA

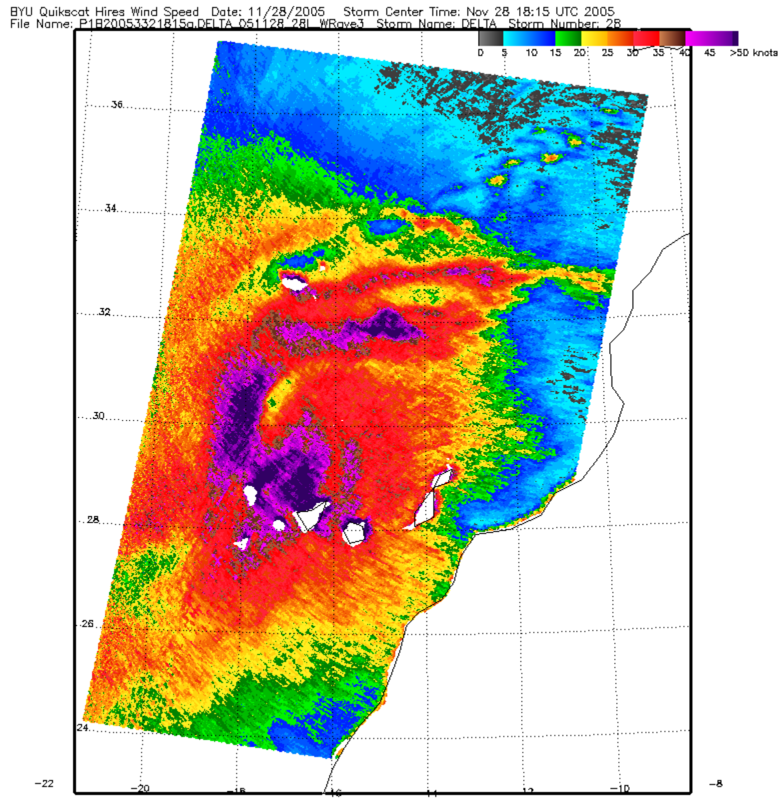
- 10m Wind Speed Probability (2005112800 UTC + 18 H)

