UN CASO DE ESTUDIO DE UN EVENTO DE CICLOGÉNESIS INTENSA EN EL MEDITERRÁNEO OCCIDENTAL

A CASE STUDY OF A STRONG CYCLOGENESIS EVENT IN THE WESTERN MEDITERRANEAN

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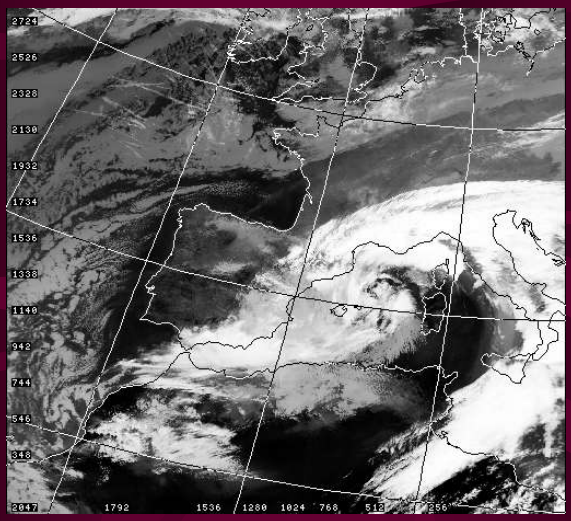
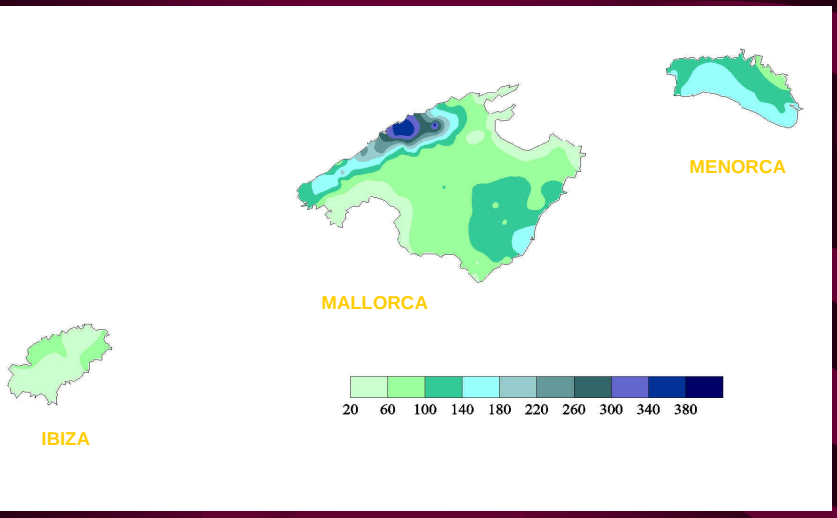
Aveiro, Portugal 10 a 13 de Fevereiro de 2003

El objetivo de este trabajo es presentar
un caso de estudio de diagnóstico y simulación numérica
de un evento de ciclogénesis intensa
que ocurrió del 10 al 12 de noviembre de 2001
en un área del mediterráneo occidental.



Ch4-IR NOAA image (11 November, 2001 / 13.29 UTC)



Observed rainfall (in mm) from Instituto Nacional de Meteorología
on 10 and11 November, 2001 in the Balearic Islands

Some effects of the cyclone in the Balearics Islands

Some effects of the cyclone in the Balearics Islands

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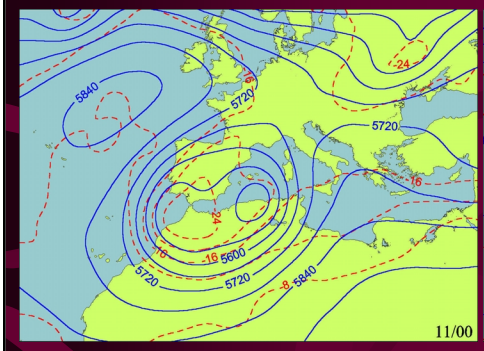
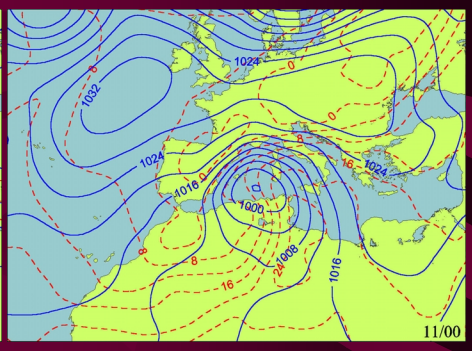
NCEP-BASED METEOROLOGICAL ANALYSES

