MESOSCALE NUMERICAL SIMULATIONS OF MEDICANES:

Comparison against satellite-derived trajectories and isolation of key physical processes

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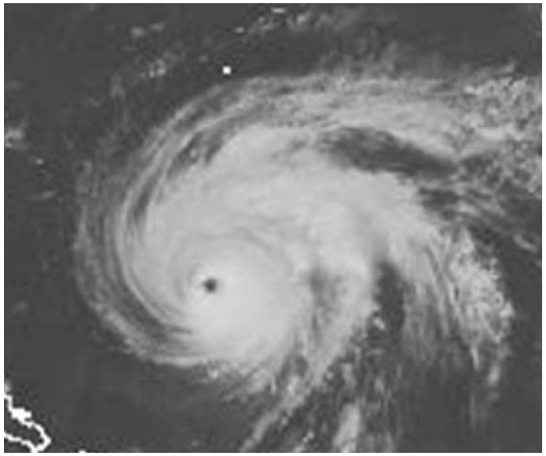
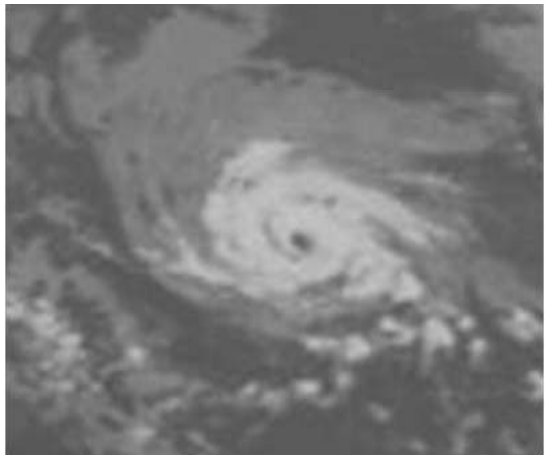
What are MEDICANES?

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

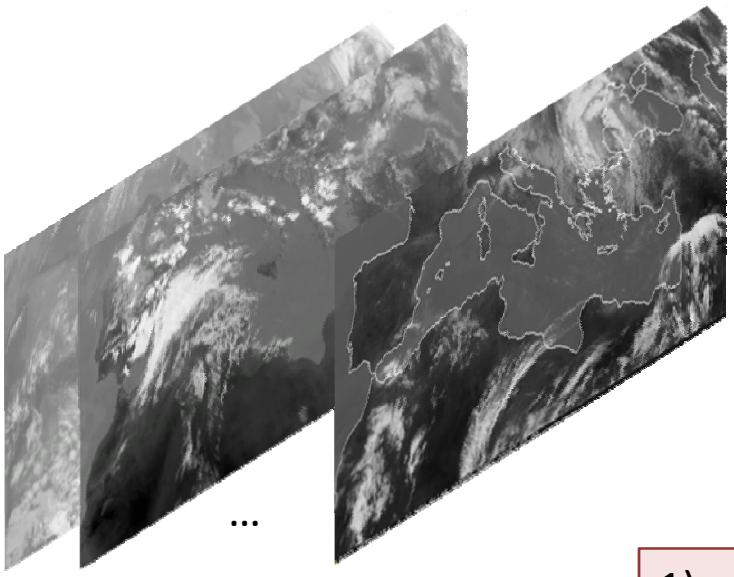


Medicane. Jan 1995

Mesoscale numerical simulations of medicanes: Comparison against satellite-derived trajectories and isolation of key physical processes

TO CREATE A DATABASE OF EVENTS

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

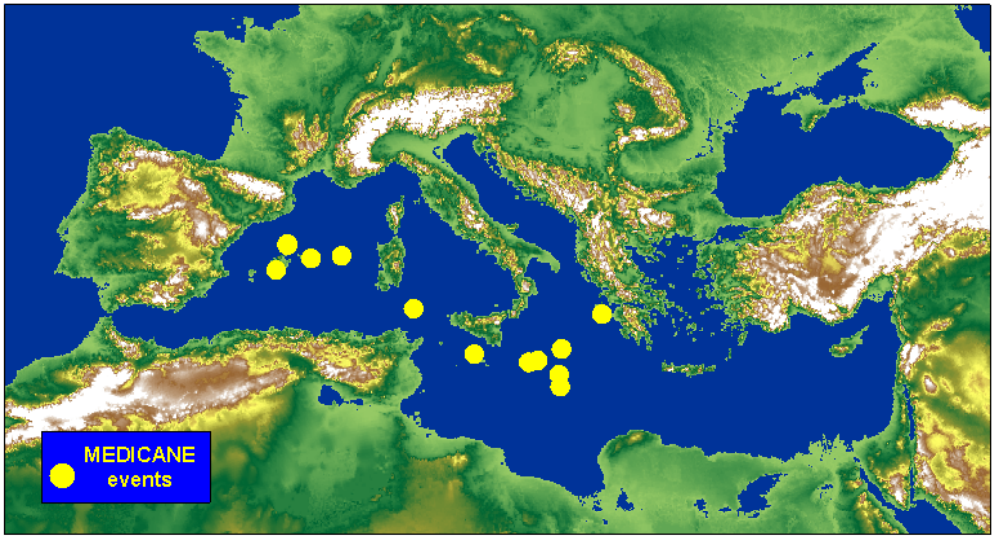
12 events

TO CREATE A DATABASE OF EVENTS

Our database

Month (#medicanes)	
March (1)	September (2)
April (0)	October (1)
May (1)	November (1)
June (0)	December (4)
July (0)	January (2)
August (0)	February (0)