Prob S10m > 10m/s



Prob S10m > 15m/s

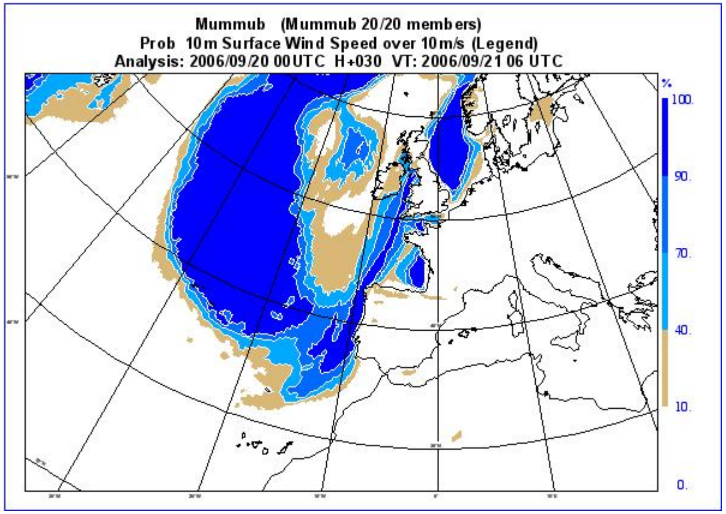




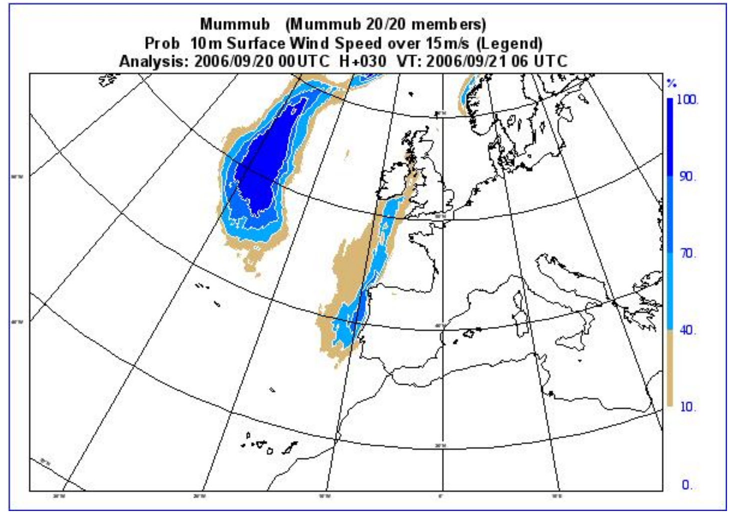
HURRICANE GORDON

- 10m Wind Speed Probability (2005112800 UTC + 18 H)

