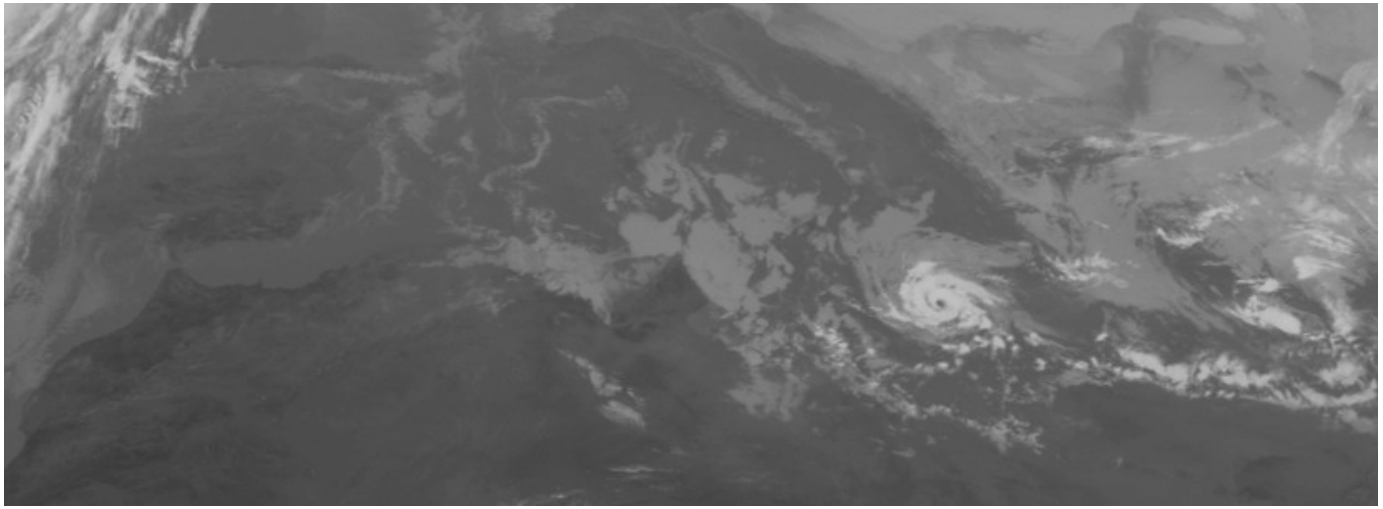
Medicanes in HadGEM3 N512 climate simulations



M.Tous (1), G.Zappa(2), R.Romero(1), L.Shaffrey(2)

(1): Universitat de les Illes Balears; (2) University of Reading

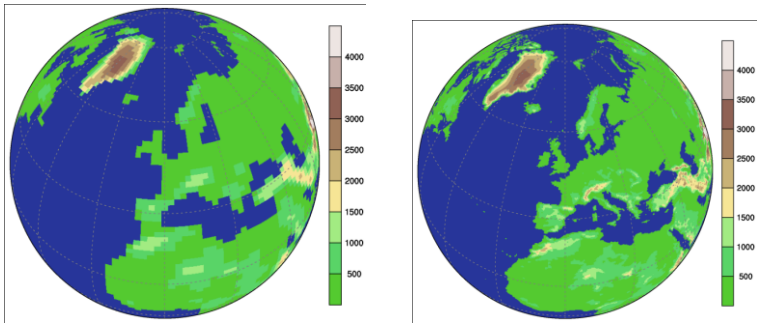
Universitat de les Illes Balears

University of Reading

Govern de les Illes Balears
Conselleria d'Educació, Cultura i Universitats
Direcció General d'Universitats, Recerca i Transferència del Coneixement

Unión Europea
Fondo Europeo de Desarrollo Regional

MODEL



N96

N512

UPSCALE **project**

Based upon HadGEM3
Resolution (horizontal) ~25 km,
(vertical) 85 hybrid heigh lev. for the first 85 km
Present: forced with daily OSTIA SST
Future: following RCP8.5 scenario

1985-2011 → **June 1985 - May 2011**
2085-2111 → **June 2085 – May 2111**

at **00, 06, 12, 18 Z**

(Mizielinski et al., 2014)

TRACKING

Hogdes 1994, 1995, 1999

Fixing vorticity centers
at 850 hPa
(filtered at T40-100)

Vorticity > $2 \cdot 10^{-5}$ s^{-1}
Lilfetime ≥ 2 time steps ≡ 12 h
Min mslp located close (<200 km)

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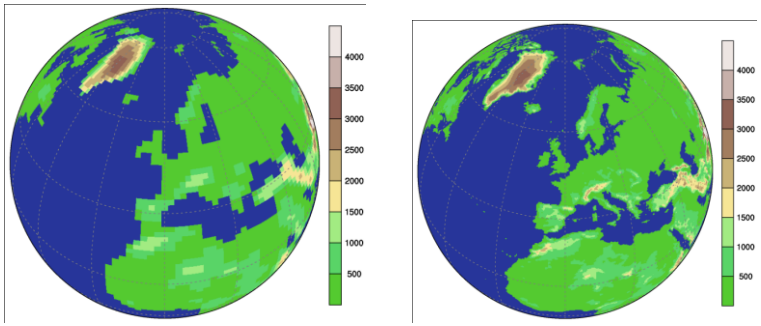

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MEDITERRANEAN CYCLONE CLIMATOLOGY

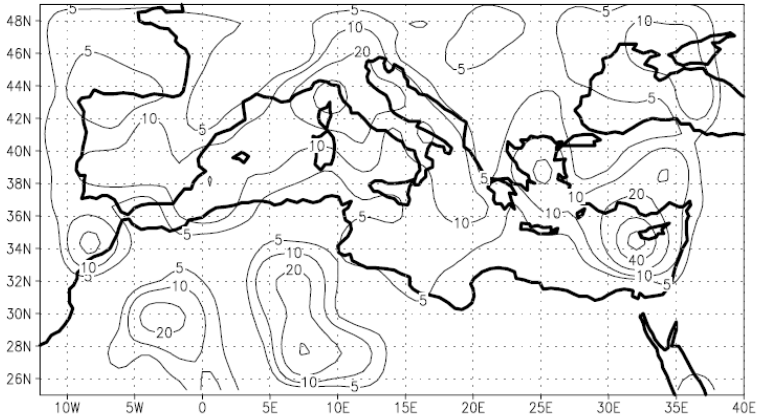

Figure 2. Mean number of cyclone centres in 2.25° × 2.25° latitude–longitude boxes. Contour intervals: 5, 10, 20, 40 and 60 centres/year.