GEOGRAPHYCAL DISTRIBUTION OF EVENTS

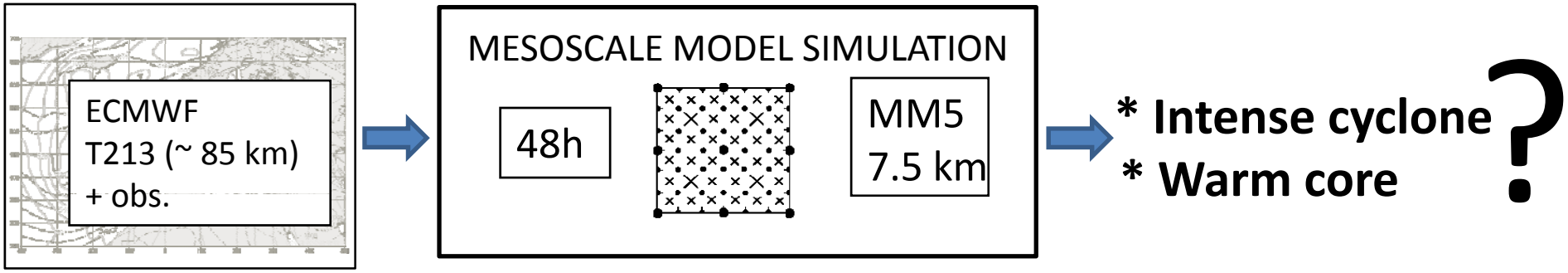


MEDICANE January 1995

Mesoscale numerical simulations of medicanes: Comparison against satellite-derived trajectories and isolation of key physical processes

Objectives

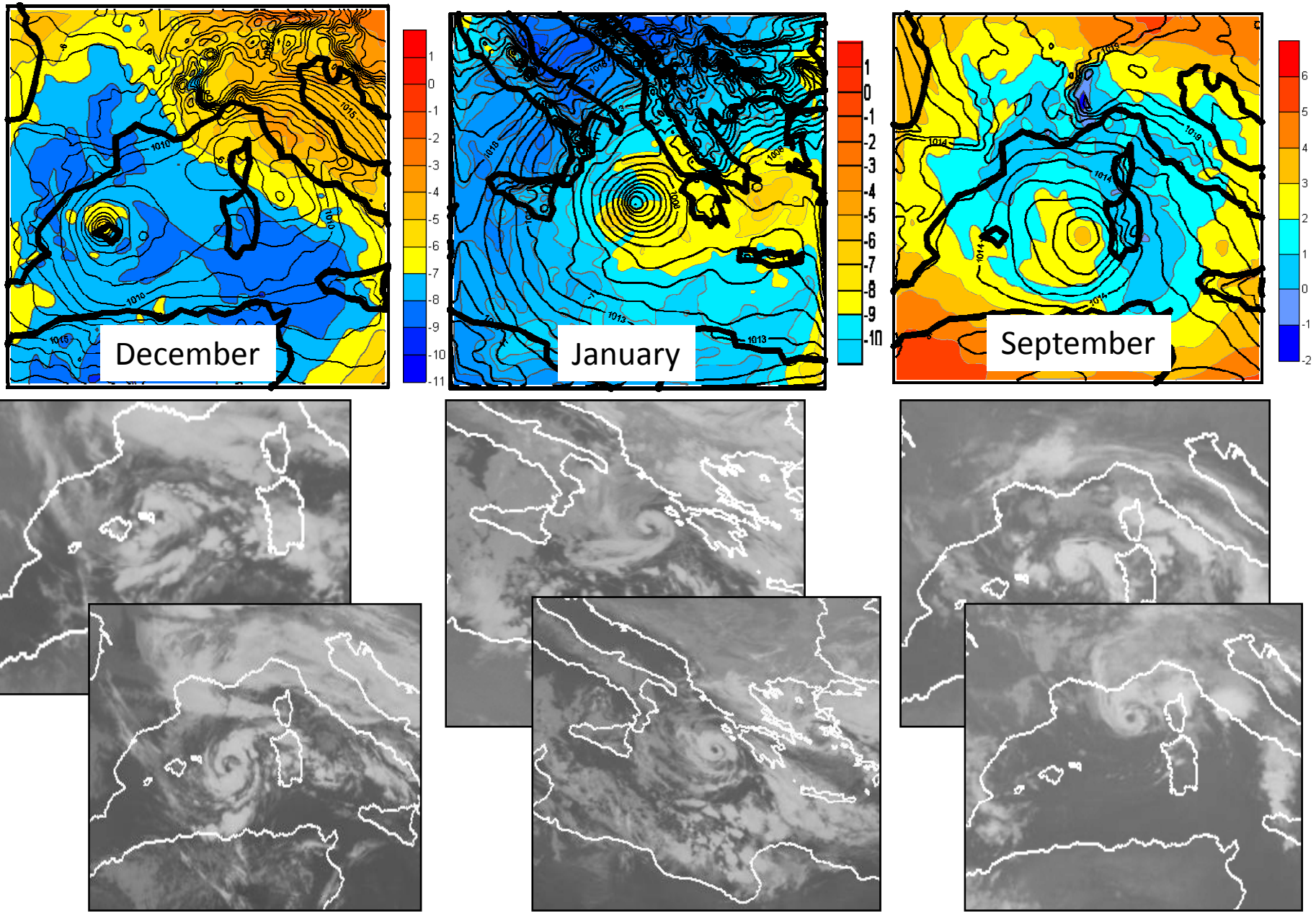
1.- To check if numerical simulations are able to reproduce the medicanes



2.- To evaluate the influence of surface heat fluxes in medicane properties

1.- Are numerical simulations able to reproduce the medicanes?

