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

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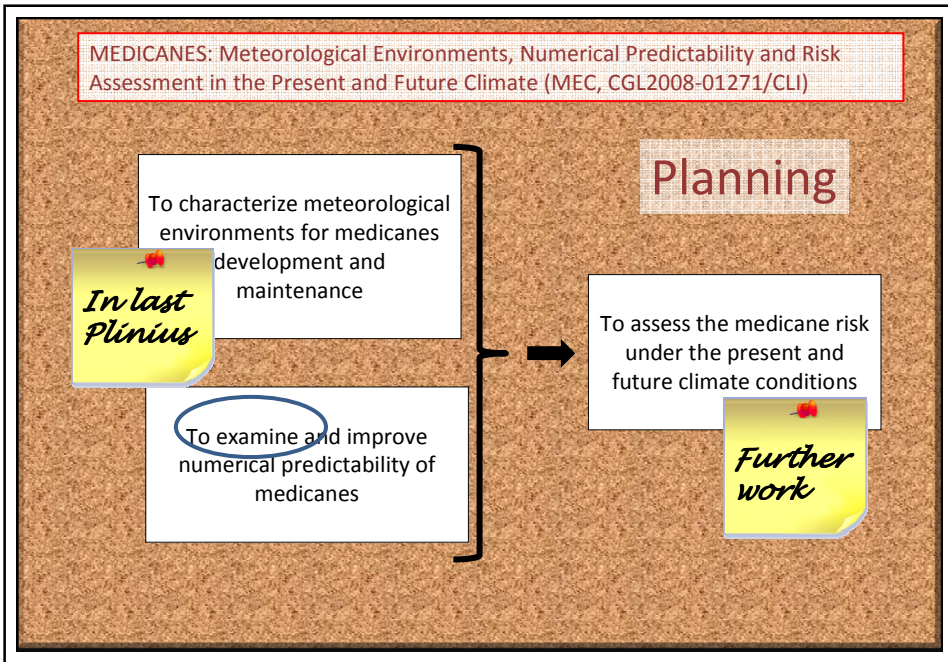
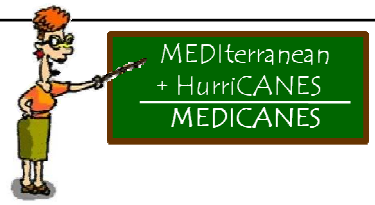
[(1)]Universitat de les Illes Balears _UIB

[(2)]Agencia Estatal de Meteorología _ AEMET

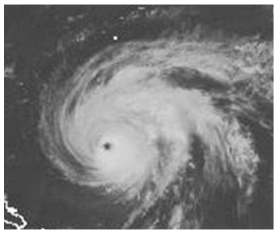


What are MEDICANES?

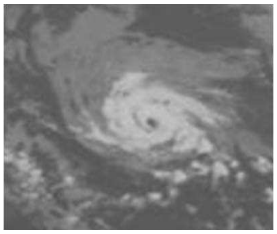


MEDICANES are tropical-like cyclones which develop over the Mediterranean Sea, sometimes attaining hurricane intensity.

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.

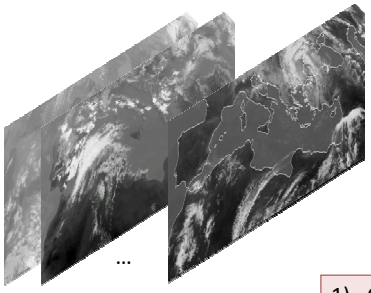


Hurricane Bill. Aug 2009



Medicane. Jan 1995

Our database



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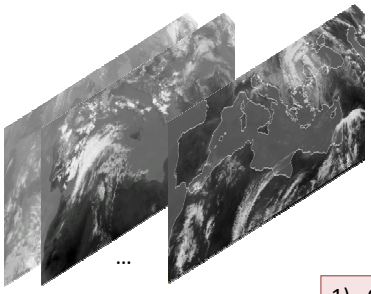
IR satellite images (1982-2005)

