

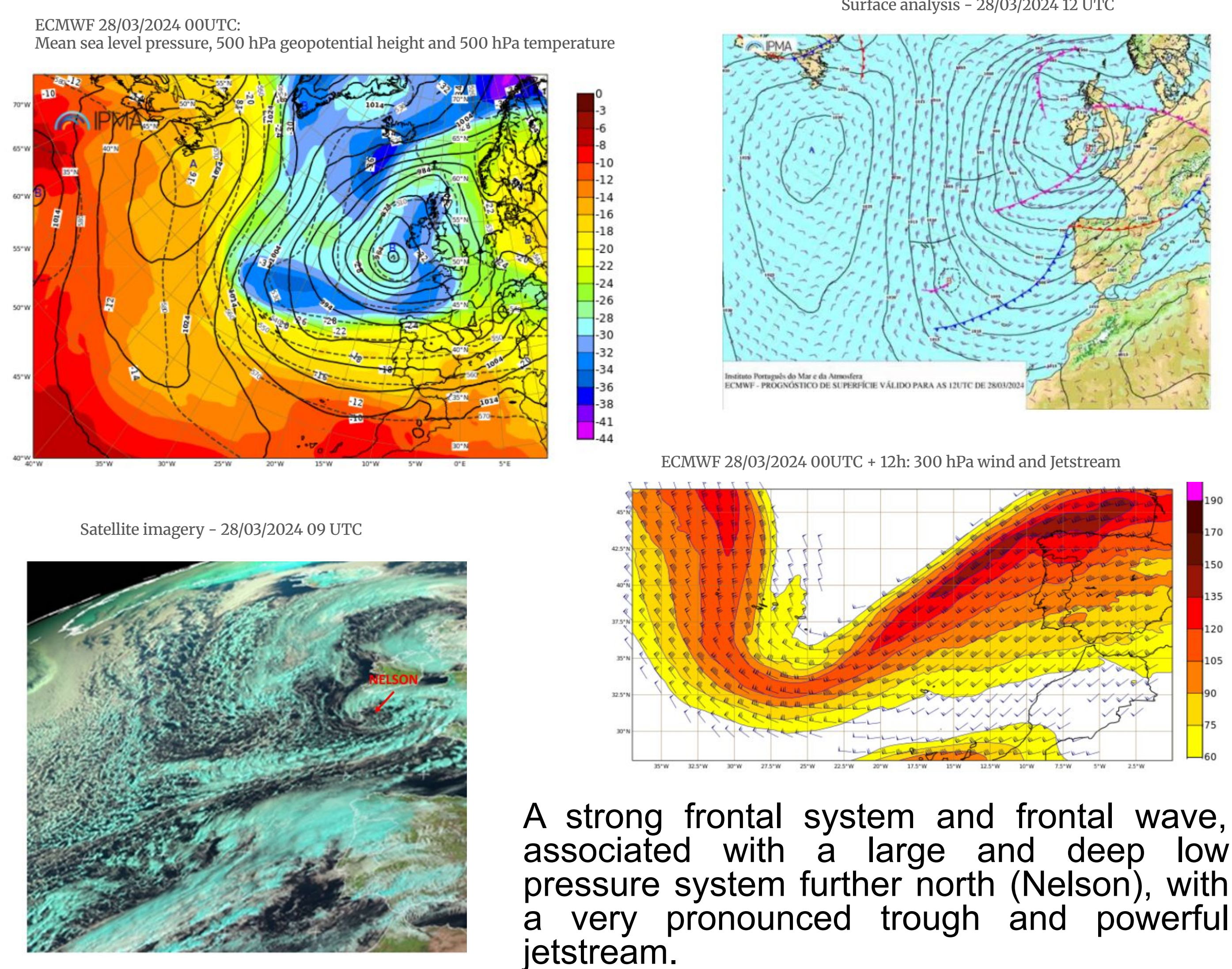
# Tornadic Event in Portugal in March 2024: Synoptic environment and Forecasting

Pedro M. Sousa and Paulo Pinto

IPMA (Instituto Português do Mar e da Atmosfera)