YES



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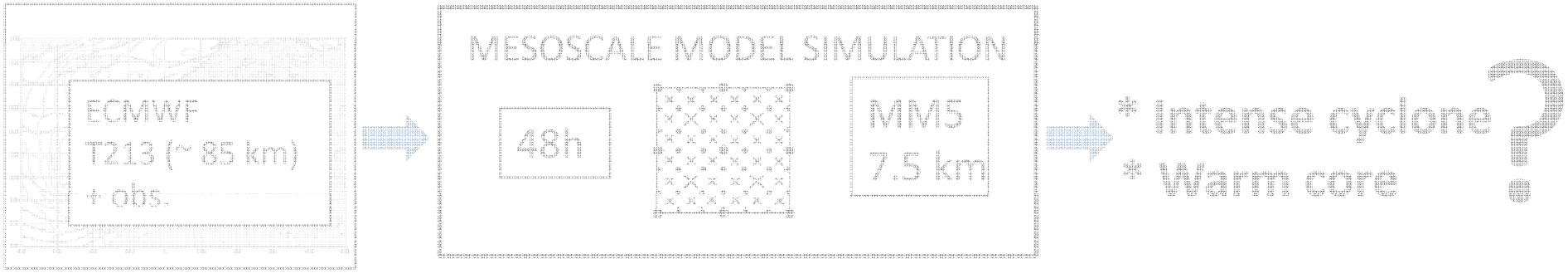


2.- To evaluate the influence of surface heat fluxes in medicane properties

- With fluxes
- Without fluxes

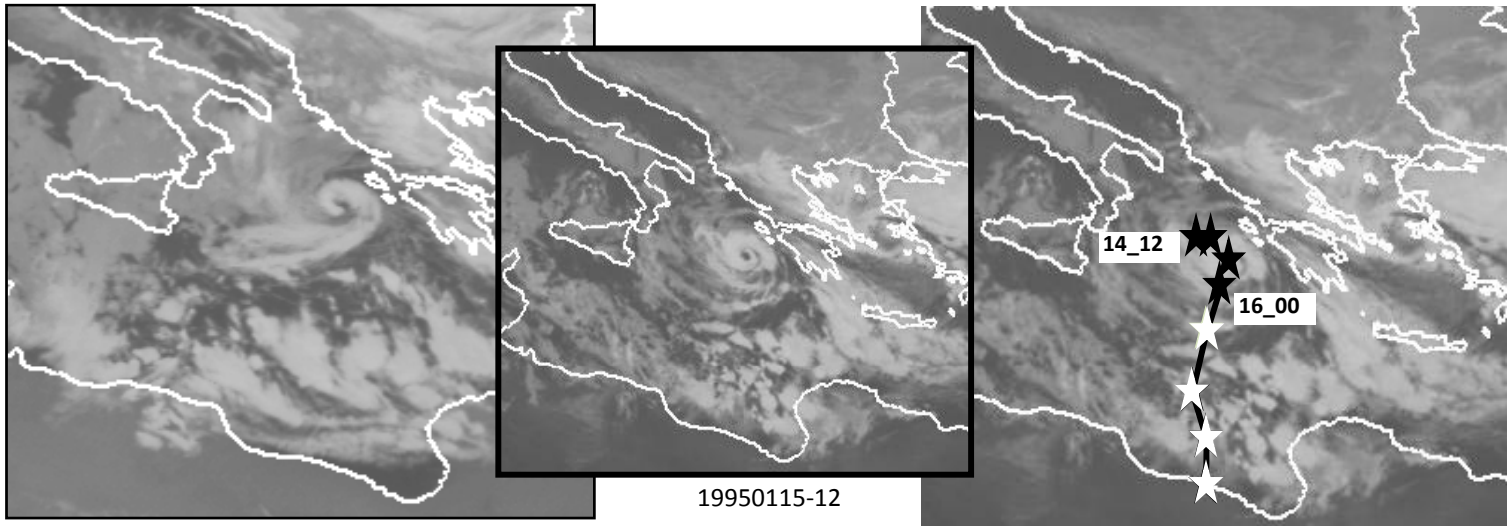
*** Trajectories**
*** Central pressure**

2.- Do surface heat fluxes influence in medicane properties ?

DATE	Influenced Trajectory	Influenced Central Pressure
September 1983	NO	
January 1995	YES	
December 1996	SLIGHTLY	
⋮	⋮	

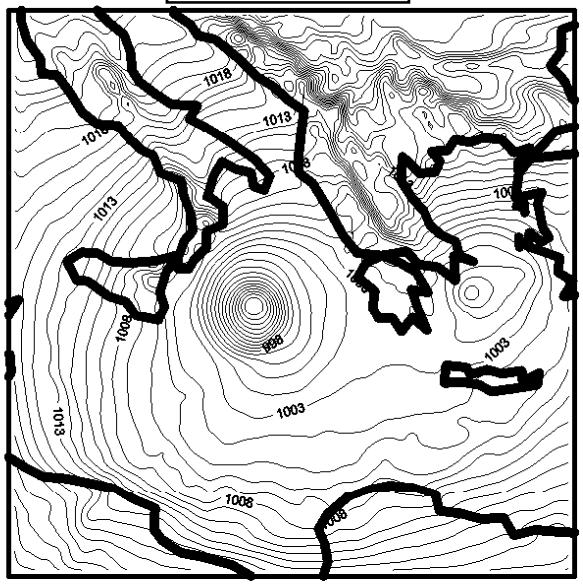
2.- Do surface heat fluxes influence in medicane properties (trajectory)?