Medicane criteria

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

12 events

Our database



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IR satellite images (1982-2005)

Medicane criteria

1) Continuous cloud cover
2) Cyclone eye clarity
3) Symmetric shape
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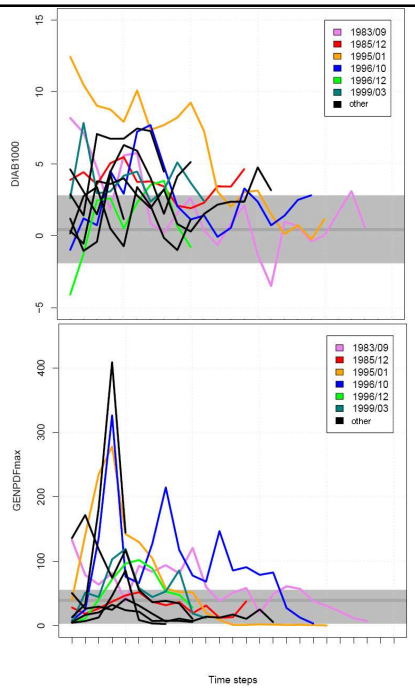
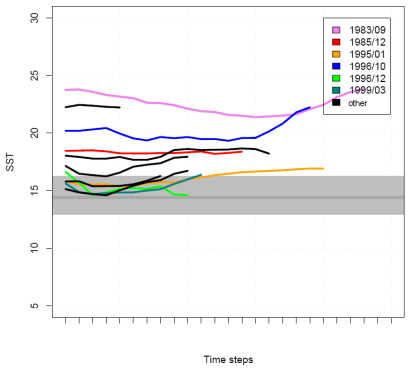
12 events

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

Meteorological environments





$$GENPDF = \left|10^5 \eta\right|^{3/2} \left(\frac{H}{50}\right)^3 \left(\frac{V_{max}}{70}\right)^3 \left(1 + 0.1\, V_{shear}\right)^{-2}$$

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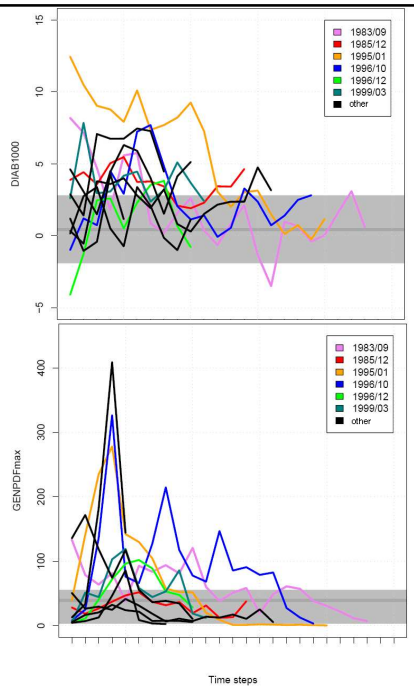
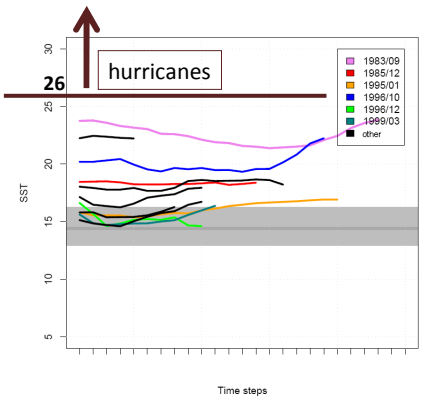


