

## Summary

Several studies are made at IPMA to assess how the numerical weather models perform and to identify numerical parameters that can be used as predictors of severe weather. In this poster two studies are shown: the first tries to identify useful predictors in heavy precipitation events in Madeira. The second study assess how ECMWF and AROME models simulated an hybrid system that affected the west coast of Mainland Portugal.

## Heavy precipitation in Madeira island during 2010, january-2011 and autumn-2012

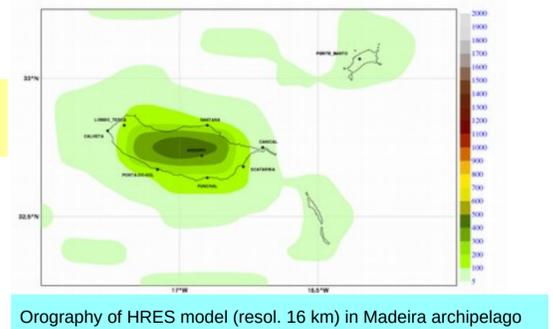
### Objectives:

(1) To identify meteorological parameters that can be used as tools on the forecasting of heavy precipitation for Madeira island

Parameters considered in the analysis:

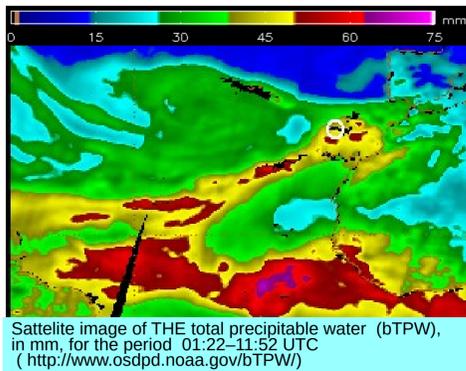
- Total precipitable water
- Atmospheric instability
- Air mass characteristics
- Air flux direction and intensity at low levels (1000, 925, 850 hPa)
- Divergence at low levels (1000, 925, 850 hPa)

Madeira island has high mountains and steep slopes which are not well represented by HRES model - resol. 16 km (Pico do Arieiro: model → 452 m; real → 1818 m)

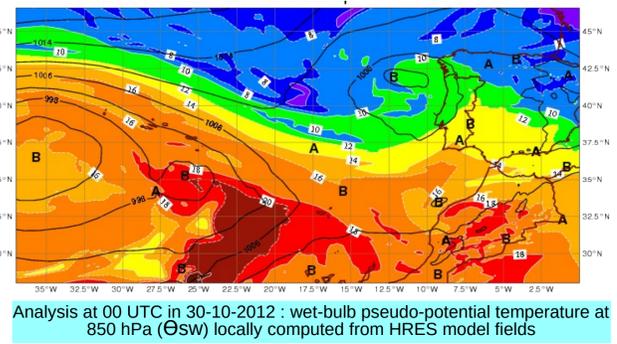
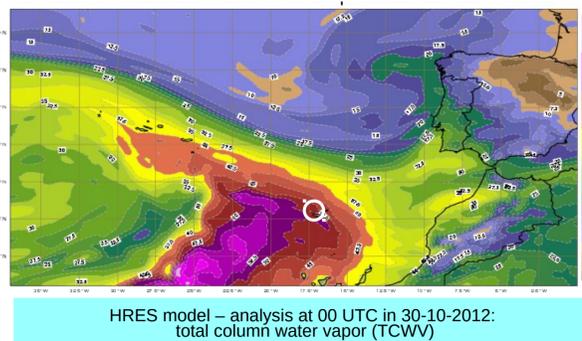


(2) To determine if there is a relationship between the Atmospheric Rivers (AR) in the NE Atlantic and the events of heavy precipitation in Madeira

Example of an event of AR: 29-30 october 2012



Maximum values of TCWV (47.5-50 mm) in Madeira region consistent with the values of bTPW



Tropical Maritime Air Mass ( $18^{\circ}\text{C} < \Theta_{sw} < 20^{\circ}\text{C}$ )

### Conclusions:

- The satellite product Blended TPW is useful to follow the developing of the AR, for a period of several days, which were related with some events of heavy precipitation in Madeira
- Parameters with predictive potential: TCWV,  $\Theta_{sw}$  at 850hPa, wind and divergence at 1000 hPa

- At sea level stations local factors such as strong convergence and air flux direction seems to enhance total precipitation