(Campins et al, 2011)

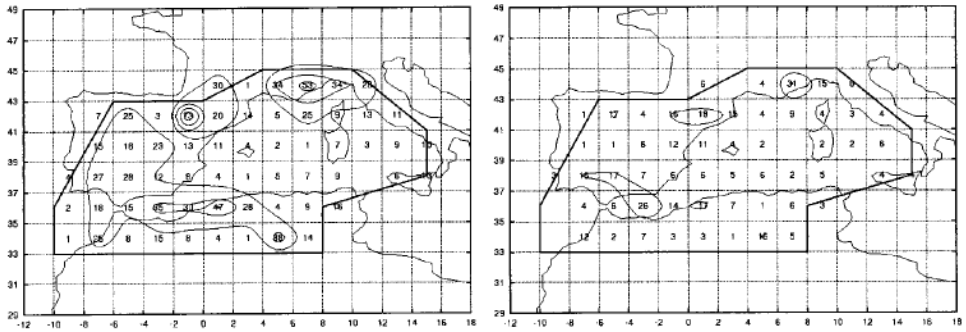

Figure 5. Seasonal frequency of appearance of cyclones obtained from the manual (top) and from the automated (bottom) method, for summer and autumn (from left to right) on 1995 at 00:00 UTC and 12:00 UTC, counted at intervals of 2° × 2° (the contour is every 15 units). The area of study is restricted to the area of the manual method

(Picornell et al, 2001)

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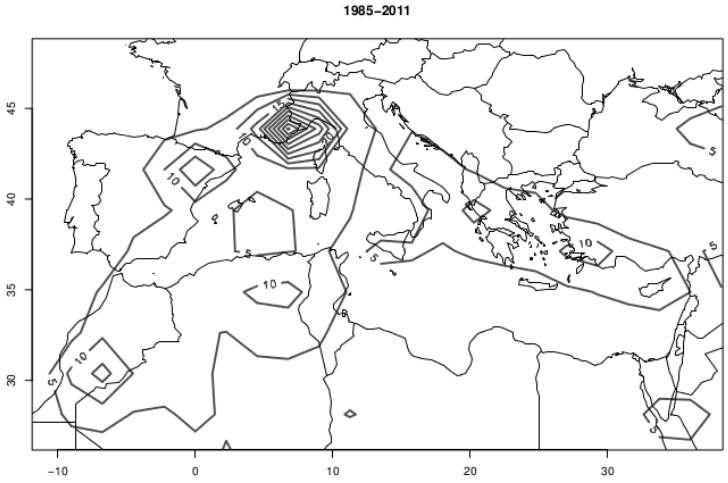
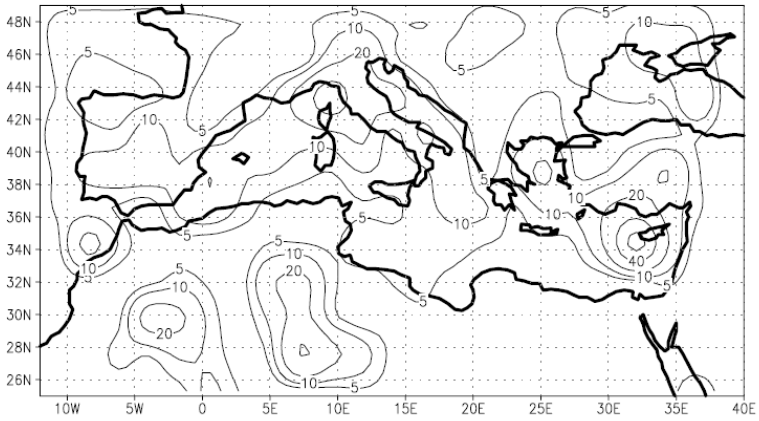


Figure 3.1: Feature density of cyclone centres per year. Contours at every 5 minimum pressure centers per year, calculated in 2.25°x2.25° lat-lon boxes.



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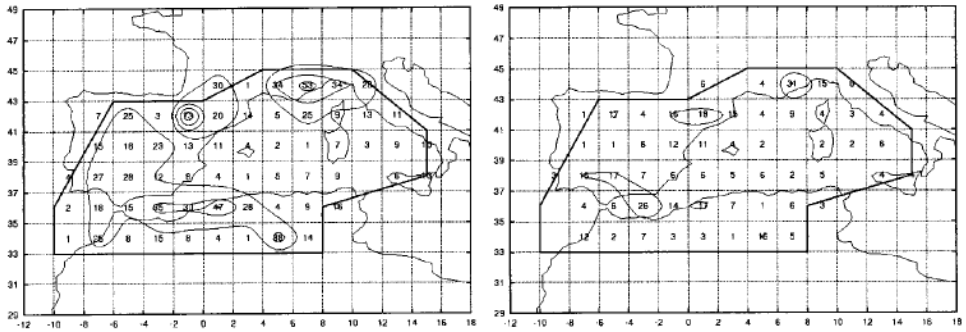