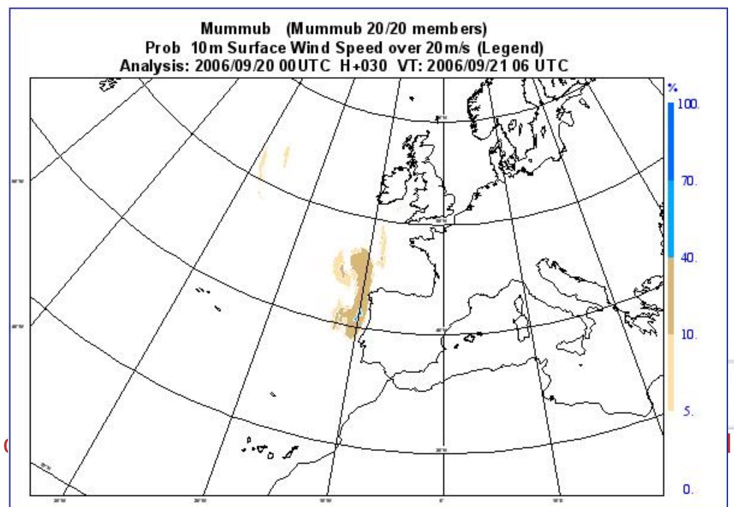
Prob S10m > 10m/s



Prob S10m > 15 m/s

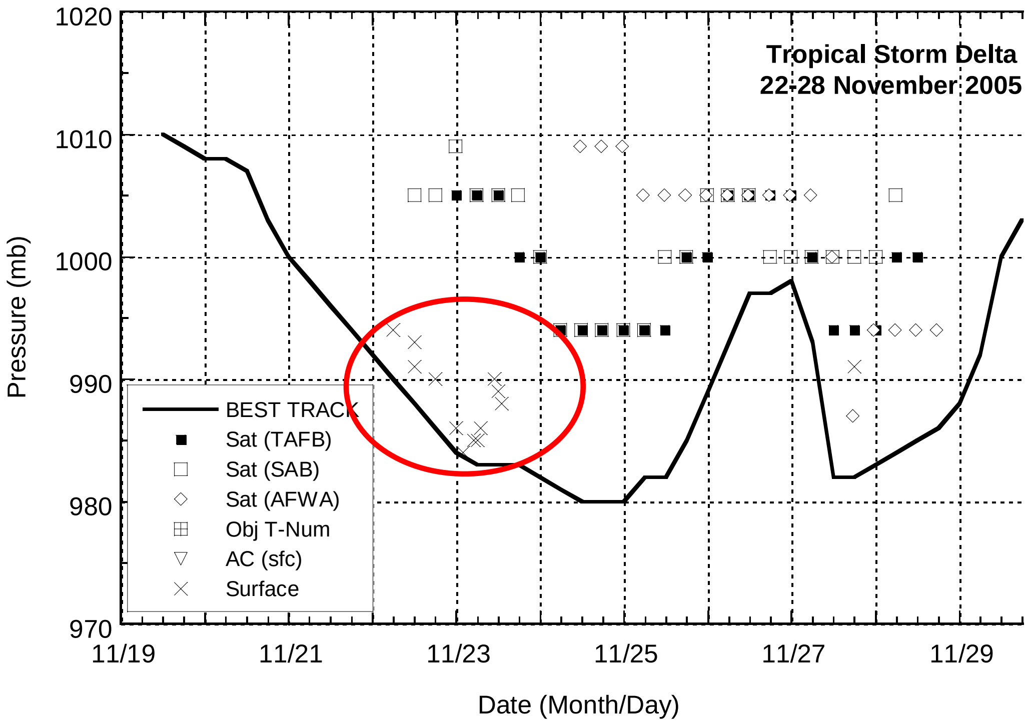


Prob S10m > 20m/s

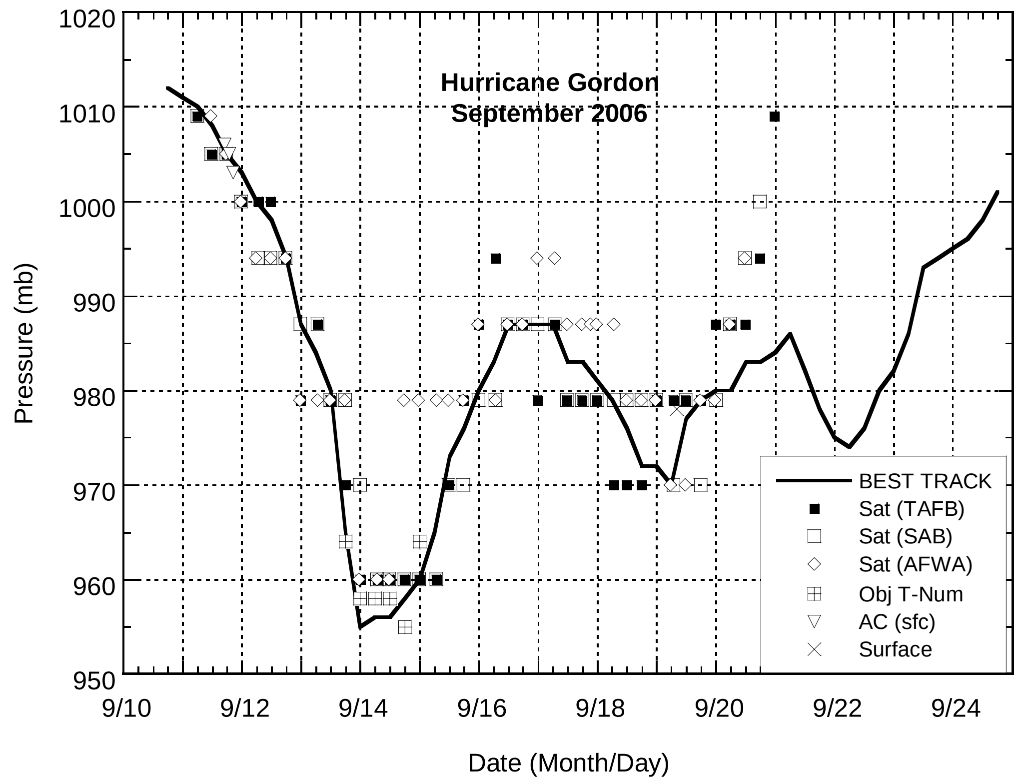


DELTA vs GORDON

- The analysis of global models generated a clear drift of the SREPS due to assimilation of the satellite data and the black listing of surface data.