Meteorological environments



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1st

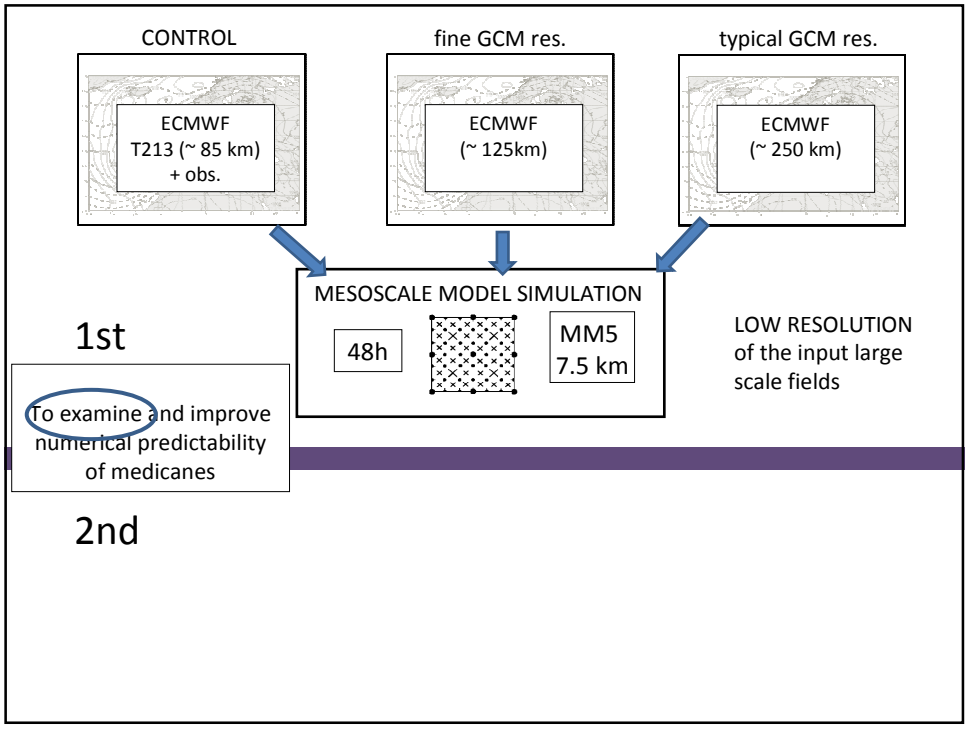
To examine and improve numerical predictability of medicanes

2nd

MESOSCALE MODEL SIMULATION

48h

MM5
7.5 km


CONTROL
fine GCM res.
typical GCM res.
ECMWF
T213 (~ 85 km)
+ obs.
ECMWF
(~ 125km)
ECMWF
(~ 250 km)
MESOSCALE MODEL SIMULATION
48h
MM5
7.5 km
LOW RESOLUTION
of the input large
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1st
To examine and improve
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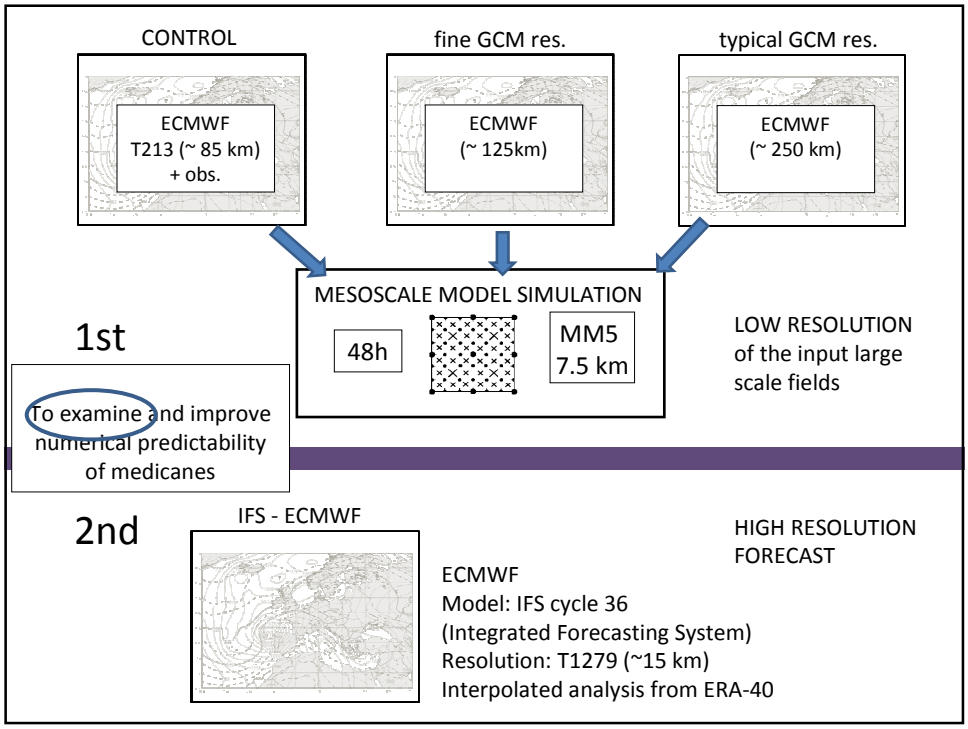
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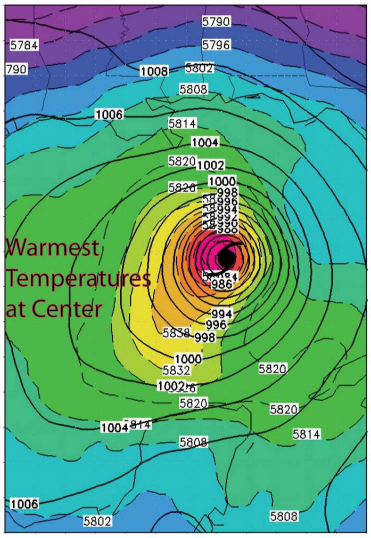
IFS - ECMWF
HIGH RESOLUTION
FORECAST
ECMWF
Model: IFS cycle 36
(Integrated Forecasting System)
Resolution: T1279 (~15 km)
Interpolated analysis from ERA-40