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IDENTIFICATION

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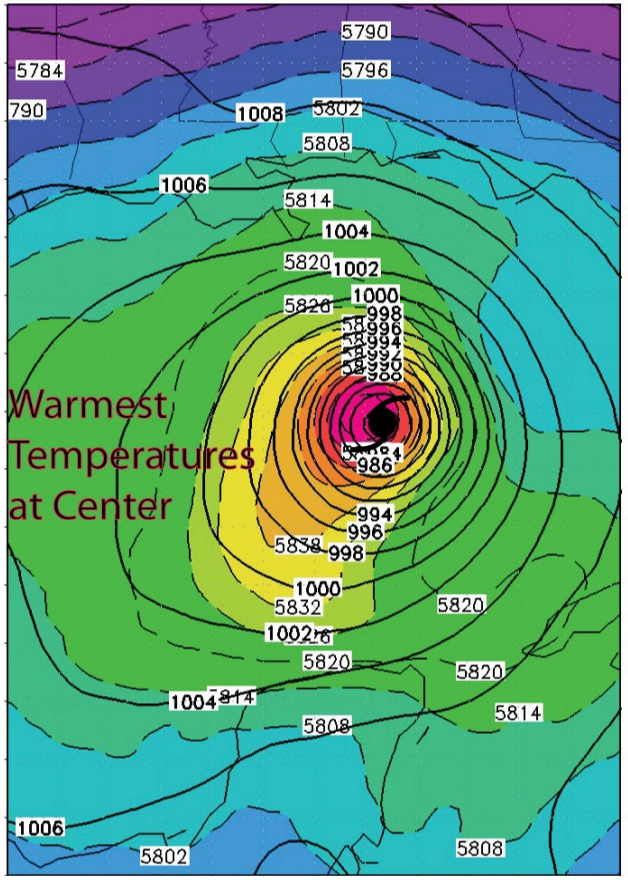
Quasi-symmetric
intense low-pressure centres
at surface with an isolated
warm-core structure aloft.

Intense low-pressure centre at surface

Warm core at 850 hPa

High humidity values at 850 and 600 hPa

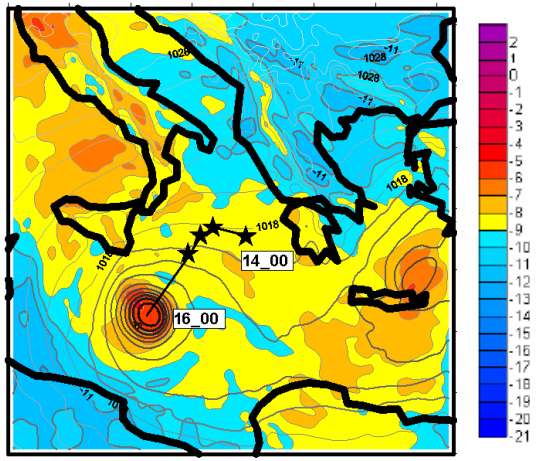
Katrina, Warm Core Low

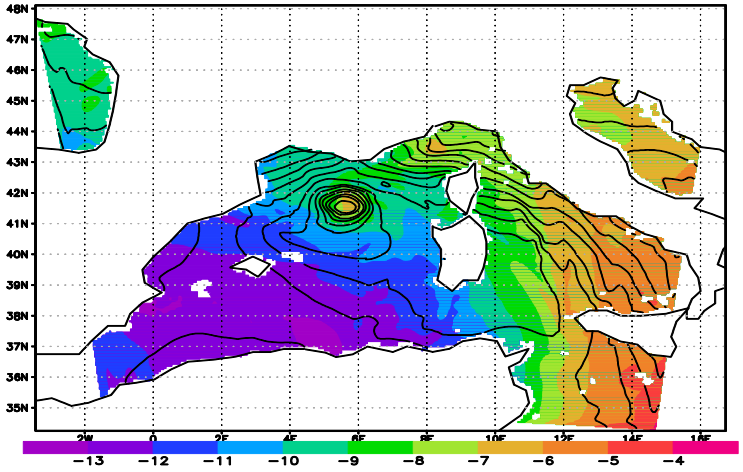


Sfc Isobars (solid, mb)
Sfc-500 mb Mean Temp (shaded)
12 UTC 28 Aug 2005

HOW THEY LOOK LIKE?

OTHER METHODOLOGIES





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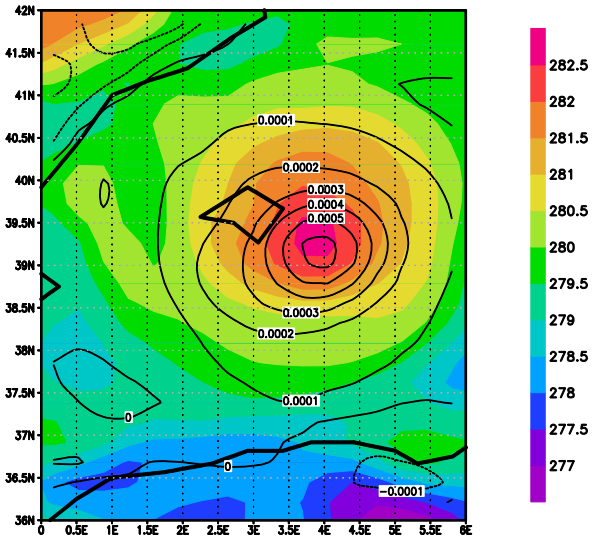