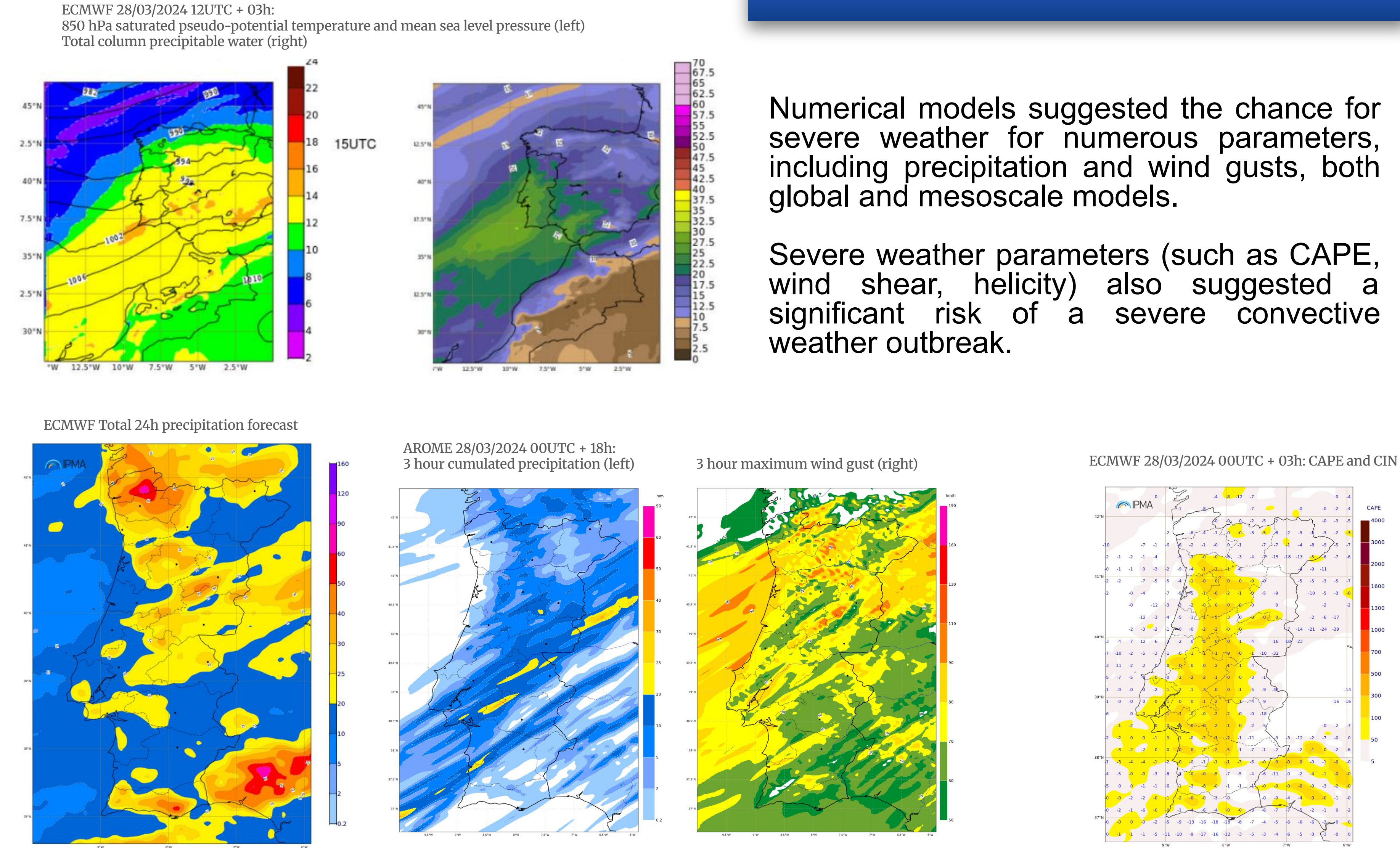


## Synoptic Environment



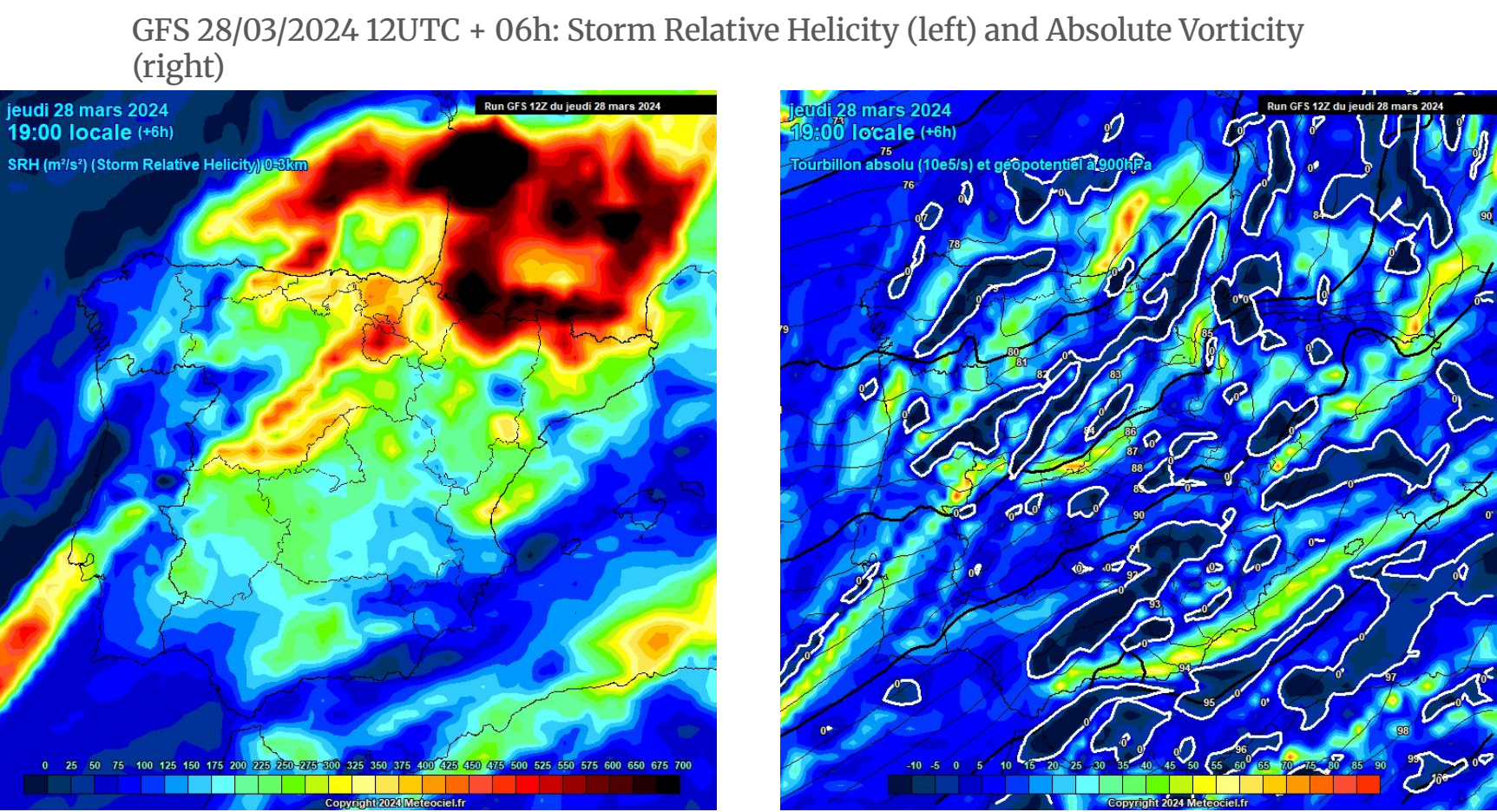