Katrina, Warm Core Low



Quasi-symmetric intense low-pressure centres at surface with an isolated warm-core structure aloft.

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

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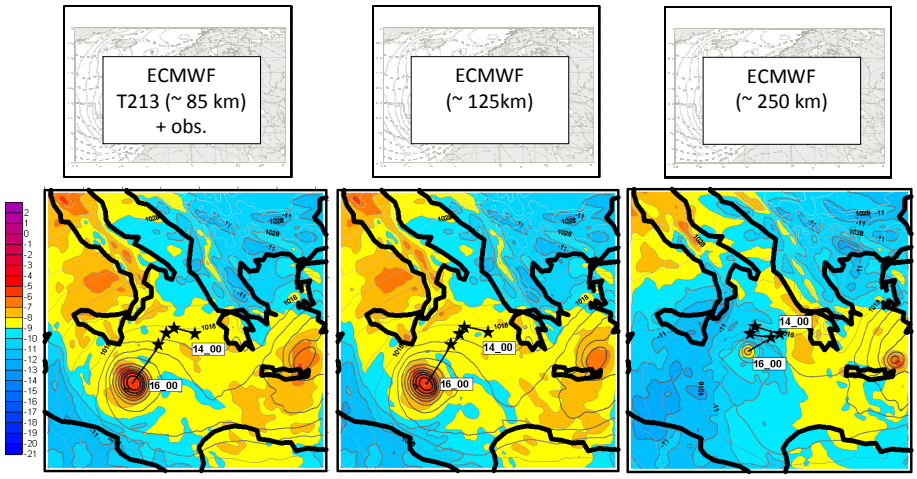
Temp.(ºC) 700 hPa



CONTROL

85 km + obs.

Fine GCM res.

125 km

Typical GCM res.

250 km

MM5

7.5 km

LOW RESOLUTION

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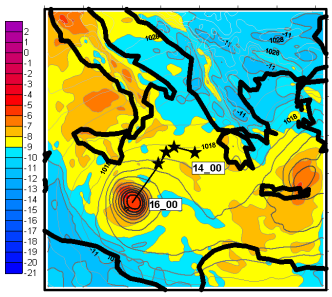
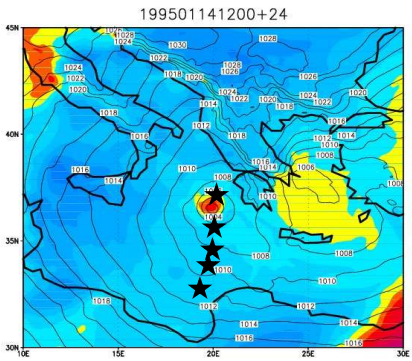