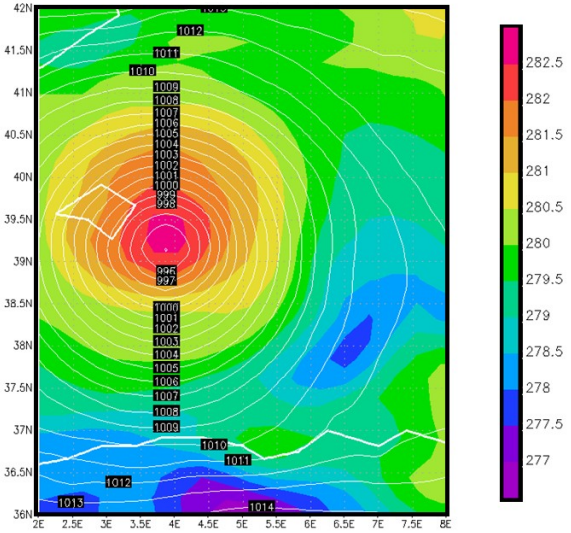

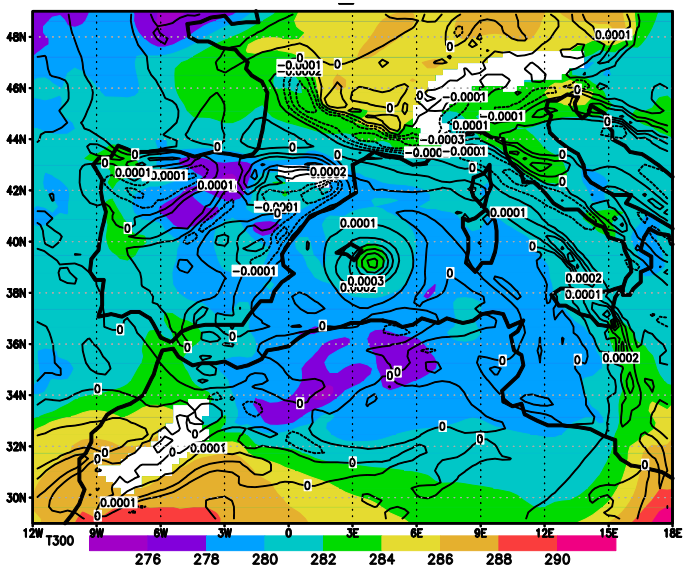

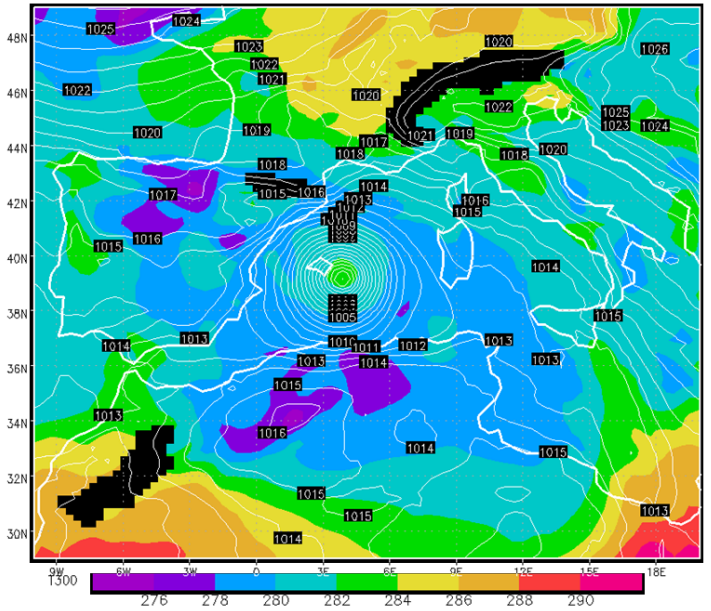

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