Mid-Upper levels (H 500 / T 500)



Low levels (SLP / T 925)



In the Balearic Islands:

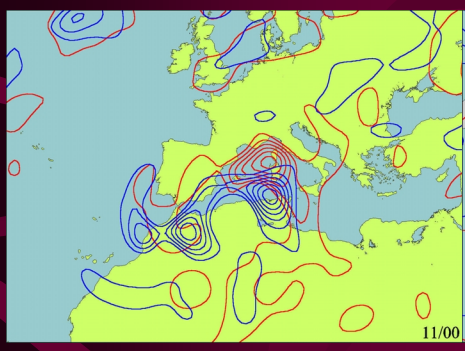
Up to 400 mm/24 h,

150 km/h winds and 12 m sea waves and,

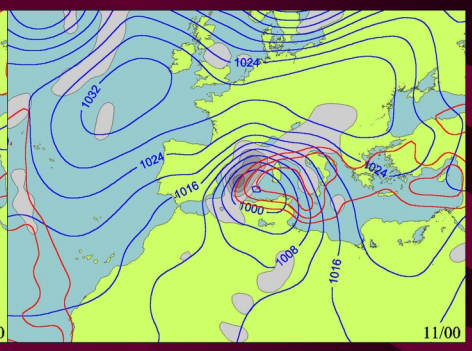
floods and severe damages on coasts

DIAGNOSIS OF THE EVENT:

Strong dynamical forcing and,
heavy precipitation promoted



QG upward forcing (700-200 / 1000-700)



Other ingredients (CI 1000-500 / WVFC 1000-700)

THE DIAGNOSTIC SYSTEM:

We have used the piecewise PV inversion technique, development by Davis and Emanuel and published in the *Monthly Weather Review, 1991*):

where, the balance condition that we have employed was derived by Charney, 1955, and we have applied the nonlinear balance equation and an approximate Ertel PV equation.

In our case study:

Time interval:

From 9-Nov-2001 at 0:00 to 12-Nov-2001 at 12:00 each 12 h, from NCEP meteorological analyses.

Anomalies:

ULev	PV perturbation above 700 hPa
LLev	Surface thermal anomaly and PV perturbation below 700 hPa
DIAB	Positive PV perturbation below 500 hPa in areas with RH > 70%

PV-based DIAGNOSIS

ULev	**PV perturbation above 700 hPa**
LLev	**Surface thermal anomaly and PV perturbation below 700 hPa**
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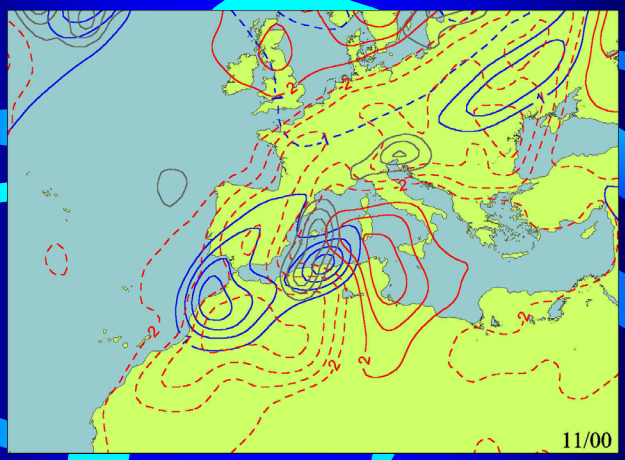
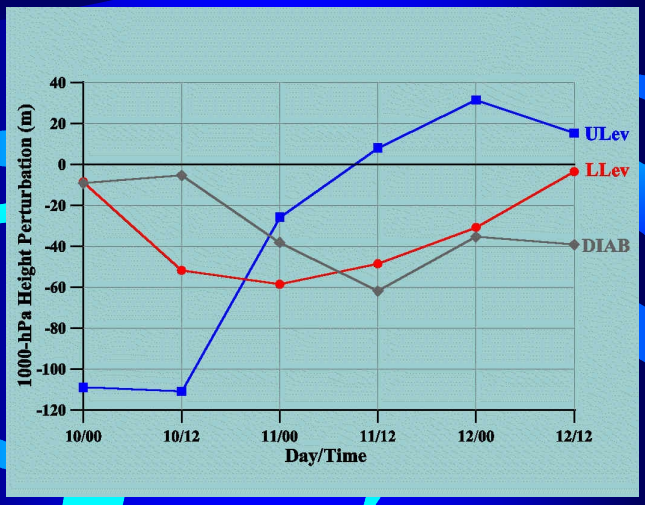
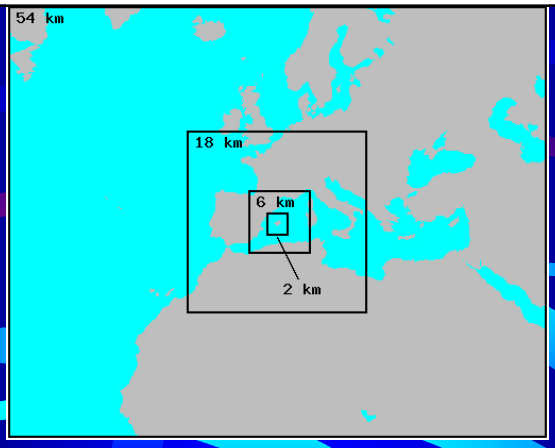