YES

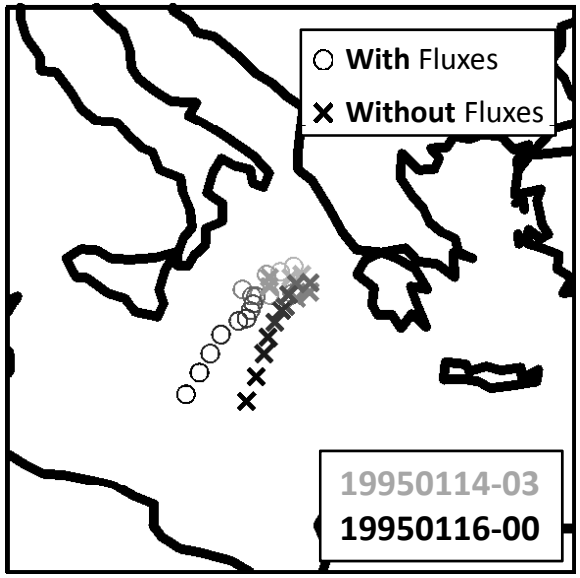


19950115-12

19950115-03



SLP every 1 hPa



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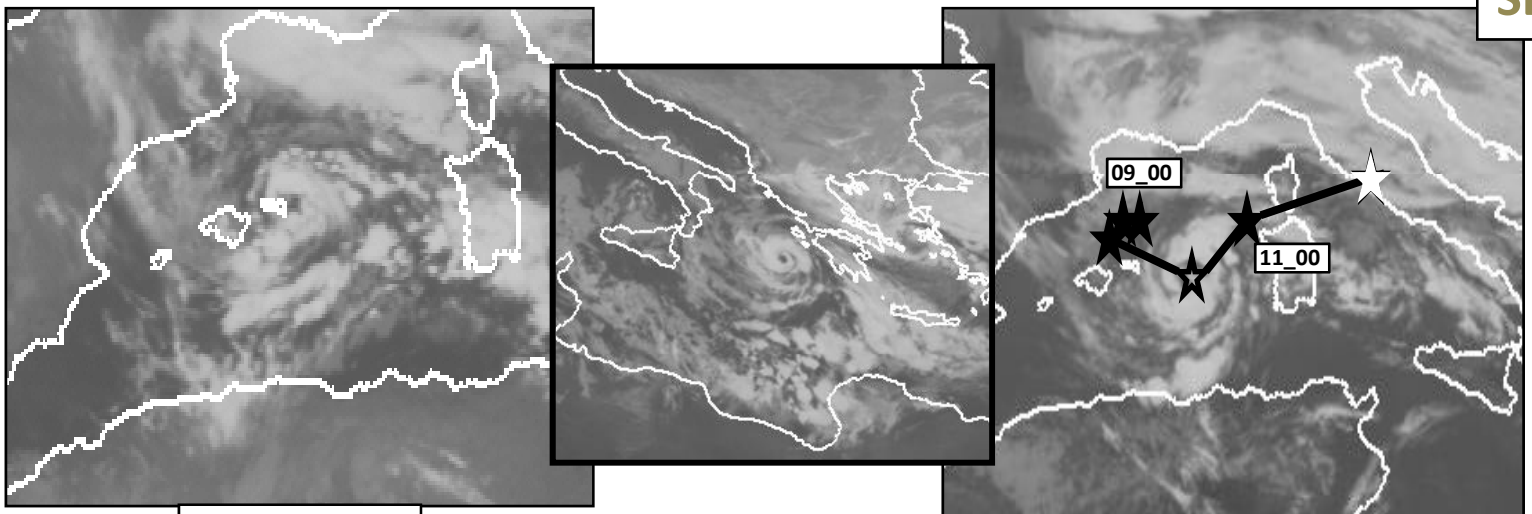
SLIGHTLY