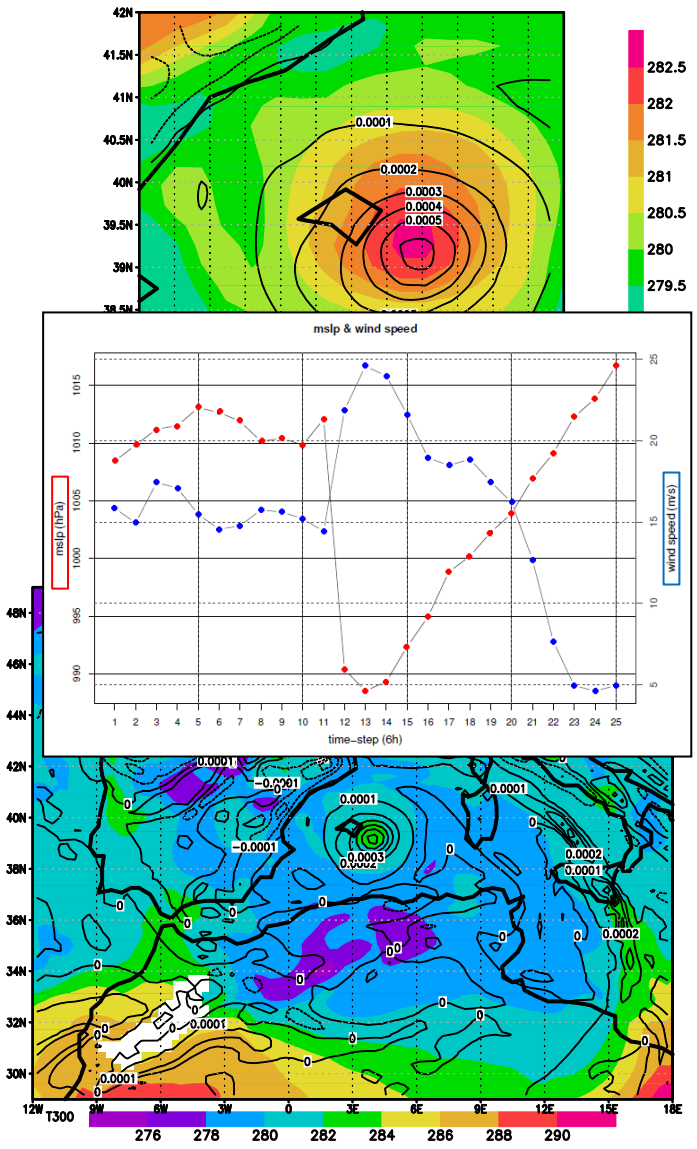
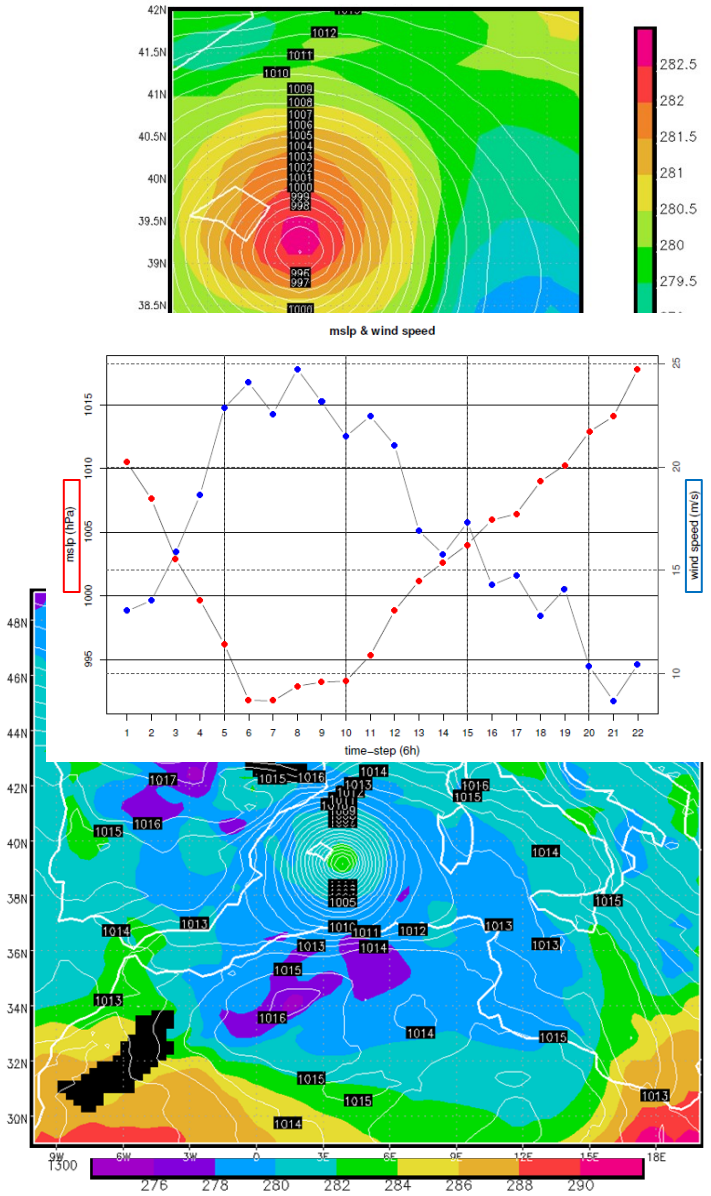
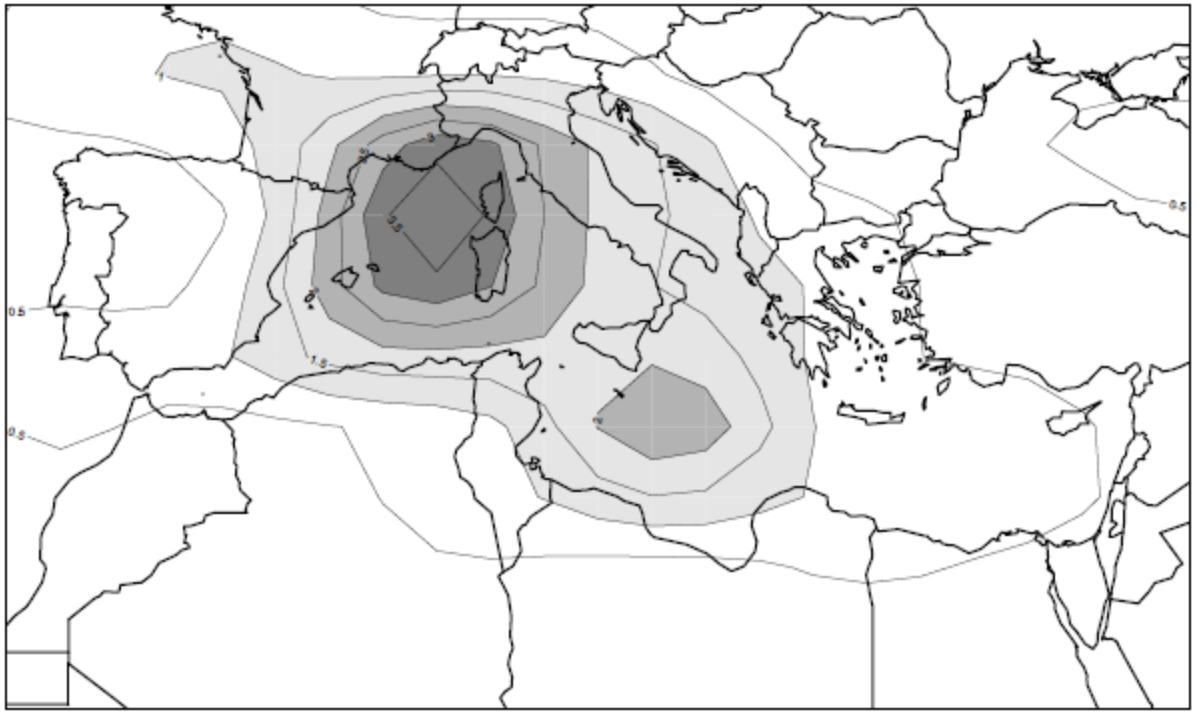




HOW THEY LOOK LIKE?