PV-based DIAGNOSIS

ULev	PV perturbation above 700 hPa
LLev	Surface thermal anomaly and PV perturbation below 700 hPa
DIAB	Positive PV perturbation below 500 hPa in areas with RH > 70%

Contribution to the surface cyclone height perturbation





The system model was applied to 48 h simulations period: 10-Nov (00h) to 12-Nov (00h), 2001

A large domain covering Europe and North Africa (54 km resolution),

A first nest covering Southern Europe and part of North Africa (18 km resolution),

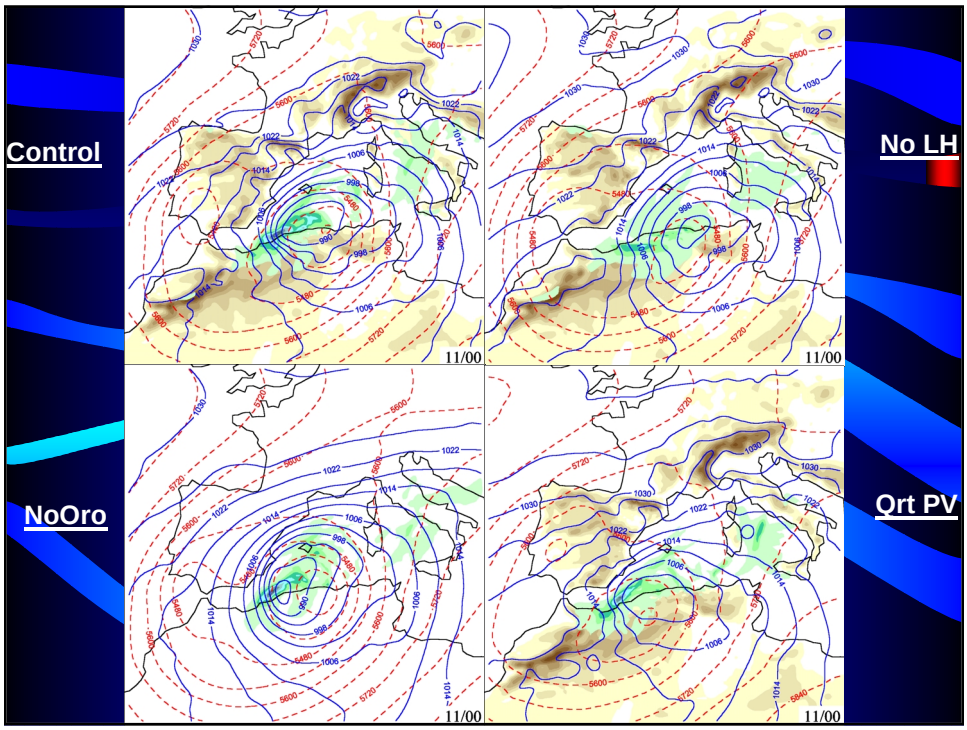
A second nest covering one part of the Western Mediterranean (6 km resolution) and,