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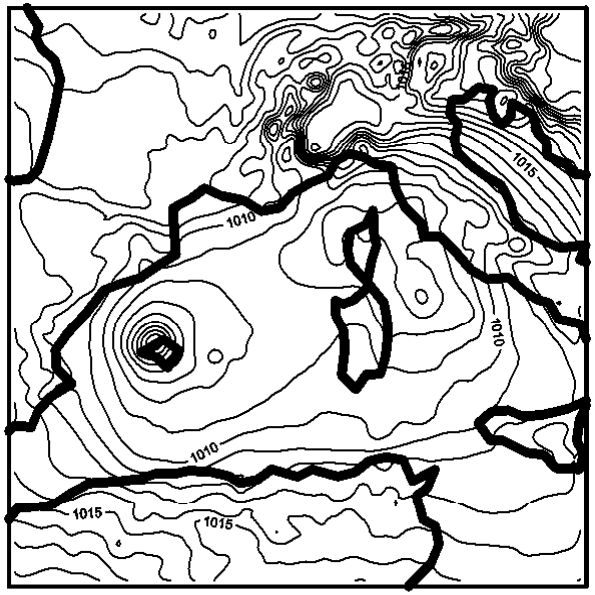
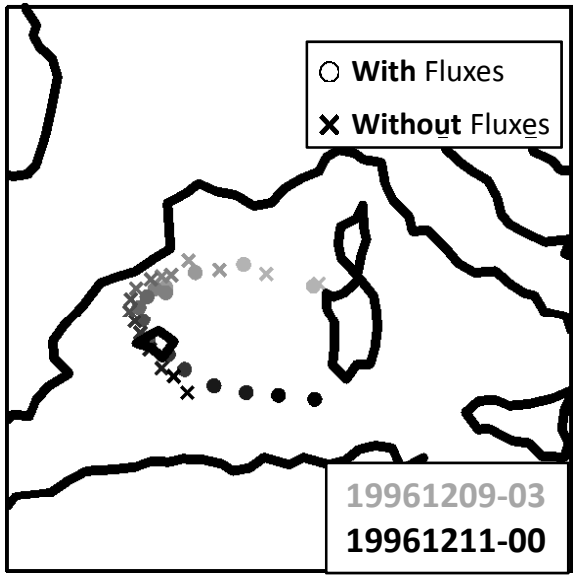
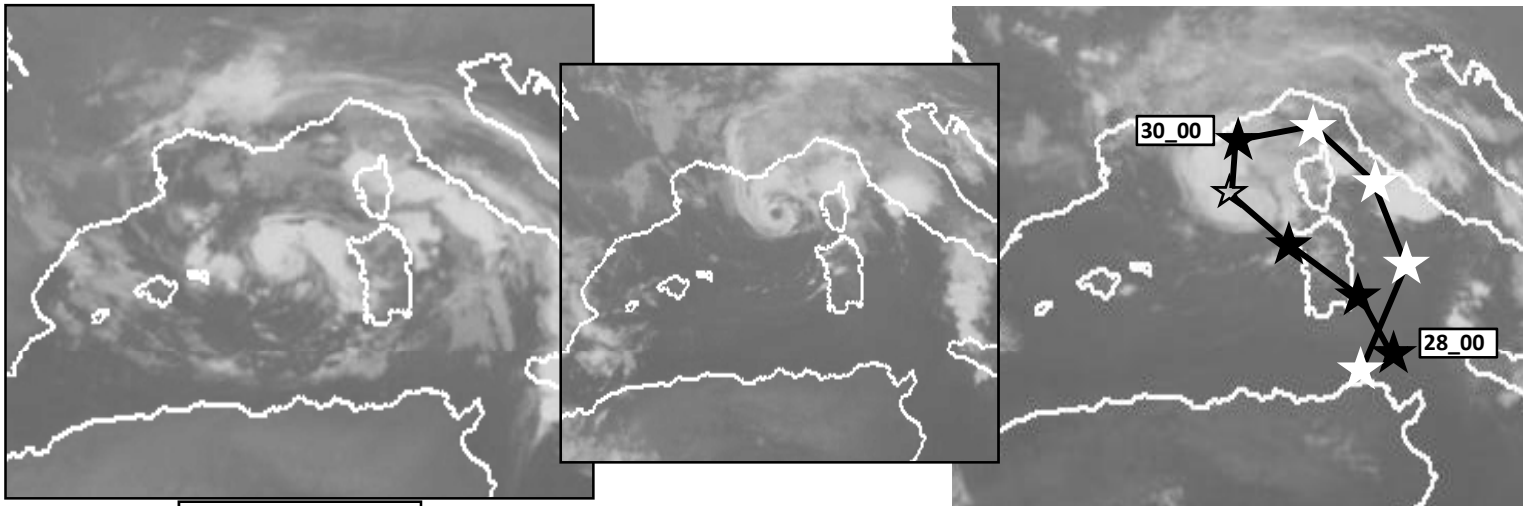


SLP every 1 hPa



2.- Do surface heat fluxes influence in medicane properties (trajectory)?