1985–2011



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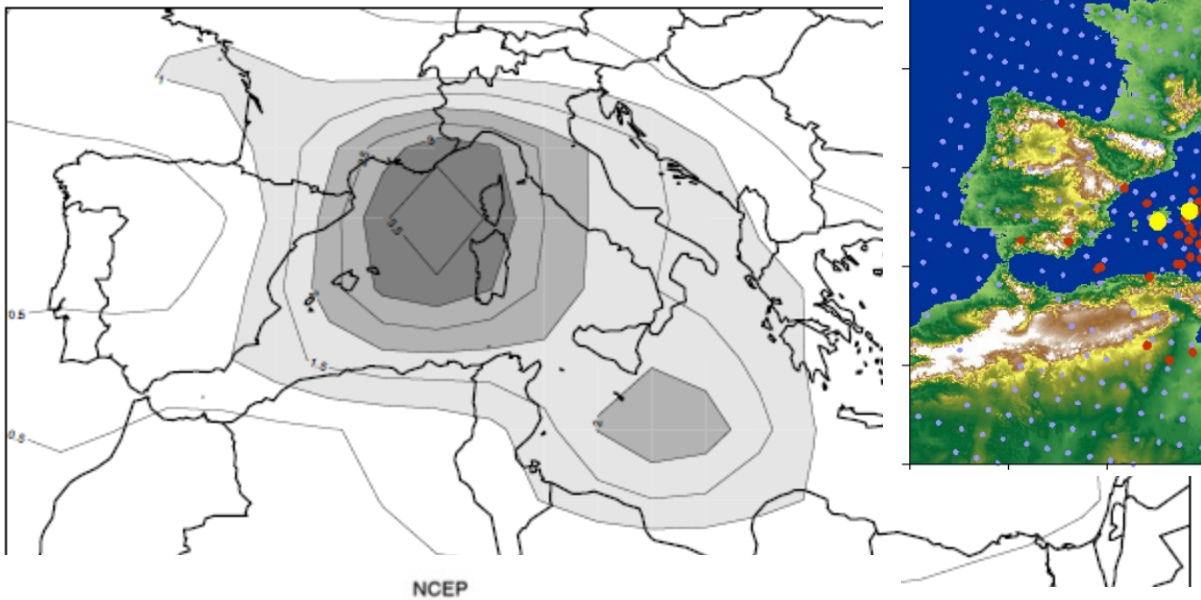
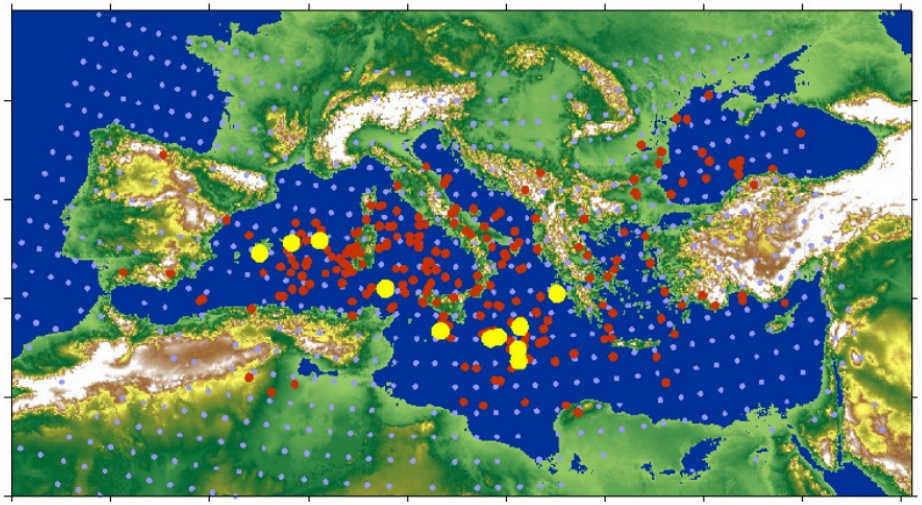
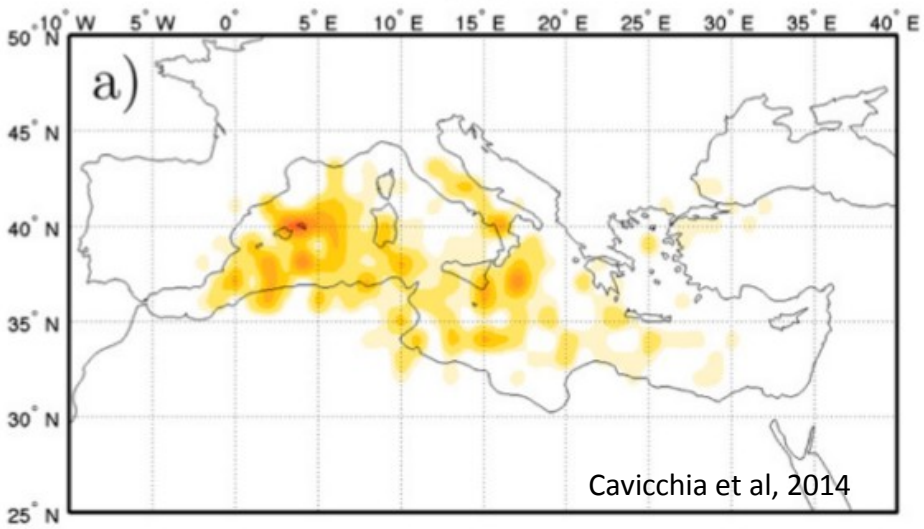


GEOGRAPHYCAL DISTRIBUTION OF EVENTS



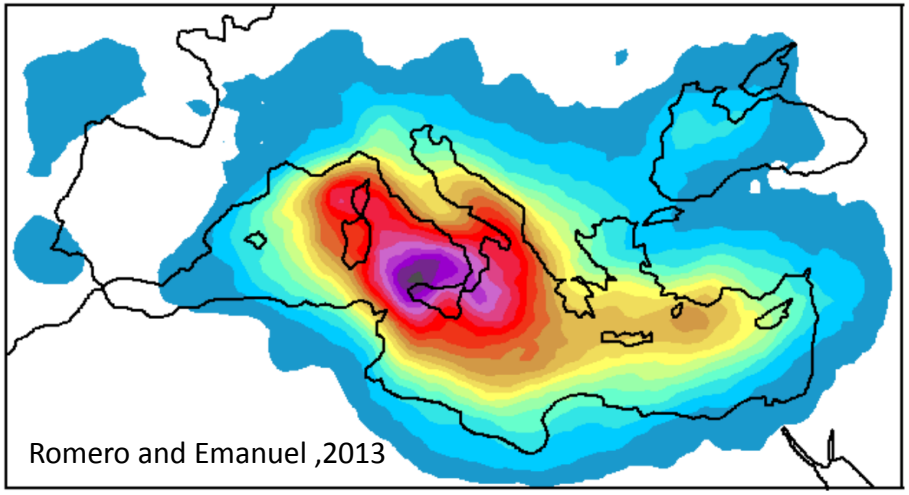
Tous and Romero, 2011 (Tethys)

NCEP



Cavicchia et al, 2014

TRACK DENSITY REANALYSIS



Romero and Emanuel ,2013

WHAT WILL HAPPEN IN THE FUTURE?