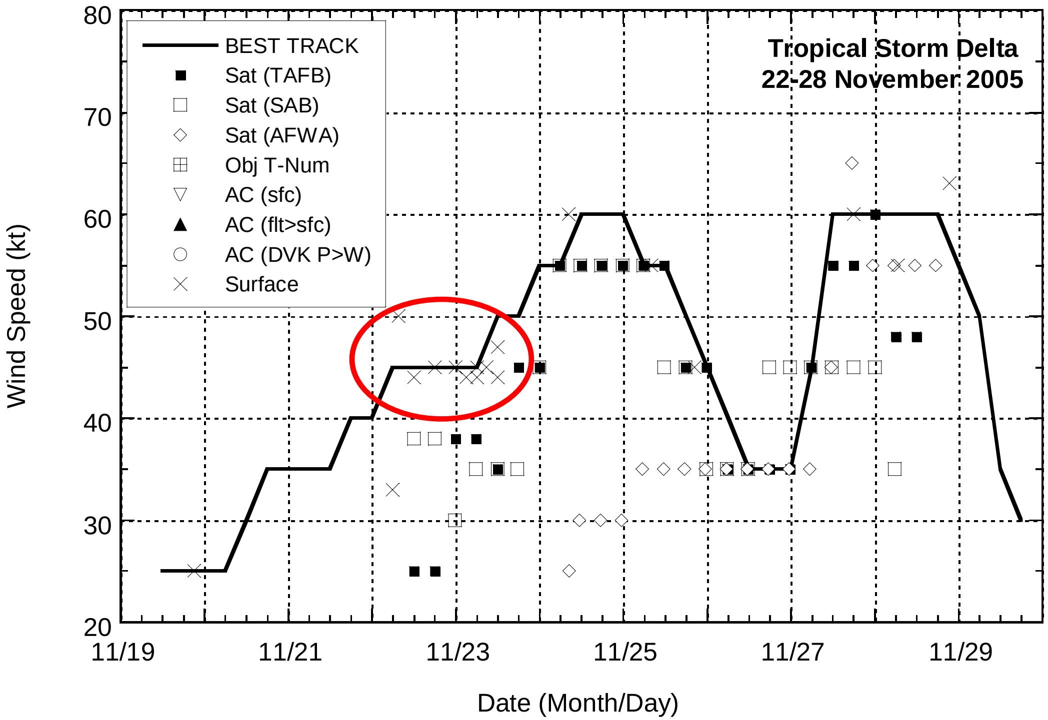
DELTA PMSL from TCR-AL072006

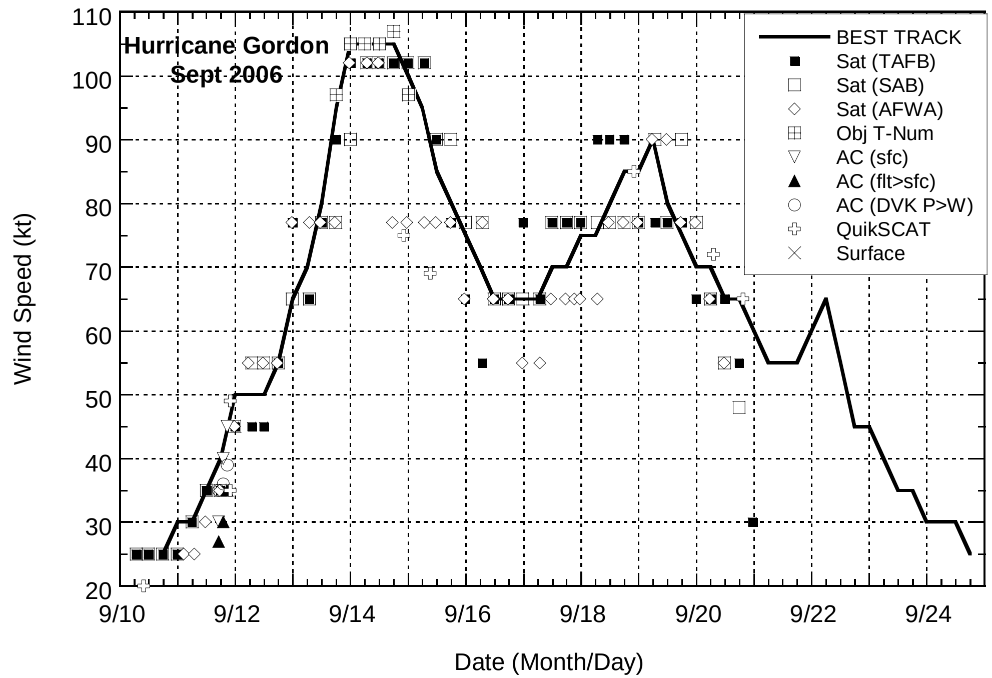


GORDON PMSL from TCR AL292005

DELTA vs GORDON

- The analysis of global models generated a clear drift of the SREPS due to assimilation of the satellite data and the black listing of surface data.