NO



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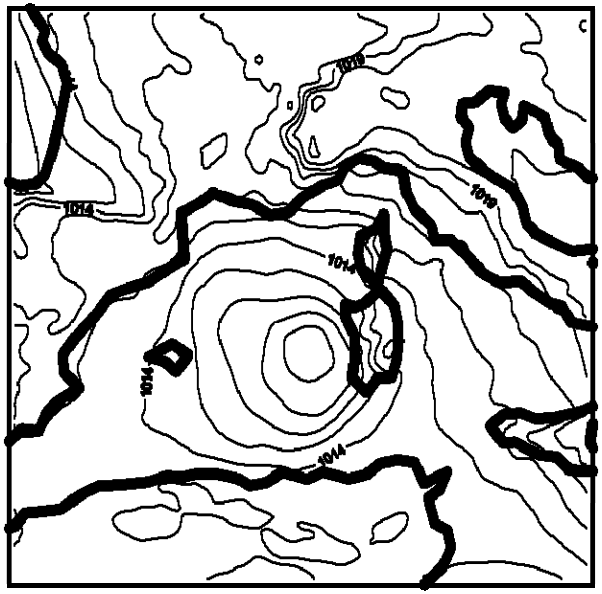
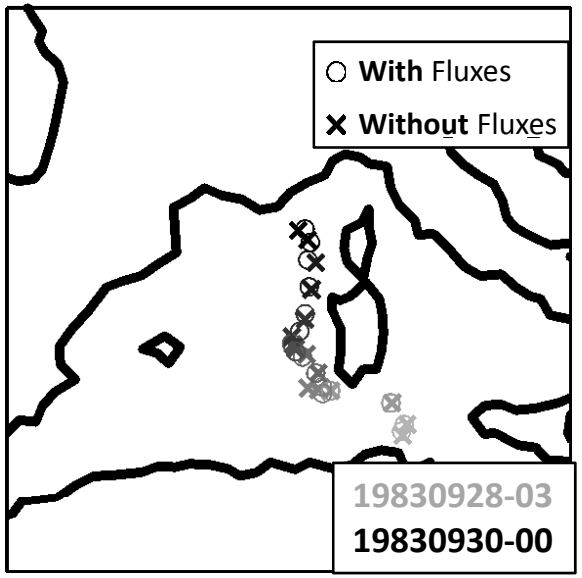
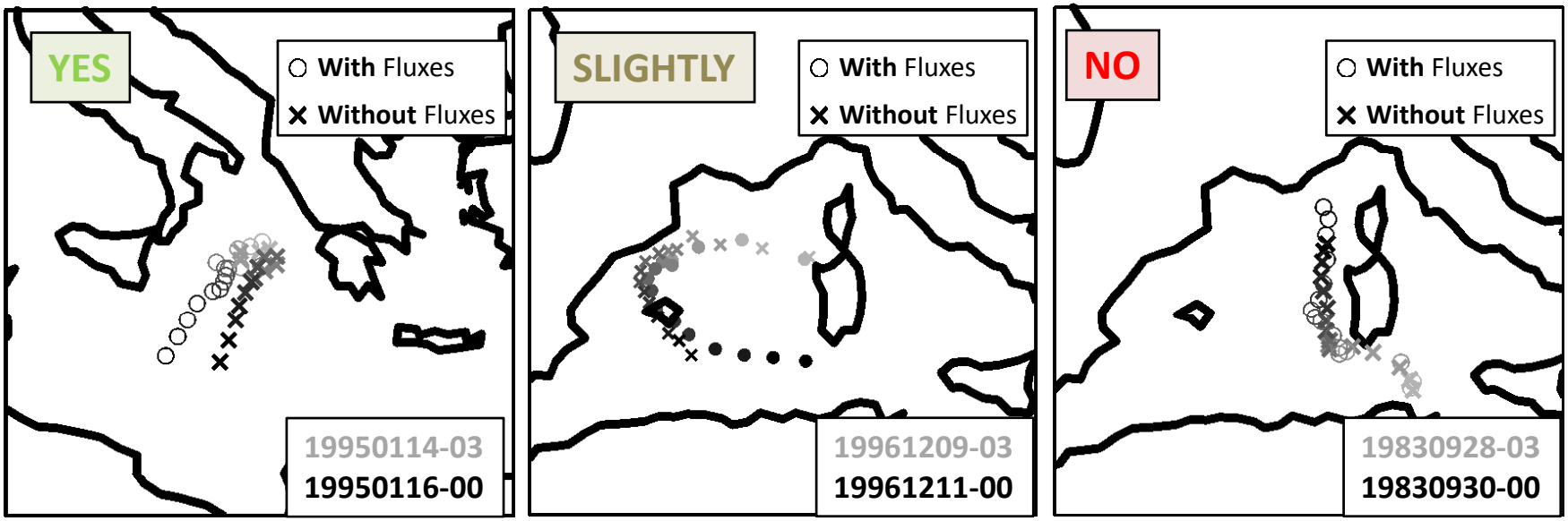


SLP every 1 hPa



2.- Do surface heat fluxes influence in medicane properties (trajectory)?