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	Minimum pressure centers →	Number of cyclones	Medicane cyclone centers →	Number of medicanes
1985-2011	147 441	45 013	826	65
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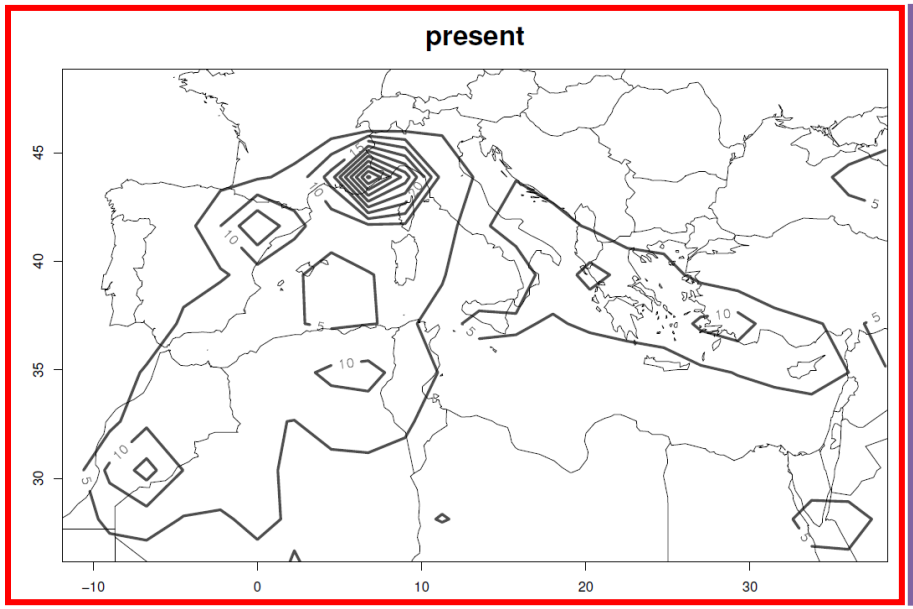

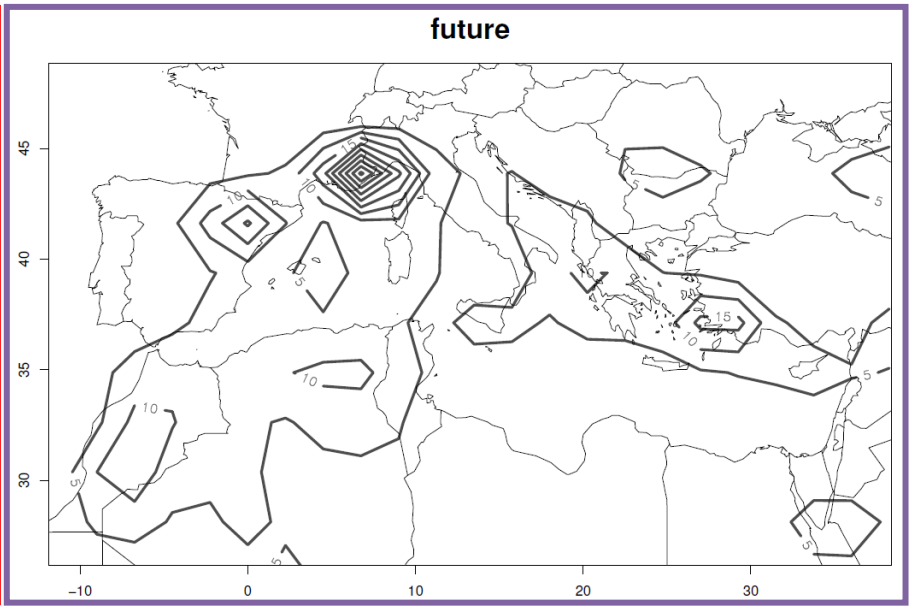

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	Cyclone lifetime steps (x 6h)			Cyclone lifetime steps (Bf>=8, x6h)		
	1Q	**mean**	**3Q**	**1Q**	**mean**	**3Q**
present	11.0	**16.2**	21.0	2.0	**5.4**	8.0
future	10.0	**20.0**	23.2	3.8	**7.2**	9.2
P-value (pres; fut)	0.13			0.08		

	mslp (hPa)			Vorticity (10 -5 s -1)			Wind speed (m/s)		
	1Q	mean	3Q	1Q	mean	3Q	1Q	mean	3Q
present	985.1	992.7	1001.0	7.8	9.6	11.3	18.1	20.4	23.3
future	993.4	998.0	1004.0	7.6	9.9	12.2	19.2	21.3	23.6
P-value (pres; fut)	0.01			0.61			0.16		

(3 max values)