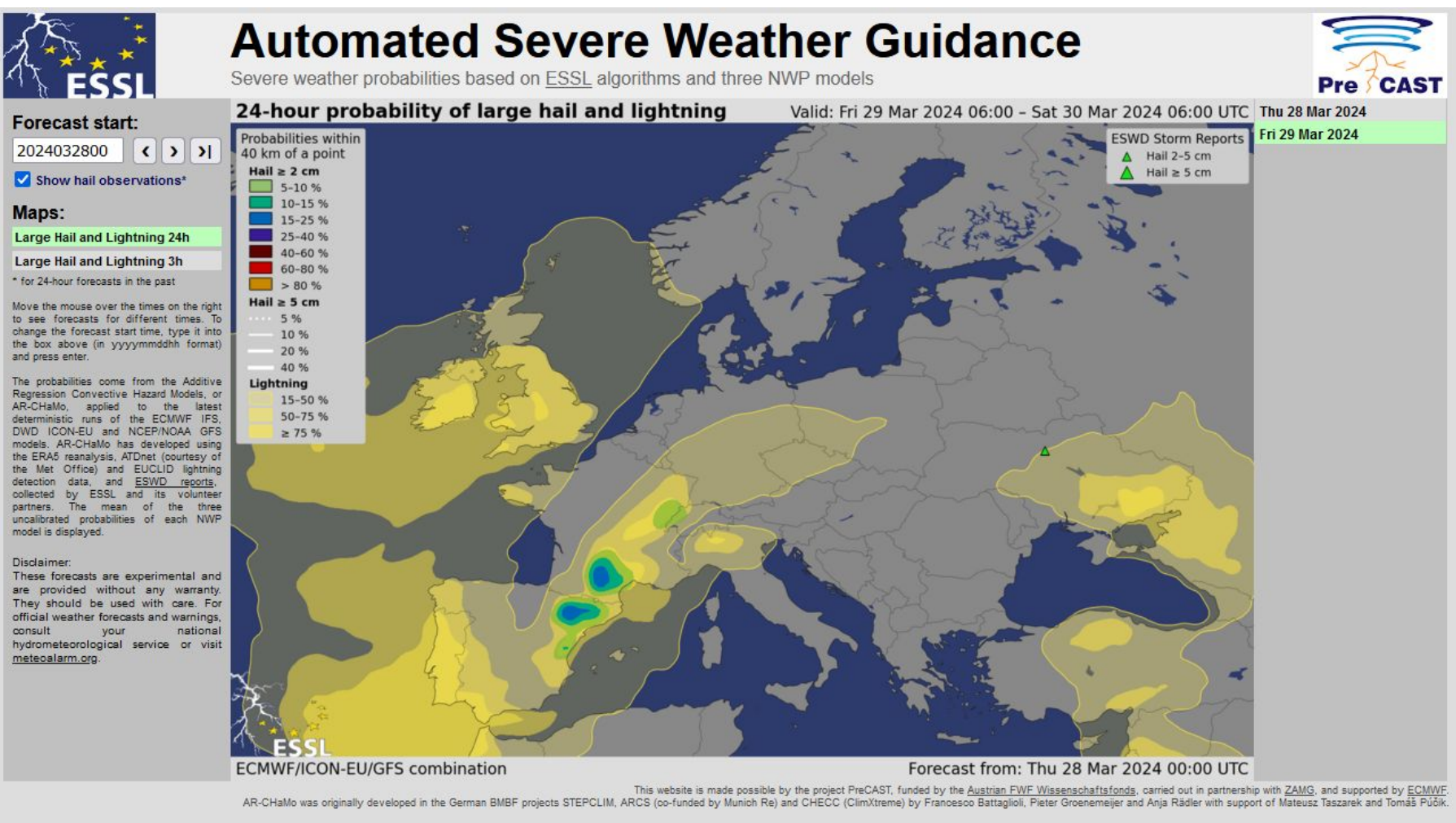
A strong frontal system and frontal wave, associated with a large and deep low pressure system further north (Nelson), with a very pronounced trough and powerful jetstream.