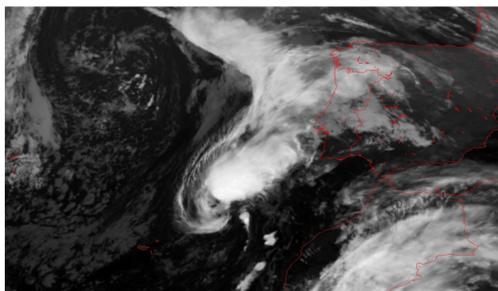
- In the mountains, orographic effects and air mass characteristics seems to play a major role in total precipitation

With the collaboration of João Rio, Sandra Coelho, Denise Diogo and Nuno Moreira.

## Windstorm in mainland Portugal on 17-october-2015

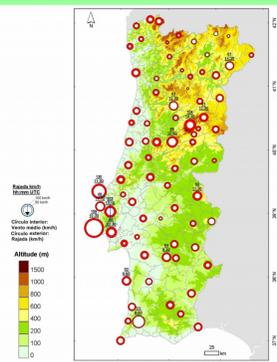
### Objectives:

(1) To characterize the low system

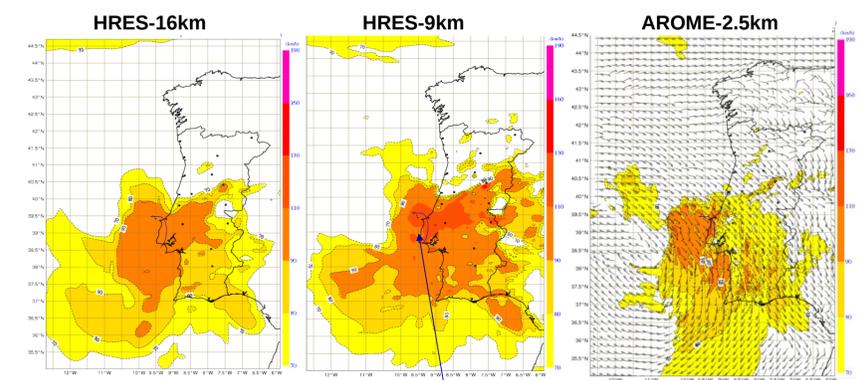


Observations of maximum winds speed/gusts at 10 m (km/h)

C. Roca	(142 m) - 128 / 169
C. Carvoeiro	(32 m) - 90 / 130
Fóia	(902 m) - 93 / 111
P. Douradas	(1380 m) - 48 / 104
Dois Portos	(110 m) - 47 / 102



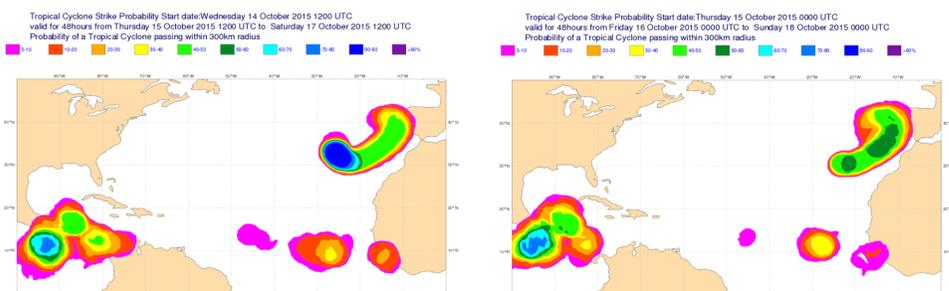
(2) To assess the differences in the wind forecasts



HRES-9km gives a better guidance than HRES-16km with an increase to 100-120 km/h in the most affected areas (delimited by the blue line)

- Tropical cyclone (TC) or a subtropical cyclone (STC)?

### Tropical Cyclone Strike Probability



Maximum probability: 80-90% western of Madeira Island and 50-60% to mainland Portugal

National Hurricane Centre analysis (given by J. Franklin):

The system was considered "hybrid", i.e., although it presented some TC characteristics remained "too" frontal to be considered a TC or a STC

### Conclusions:

- The hybrid system that affected the most western region of mainland Portugal on 17-october-2015 caused very strong and persistent winds giving extensive damages.

- HRES-9 km and AROME-2.5 km have similar values of wind gusts as are in better agreement with the observations than HRES-16 km.

- HRES from the 3 days before the event showed a large dispersion in the MSLP and wind field forecasts which is typical of this kind of systems.

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