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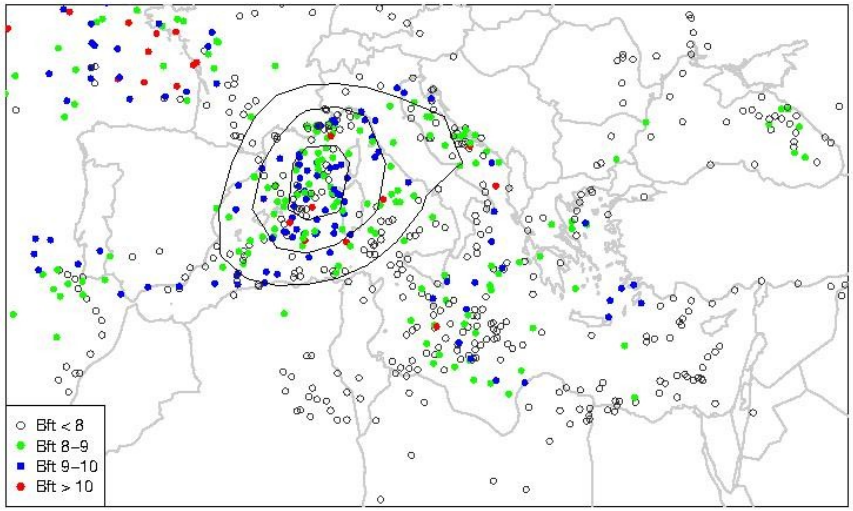
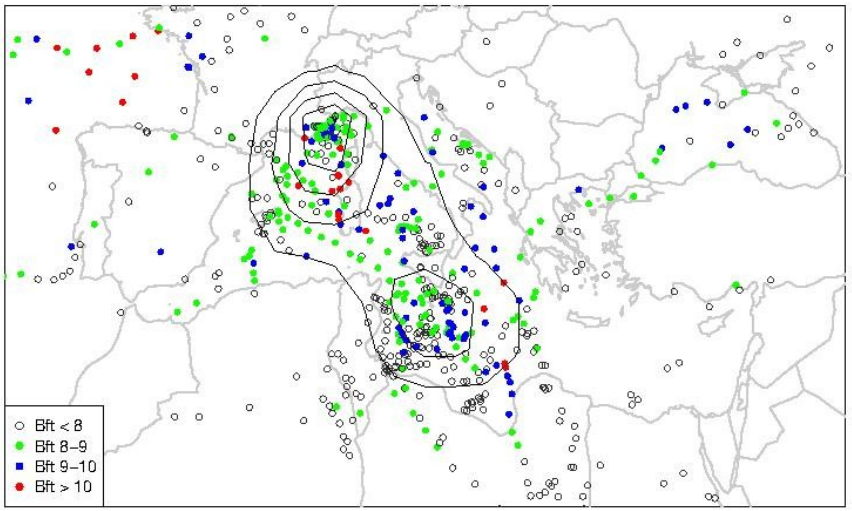
present



future



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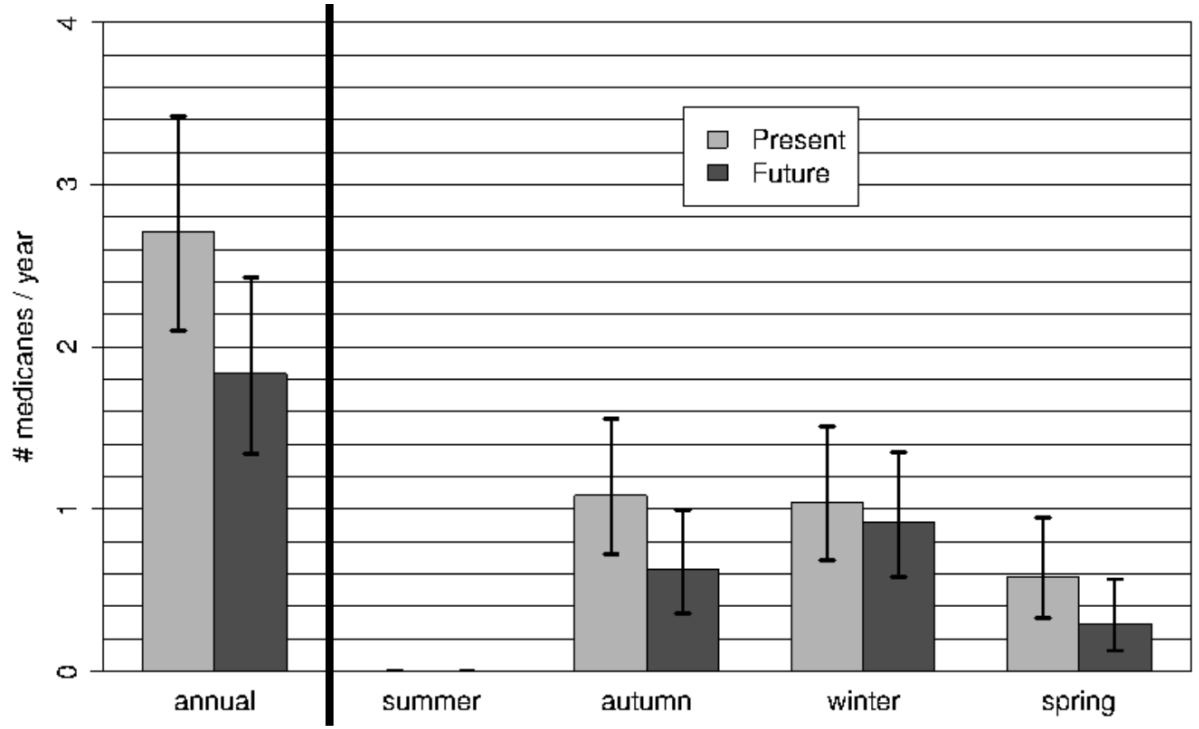

CONCLUSIONS

HadGEM3 N512 has been validated for the general Mediterranean cyclone climatology. The cyclone spatial distributions are consistent with other regional climatologies, although some discrepances in the Eastern Mediterranean basin are identified.

Medicane appearances in the model have the main features of tropical-like cyclones.

The number and the distribution of the detected medicanes are consistent with other climatologies in the present climate scenario.

The number of cyclones will be failry similar while medicanes will decrease in number and increase in intensity.

Medicane areas are projected to reduce in size but increase in density, with the Gulf of Genoa and south of Sicily emergint as the highest risk zones.


Thank you!