DELTA Wind from TCR-AL072006

GORDON Wind from TCR AL292005

SUMMARY

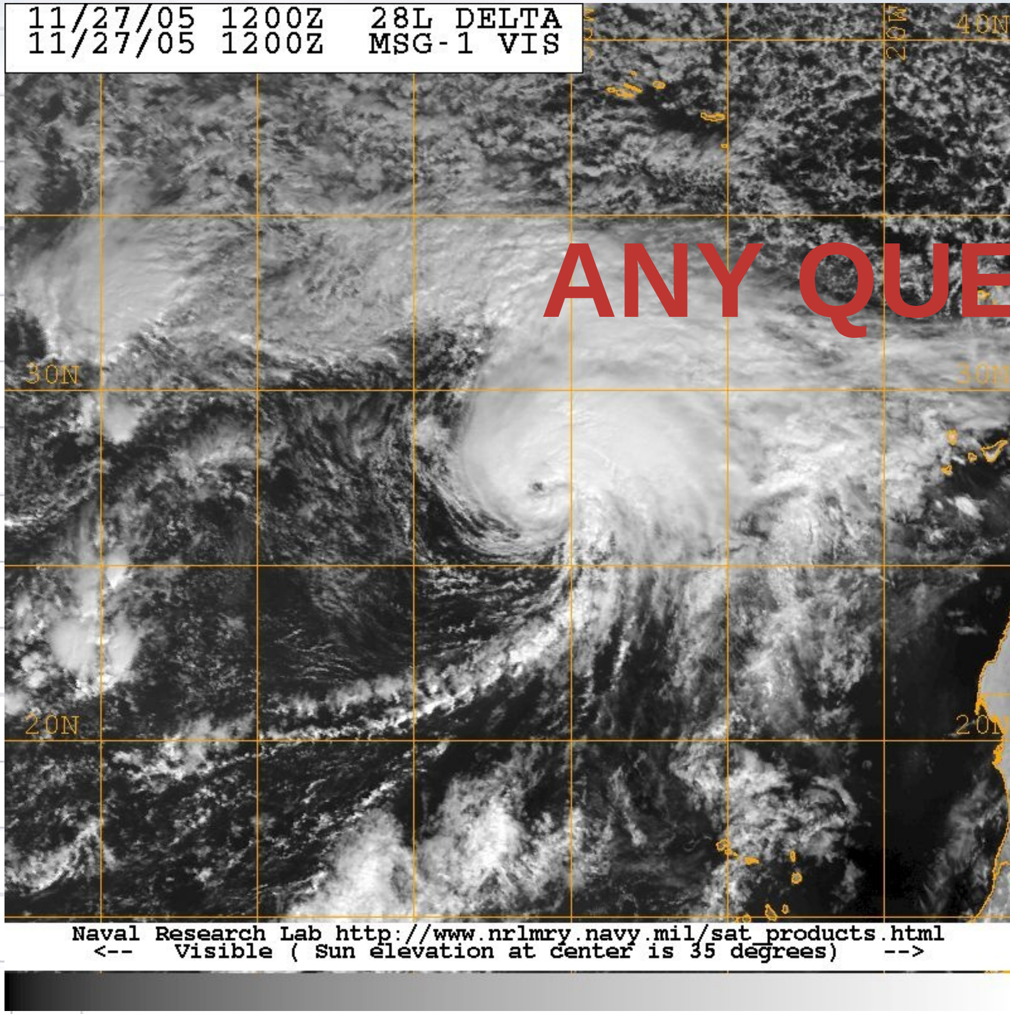
- The AEMET Short-Range EPS is a useful tool to characterize low predictability areas on severe weather events.
- The system exhibit a good performance according to the different probabilistic scores using observations.
- The calibration results exhibit a good spread-skill relationship, reduction of outliers in rank histograms, better reliability diagrams and brier skill scores than multimodel.
- The extratropical transitions of DELTA and GORDON shown a different behaviour of the system.

