The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution

M.Tous(1), R.Romero(1), J.A.García-Moya(2) and C.Ramis(1)

(1) Universitat de les Illes Balears  _ UIB
(2) Agencia Estatal de Meteorología _ AEMET

To characterize meteorological environments for medicanes development and maintenance

To examine and improve numerical predictability of medicanes

To assess the medicane risk under the present and future climate conditions

MEDICANES: Meteorological Environments, Numerical Predictability and Risk Assessment in the Present and Future Climate (MEC, CGL2008-01271/CLI)
**What are MEDICANES?**

**MEDICANES** are tropical-like cyclones which develop over the Mediterranean Sea, sometimes attaining hurricane intensity.

**MEDICANES** operate on the thermodynamical disequilibrium between the sea and the atmosphere and in this respect, as well in their visual appearance in satellite images, are much tropical cyclones.

The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution

---

**Our database**

**12 events**

**Medicane criteria**

1) Continuous cloud cover
2) Cyclone eye clarity
3) Symmetric shape
4) Ø < 300 km
5) Lifetime > 6 h

The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution
Our database

IR satellite images (1982-2005)

Medicane criteria
1) Continuous cloud cover
2) Cyclone eye clarity
3) Symmetric shape
4) Ø < 300 km
5) Lifetime > 6 h

12 events

• Central and Western of the Mediterranean
• Most frequent in winter and autumn

The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution

Meteorological environments

\[ \text{GENPDF} = 10^9 \left( \frac{\text{H}}{50} \right) \left( \frac{\text{V}_{\text{max}}}{70} \right)^3 \left( 1 + 0.1 \text{V}_{\text{max}} \right)^{-2} \]

The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution
The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution

\[ \text{GENPDF} = 10^8 \pi \left( \frac{H}{50} \right)^2 \left( \frac{V_{\text{max}}}{70} \right)^3 \left( 1 + 0.1 V_{\text{max}} \right)^{-2} \]
To examine and improve numerical predictability of medicanes

1st

MESOSCALE MODEL SIMULATION

ECMWF T213 (~ 85 km) + obs.
ECMWF (~ 125 km)
ECMWF (~ 250 km)

LOW RESOLUTION of the input large scale fields

2nd

IFS - ECMWF
ECMWF
Model: IFS cycle 36
(Integrated Forecasting System)
Resolution: T1279 (~15 km)
Interpolated analysis from ERA-40
Quasi-symmetric intense low-pressure centres at surface with an isolated warm-core structure aloft.

Katrina, Warm Core Low

Sfc Isobars (solid, mb)
Sfc-500 mb Mean Temp (shaded)
12 UTC 28 Aug 2005  http://tornado.sfsu.edu/

The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution
The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution.
The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution
The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution.

**ANOTHER EXAMPLE:**
December 1996

The influence of input large scale fields on the ability of a mesoscale model to simulate medicanes: from very high to low resolution.
CONCLUSIONS

MM5 simulations at 7.5 km forced with large-scale fields of different horizontal resolutions, are able to develop medicane-like structures, even with the coarsest input data experiments.

The simulated trajectories, using control and fine GCMs resolutions, are worse than using typical GCMs resolutions.

IFS – ECMWF experiments at 15 km exhibit less skill than the MM5 simulations: the forecasted medicanes are smaller in size and weaker in intensity.

This fact encourages the application of mesoscale models nested in GCMs in order to assess the medicane risk under present and future climate conditions.
CONCLUSIONS

MM5 simulations at 7.5 km forced with large-scale fields of different horizontal resolutions, are able to develop medicane-like structures, even with the coarsest input data experiments. The simulated trajectories, using control and fine GCMs resolutions, are worse than using typical GCMs resolutions.

IFS – ECMWF experiments at 15 km exhibit less skill than the MM5 simulations: the forecasted medicanes are smaller in size and weaker in intensity.

This fact encourages the application of mesoscale models nested in GCMs in order to assess the medicane risk under the present and future climate conditions.

Improved IFS experiments are planned with resolutions up to 2 km, 4D data...