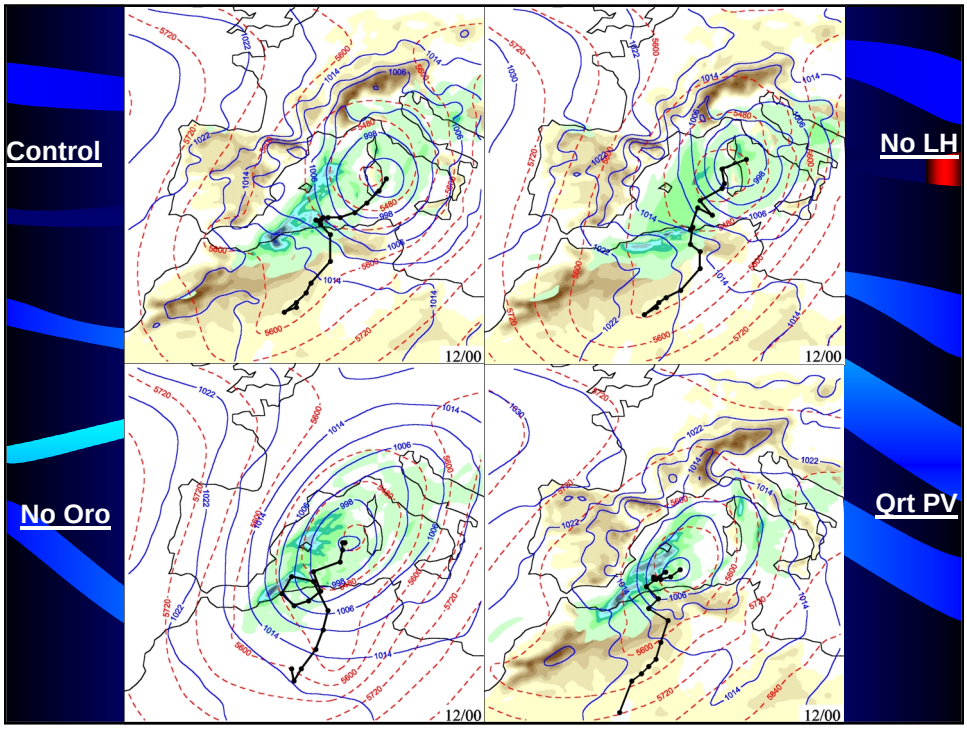
A third nest covering the Balearic Islands (2 km resolution).

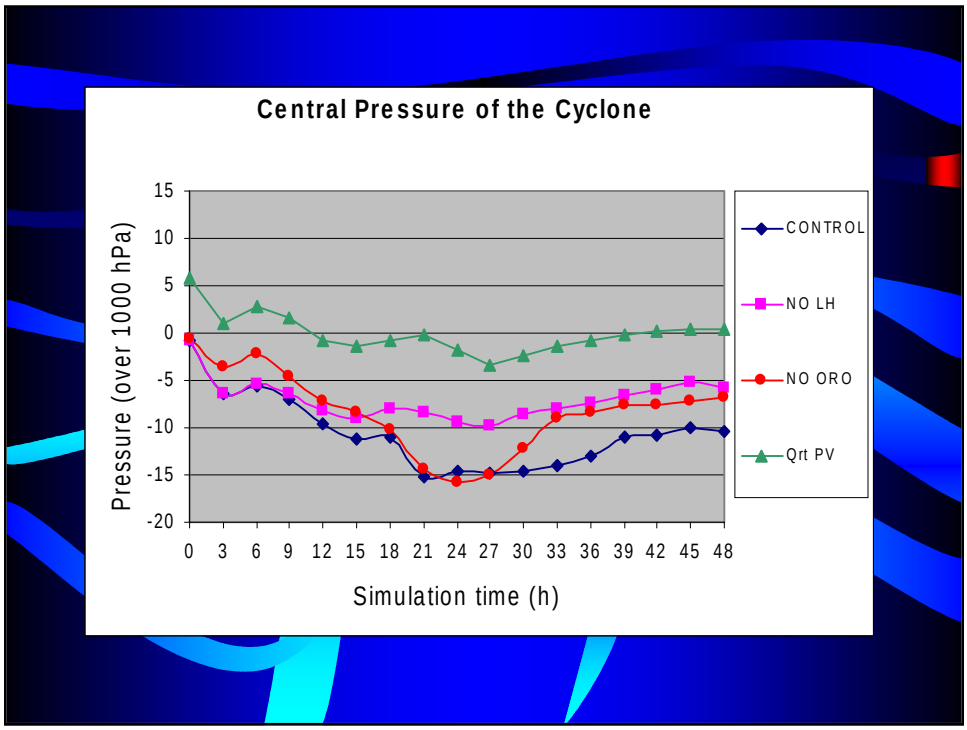
Vertical structure with 23 unequally spaced σ levels.

