QENDRESA MEDICANE FORECAST FROM ECEPS

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Tropical-like cyclones rarely affect the Mediterranean region but they can produce **strong winds** and **heavy precipitations**. These **warm-core cyclones**, called **MEDICANES**, develop over the sea and are small and infrequent. For these reasons, the detection and forecast of medicanes are difficult tasks.

Ensemble Prediction Systems (EPS) can be extremely useful to predicting medicanes with the necessary accuracy and anticipation, focusing the prediction on a **probabilistic way**. The large amount of information provided by probabilistic models must be presented in a concise and clear way, highlighting the predominant characteristics but still showing possible extreme values although they may have low probability. For this purpose specific tools have been developed in AEMET and are presented in this work for the **Qendresa medicane** (November 2014), forecasted by the **ECMWF EPS (ECENS)**.

QENDRESA MEDICANE November 7th, 2014

Analysed track from ECHRES

Maximum gusts $> 42{,}7 \; m/s$ $\Delta p = 20 hPa/6h$

ECMWF NWP Models

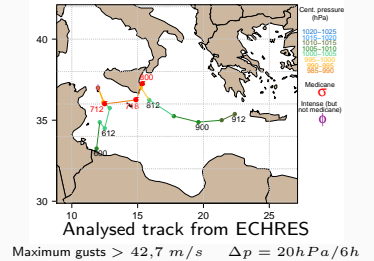IFS → **ECHRES** (18 km)
EPS → **ECENS** (32 km)

Cyclone tracking
+
Cyclone Phase Space
(Hart 2003)

Medicane definition from NWP Models

- **Very intense cyclone**, $\nabla p \geq 3{,}2 \; hPa/100 \; km$ at least in six of the eight principal directions around the minimum
- **Thermally symmetric** cyclone, $B < 10 \; m$.
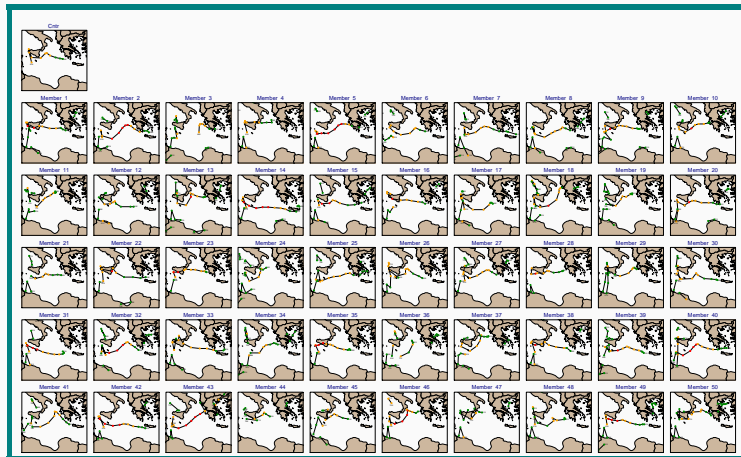- **Deep Warm Core**, $-V_T^L > 0$ y $-V_T^U > 0$.

(Picornell et al. 2014)

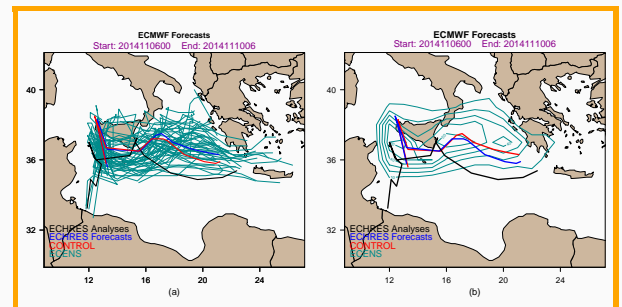# Cyclone Forecast Graphical Products from ECENS