## Numerical Models



Numerical models suggested the chance for severe weather for numerous parameters, including precipitation and wind gusts, both global and mesoscale models.

Severe weather parameters (such as CAPE, wind shear, helicity) also suggested a significant risk of a severe convective weather outbreak.



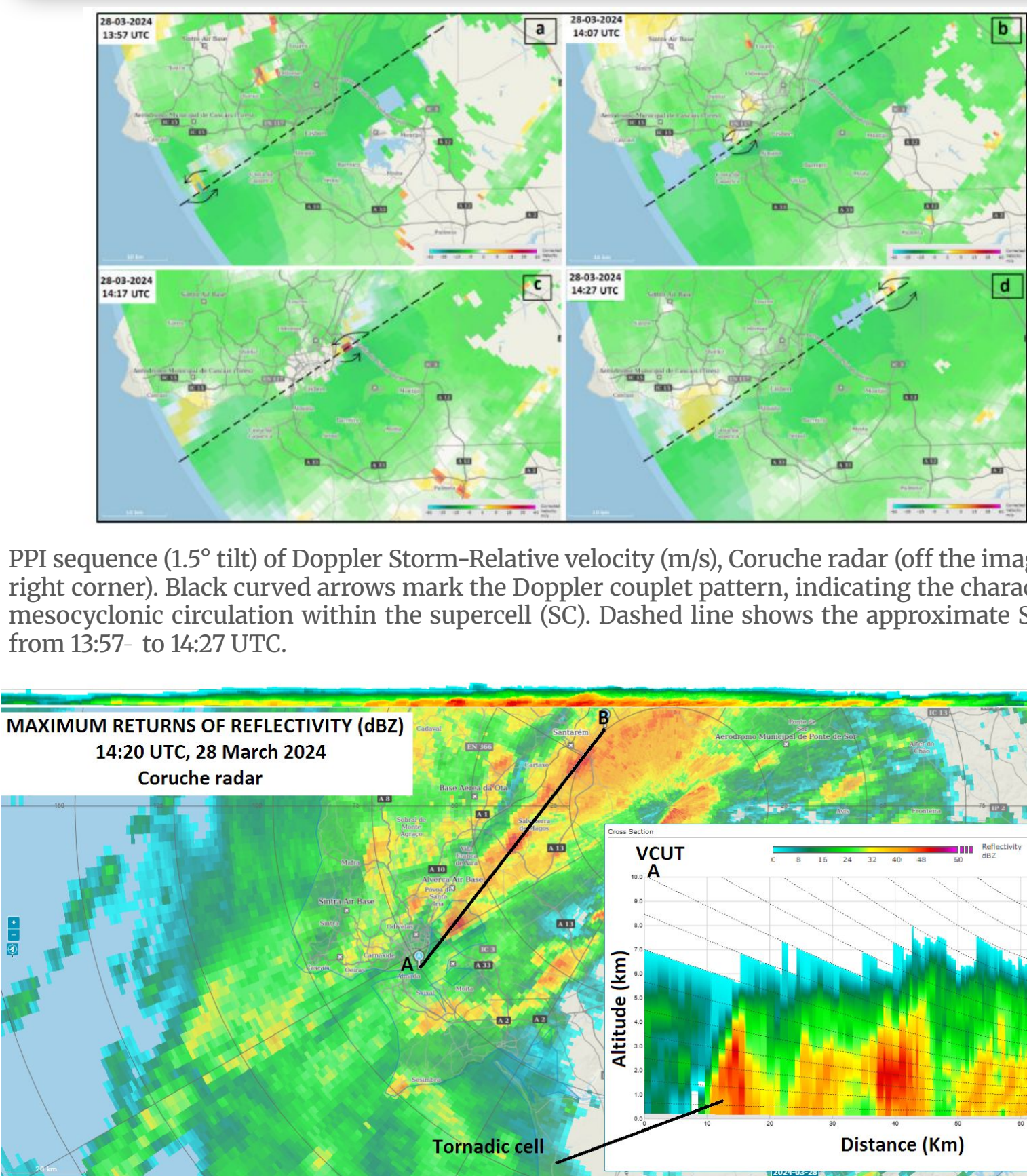
## Weather Warnings



Accordingly to the model outputs, weather forecasters at IPMA issued Weather Warnings for rain, wind, snow and sea waves.

Additionally, bulletins also referred the need for convective risk surveillance, highlighting relevant shear and helicity.

## Observation & Impacts



Maximum returns of reflectivity (dBZ) at 14:20 UTC, 28 March 2024, from the Coruche radar. The vertical cut performed on the MAXZ shows the vertical extent of cells, highlighting the tornadic one. NWP data and observations indicated 0–6 km shear of approximately 35 m/s.



(left) Photo of the tornado funnel east of the Vasco da Gama Bridge, taken from the north bank of the Tagus River, likely between 14:21 and 14:24 UTC, 28 March 2024.

(right) Photo of the tornado funnel taken after the previous image near the bridge. The funnel cloud (f) is indicated, as well as debris clouds (d), visible laterally due to water aspiration. The arrow on the right points to the shadow of the distant south bank of the Tagus River, 28 March 2024.



Overview of trees uprooted by the tornado in Benaciate, Silves, 28 March 2024

## Wrap up

On March 28, 2024, two tornadoes occurred in mainland Portugal: one over the Tagus River estuary (no visible damage) and another near Benaciate (Silves), rated F1/T2 with peak winds of 119–148 km/h.

Both tornadoes developed from supercell thunderstorms embedded in a frontal wave moving southeastward across southern Portugal. The maritime tropical air mass exhibited moderate instability and moderate to high precipitable water content. Strong wind shear between the surface and 6 km layers supported organized convection and storm persistence, with significant directional shear within the lowest kilometre enhancing mesocyclone rotation.

The same synoptic environment also favoured intense convective gusts, several exceeding 100 km/h. One of the most notable events occurred at Sarilhos Grandes, where the recorded wind strength was equivalent to F1/T2 intensity, consistent with the supercellular dynamics and local enhancement of low-level outflow.