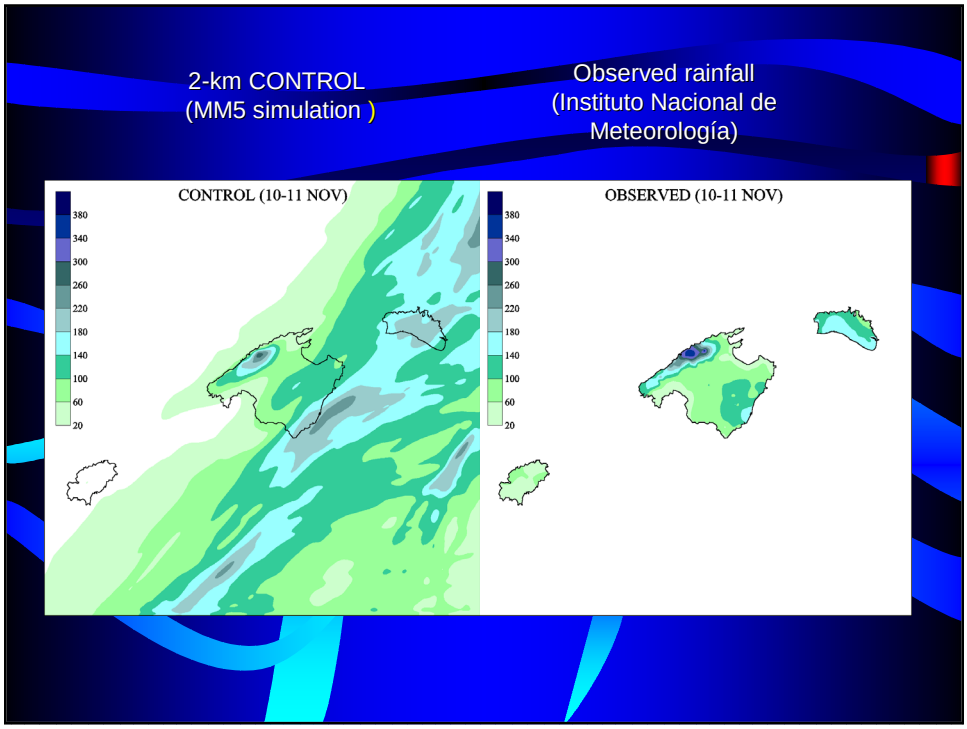
IC and BC: 2.5° NCEP analyses available at 0:00/12:00 UTC +