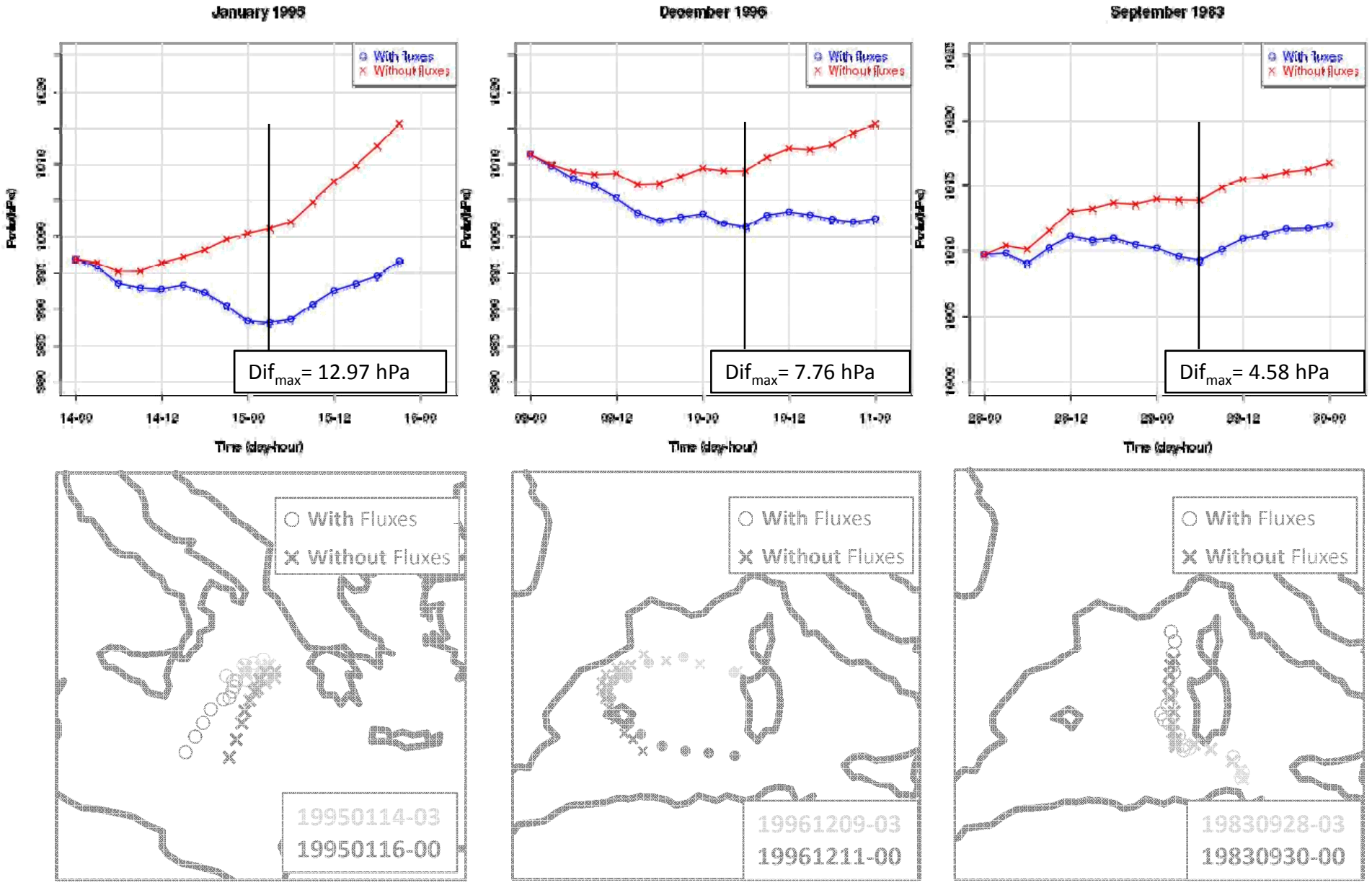


Fluxes can influence the trajectories of medicanes,
but sometimes this influence is small
or almost indistinguishable.

2.- Do surface heat fluxes influence in medicane properties ?

DATE	Influenced Trajectory	Influenced Central Pressure
September 1983	NO	YES (moderate)
January 1995	YES	YES
December 1996	SLIGHTLY	YES (moderate)
⋮	⋮	⋮

2.- Do surface heat fluxes influence in medicane properties (central pressure)?



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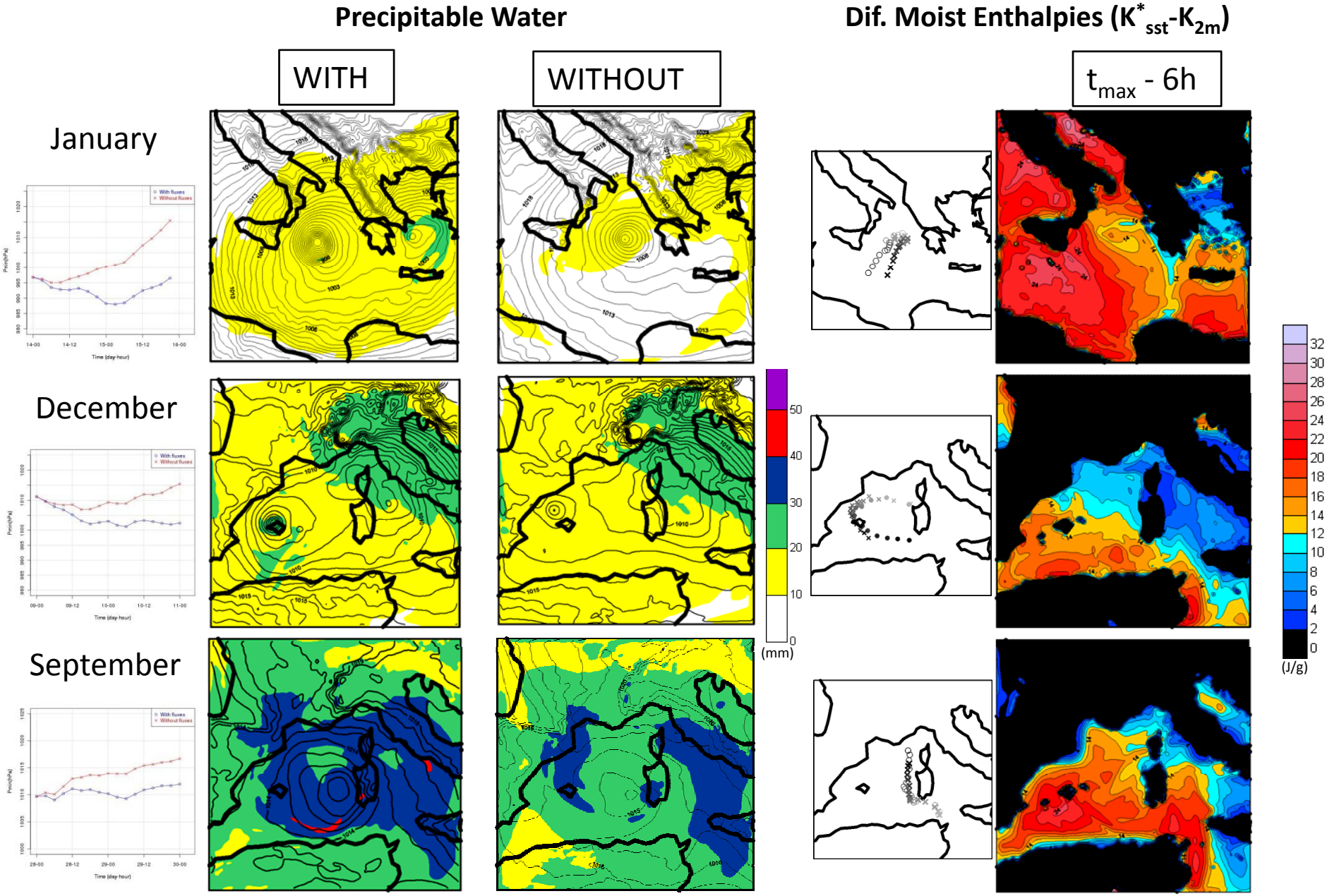