IFS - ECMWF

T1279 (~15 km)



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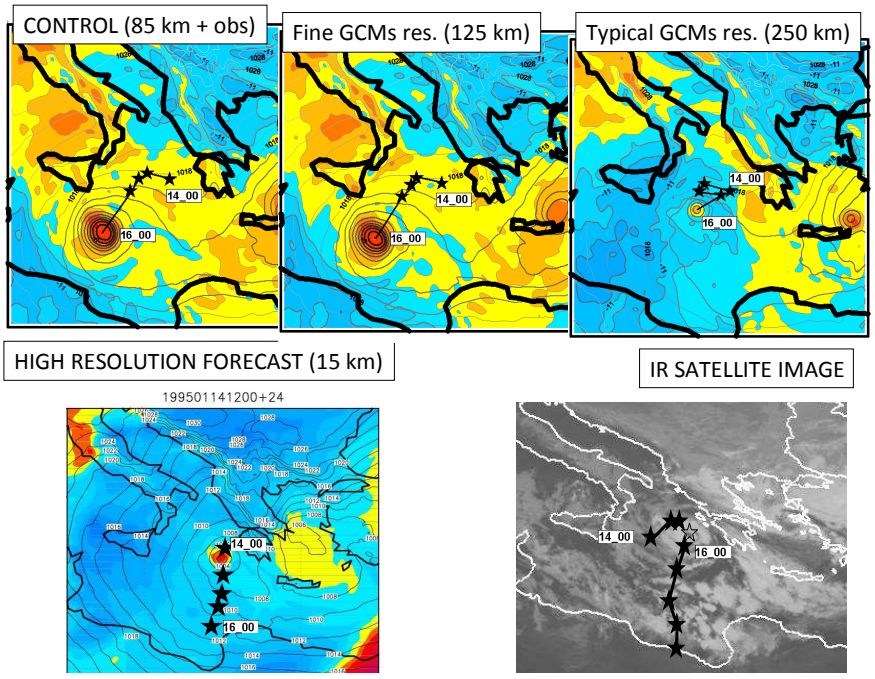

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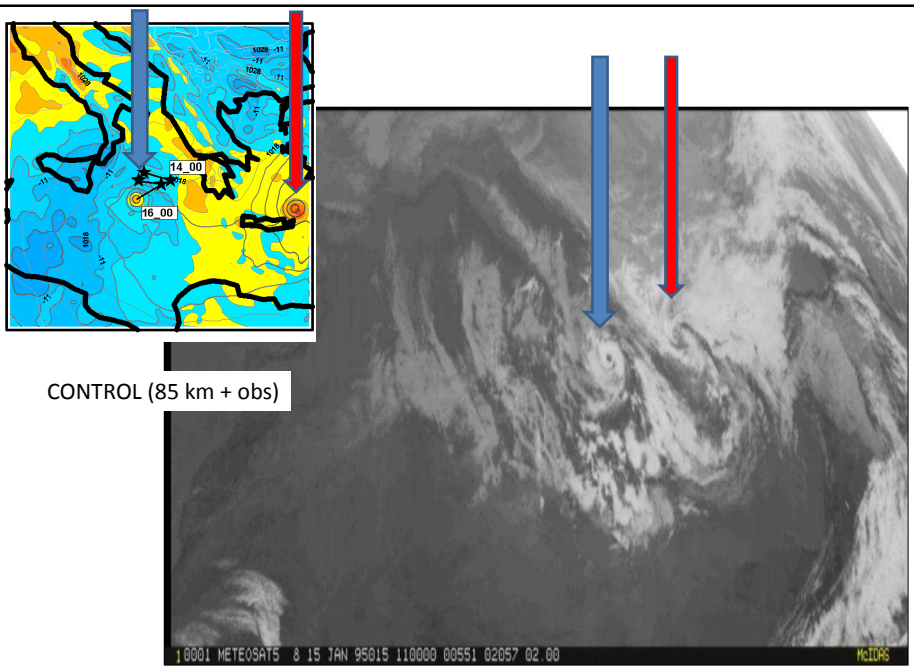

