Predictability of a Mediterranean Tropical-like Cyclone

Guido Cioni, Daniel Klocke, Diego Cerrai
Mediterranean Tropical-like Cyclones

Ernst and Matson (1983), Emanuel (2005), Miglietta et al. (2013), Tous and Romero (2013), Cavicchia et al. (2014)
Qendresa (7-8 Nov. 2014)

Pyharoulis et al. (2017)
Cioni et al. (2018)
Pytharoulis et al. (2017)  
Cioni et al. (2018)
Predicting the event
Predicting the event

Forecasts initialized at 00 UTC on 7/11/2014
Predicting the event

Forecasts initialized at 00 UTC on 7/11/2014
Is resolution really important to predict these events?
Experiments

Modelling strategy

• ICON
• 10 km to 300 m grid spacing
• 6 hourly ECMWF-IFS operational analyses as forcing
Resulting tracks
Resulting tracks

Experiments

1 km

[Map showing resulting tracks with observed data points and a color scale for pressure in hPa.]
Resulting tracks

300 m
1 km
When convection is explicitly represented, the simulated trajectory converges to the observed one.
The high-resolution simulation
Predictability from the "small" scale

- Low-levels temperature anomaly in a radius of 50 km around the cyclone position during the intensification phase

- Convection-permitting simulations do not produce a warm core
From the "small" to the "large" scale

- Stronger dipole of PV with higher resolution (resolved convection)

\[ \frac{\partial \Pi}{\partial t} \propto \frac{\partial}{\partial z} \left( \frac{\partial \theta_{\text{rad}}}{\partial t} + \frac{\partial \theta_{\text{cond}}}{\partial t} \right) \]

(adopted from Van Delden, 2003)

Average of PV in a 50 km radius around the cyclone position
Predictability from the large scale

- PV maximum above the cyclone appears only with poorly resolved convection
- Different PV distribution modifies the atmospheric state and the cyclone evolution
Questions?