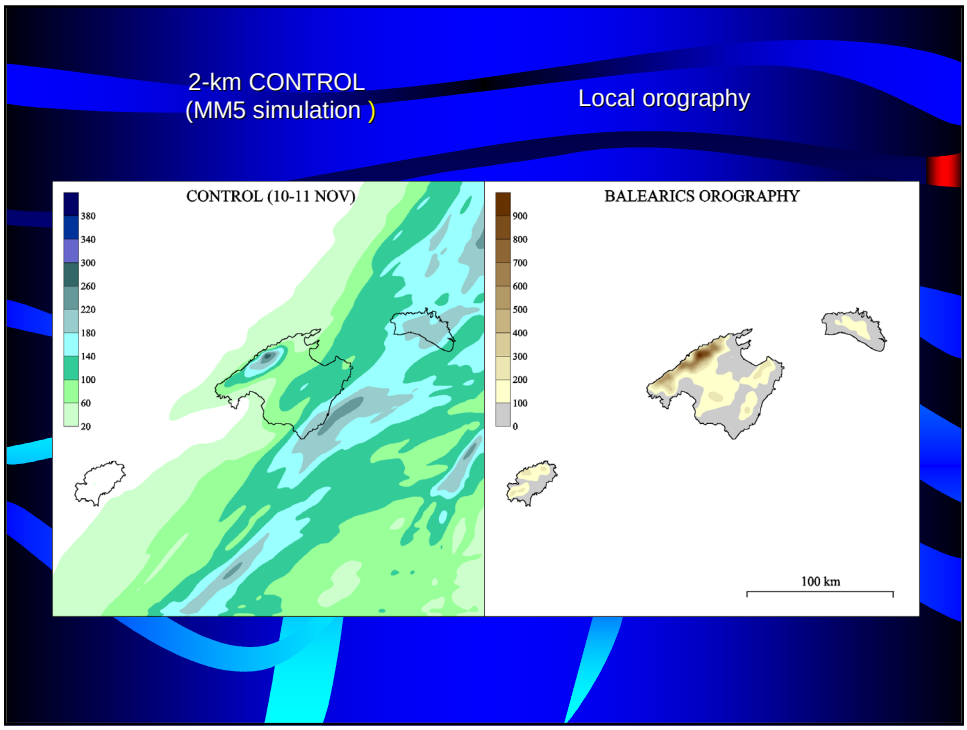
upper-air and surface observations

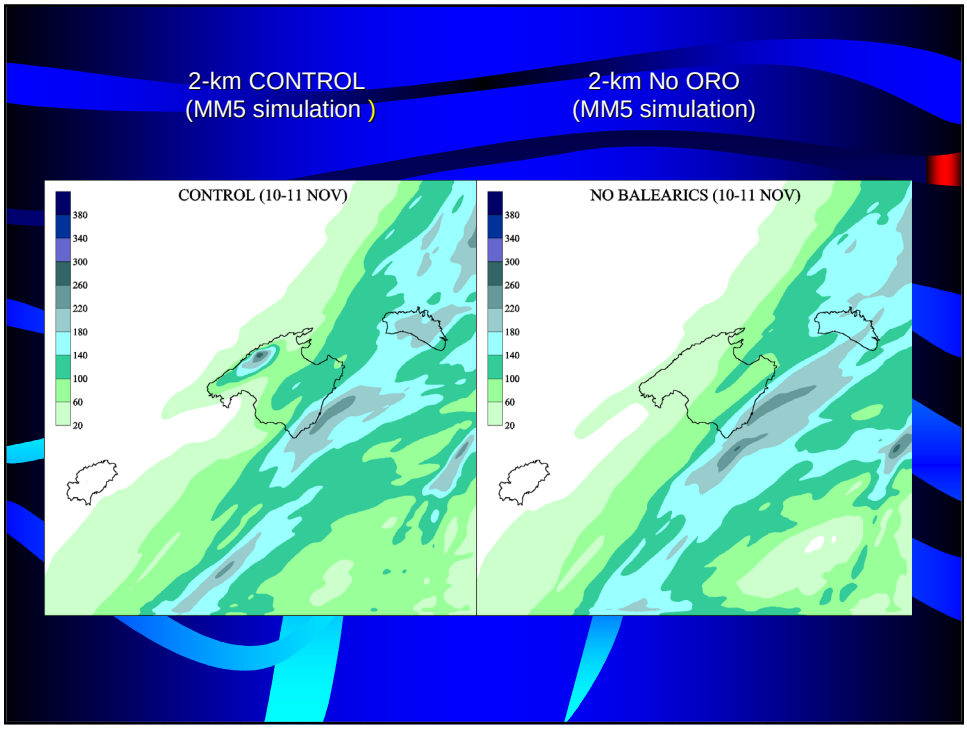

Control
No LH
NoOro
Qrt PV
11/00
11/00
11/00
11/00


Control
No LH
No Oro
Qrt PV
12/00
12/00
12/00
12/00


Central Pressure of the Cyclone
Pressure (over 1000 hPa)
15
10
5
0
-5
-10
-15
-20
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48
Simulation time (h)
CONTROL
NO LH
NO ORO
Qrt PV


2-km CONTROL
(MM5 simulation)
Observed rainfall
(Instituto Nacional de
Meteorología)
CONTROL (10-11 NOV)
OBSERVED (10-11 NOV)
380
340
300
260
220
180
140
100
60
20


2-km CONTROL
(MM5 simulation)
Local orography
CONTROL (10-11 NOV)
380
340
300
260
220
180
140
100
60
20
BALEARICS OROGRAPHY
900
800
700
600
500
400
300
200
100
0
100 km


2-km CONTROL
(MM5 simulation)
2-km No ORO
(MM5 simulation)
CONTROL (10-11 NOV)
380
340
300
260
220
180
140
100
60
20
NO BALEARICS (10-11 NOV)
380
340
300
260
220
180
140
100
60
20

SOME OF OUR CONCLUSIONS:

We have studied an extreme cyclogenesis event in the western Mediterranean, that is, the worst storm affecting the Balearic Islands in the last years.

From Quasi-geostrophic and PV-based diagnosis :

Some typical sequence of many extratropical cyclones.
A strong dynamical forcing for upward motion (and surface pressure fall).
Continuous moisture supply at low levels for heavy precipitation to occur.
The Baroclinic development plus diabatic contribution from condensation.

From numerical simulations:

Local orographic forcing was crucial for the flood-producing rainfall.
The latent heat release (LH) and the orography (Oro) in Mallorca modulated the deepening rate and trajectory of the cyclone.

Muito obrigado!

por a vossa atenção...