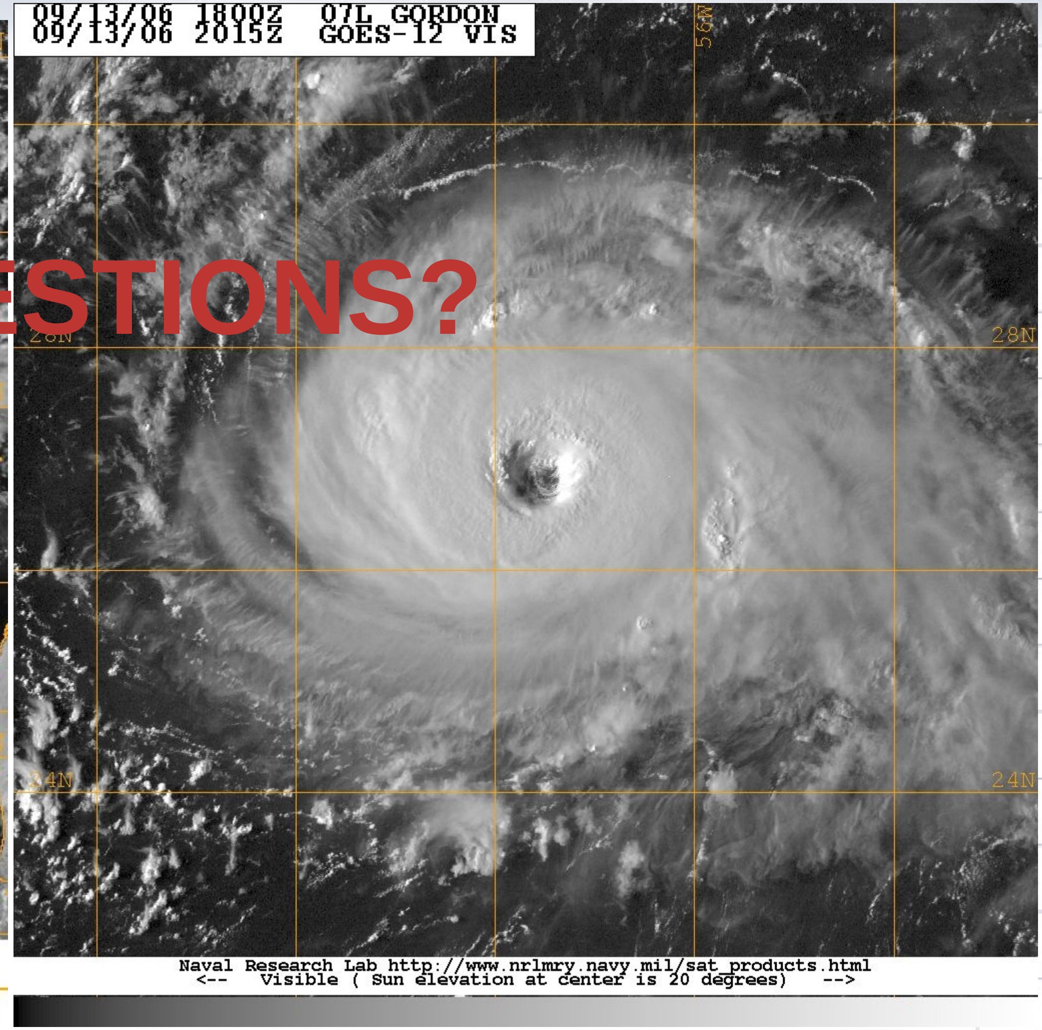
SUMMARY

- Less spread for the PMSL and small values of winds than observed on DELTA transition were found.
- The analysis of global models generated a clear drift of the SREPS due to assimilation of the satellite data and the black listing of surface data.
- Although the initialization of the ensemble members is not optimum, the system has the potential of give information of less predictable areas by means spread patterns.

THANK YOU
MUCHAS GRACIAS

ANY QUESTIONS?