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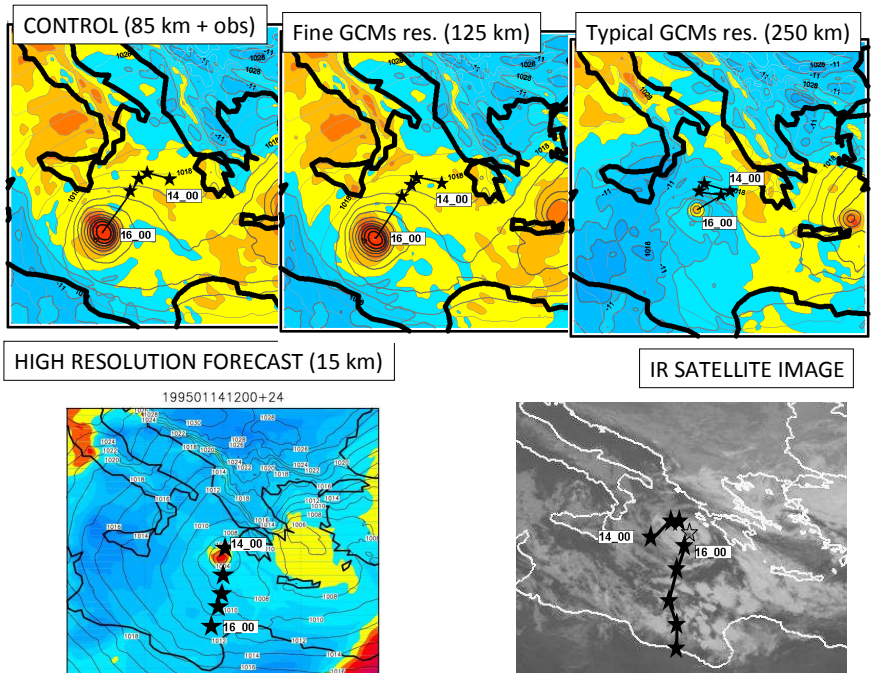

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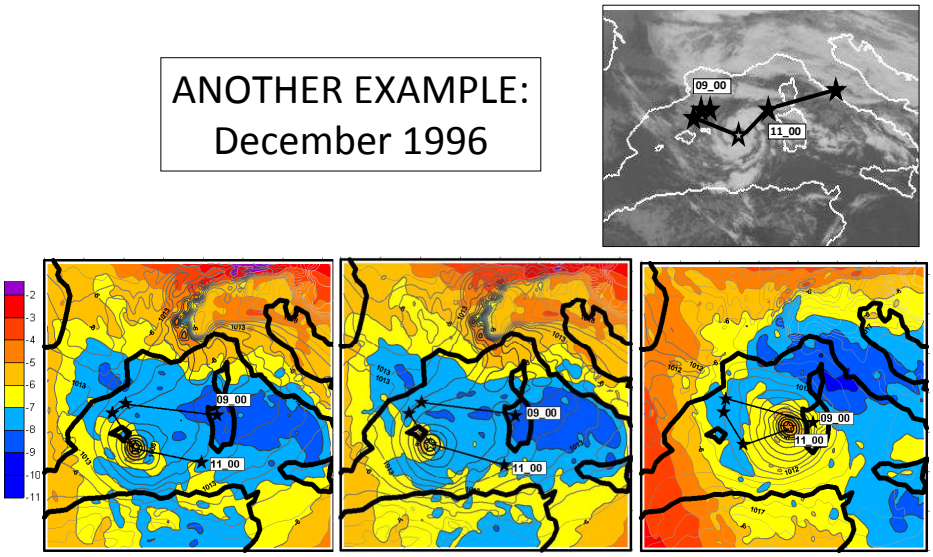

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CONCLUSIONS

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.

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