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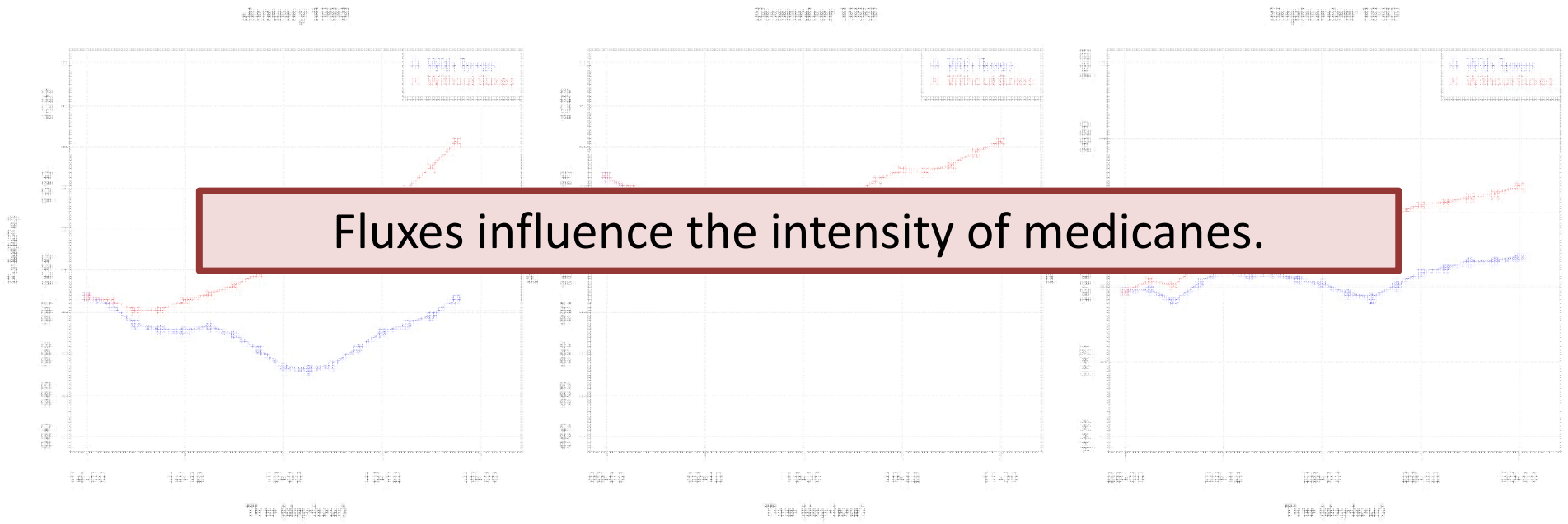
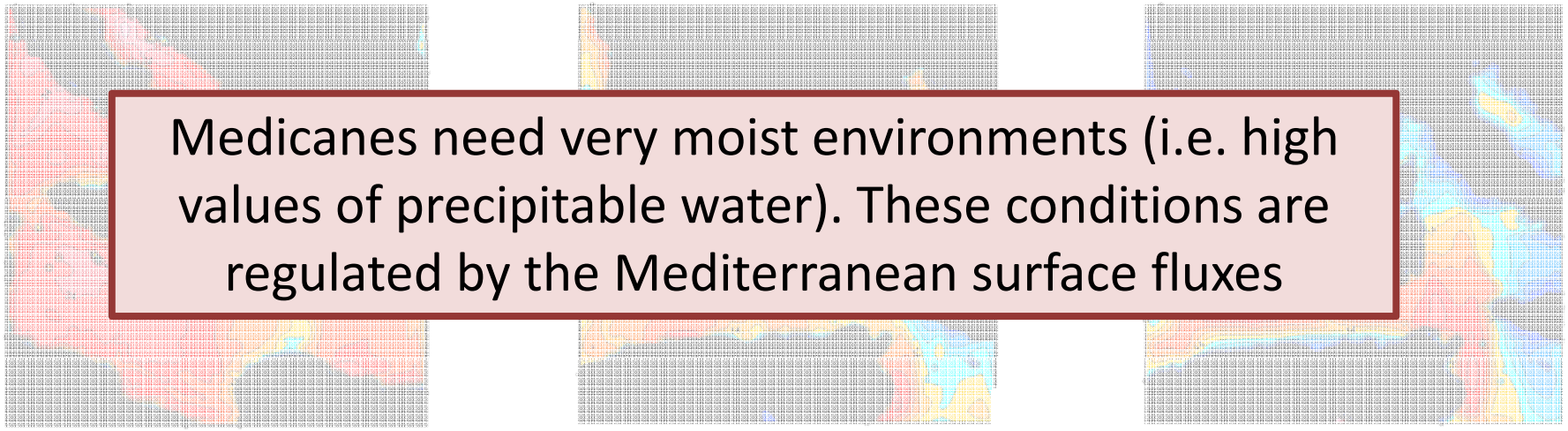


Fluxes influence the intensity of medicanes.



Medicanes need very moist environments (i.e. high values of precipitable water). These conditions are regulated by the Mediterranean surface fluxes

Conclusions & Further Work

* Numerical simulations are able to reproduce medicane events (intense cyclones with warm core).

•Surface heat fluxes influence the medicane development, helping to intensify the storm when it moves over areas with high sea-atmosphere moist enthalpy differences.

•These results reinforce the idea of an important role of air-sea intereaction for Medicane development, but the crucial factor seems to come from **dynamic forcing**. New experiments with weakened (or strengthened) upper-level PV anomalies are underway.