Detailed information

Stamp maps. Each stamp represents one ensemble member forecast of cyclone track. The cercle colour indicates the cyclone intensity (weak ($\nabla p < 1{,}5 \; hPa/100 \; km$), intense ($1{,}5 \leq \nabla p < 3{,}2 \; hPa/100 \; km$) and very intense ($\nabla p \geq 3{,}2 \; hPa/100 \; km$))

a) Probability (%) of cyclone intensity falling in each category, EPS-grams of b) Mean MSLP gradient, d) Mean Geostrophic Circulation, e) MSLP and c) and f) thermal wind at low and hight level, computed from 51 members of the real-time forecasts.
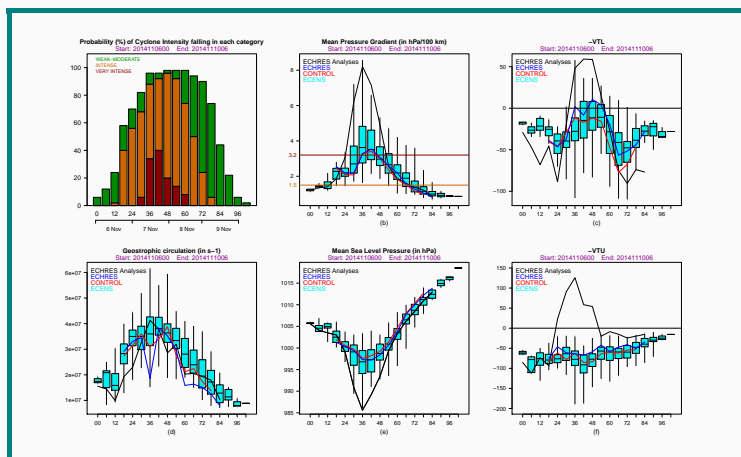
Specific products have been developed to help **medicane forecast** as derived from ECMWF model outputs.
- to summarise predominant characteristics
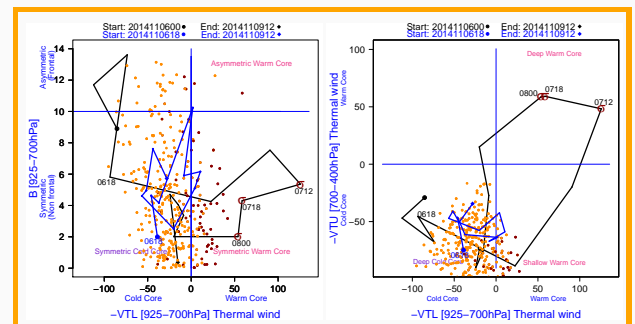- to show extreme values

Summarised information

a) Forecast tracks from ensemble members: This product shows the predicted cyclone tracks from ECEPS members. The forecasts have been calibrated using the analysed and the forecasted tracks from ECHRES model. b) Track probability: This contoured map shows cyclone strike probability (probability of a cyclone passing within 100 km)

Cyclone Phase Diagrams: Analysed (black line) and forecast cyclone evolution by ECHRES. Points: intense and very intense forecast cyclones by ECENS. The symbol σ indicates that the cyclone is identified as **MEDICANE**

(Picornell & Campins, 2018)

Summary

- Some **automatic tools** have been developed to detect and characterize mediterranean cyclones. Otherwise, **higher resolution models** present new challenges to follow smaller structures, as MEDICANES, related with severe weather in mediterranean regions. These tools have been tuned **to predict in a probabilistic way** the occurrence of **medicanes**.
- Some **products** are presented to show the information as derived from EPS models both in a detailed manner and in a concise and clear way. **Predictability of Qendresa medicane** has been studied comparing ECENS predictions with analyses and deterministic forecast from ECHRES.
- All **ensemble members** detect a cyclone, some of them **intense enough**. Shallow warm core structure are forecasted by some members, but **none** is able to forecast a **deep warm core**. In view of these results, we can affirm that the ECENS model is able to predict in an acceptable, although improvable, way the intensity as well as the trajectory of very intense cyclones of small dimensions. However higher resolution models will be necessary to better predict the thermal structure and their possible tropical transitions.
- **Future work**: Implement a **real-time cyclone probabilistic forecast** from ECENS as a tool for operational predictions in Aemet. To improve the probabilistic forecast of medicanes higher resolution EPS models will be necessary.

References

Hart, R.E., (2003). A cyclone phase space derived from thermal wind and thermal asymmetry. Mon. Wea. Rev., 131, 585-616.

Picornell, M.A., Campins, J., and Jansà, A., (2014). Detection and thermal description of medicanes from numerical simulation. Nat. Hazards Earth Syst. Sci. 14: 1059–1070.

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