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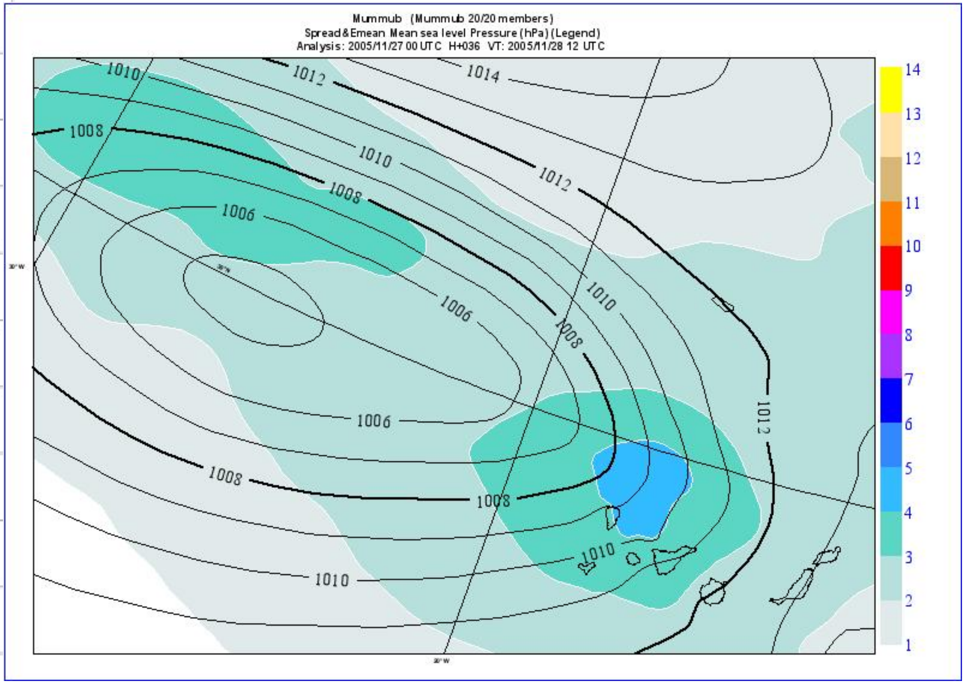
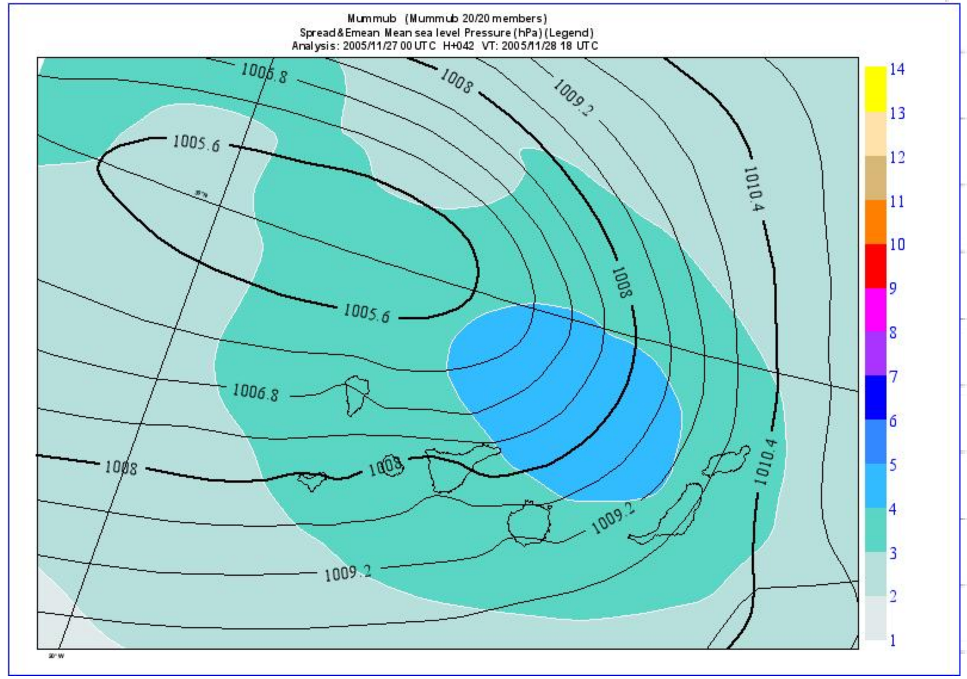
TROPICAL STORM DELTA

- MSLP Spread / Ensemble Mean Maps (20051127 00UTC)

VT:20051128 12UTC



VT:20051128 18UTC



SREPS CALIBRATION