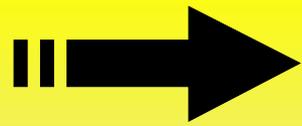
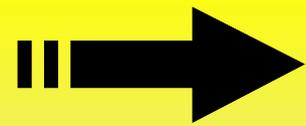


IV Reunión de la Redibérica del MM5

Aveiro – 26/27 Abril 2007



**MM5 en la ULE:
operativo / investigación**



MM5 en la ULE: operativo / investigación

I. Simulación operativa

I. Simulación operativa en el GFA

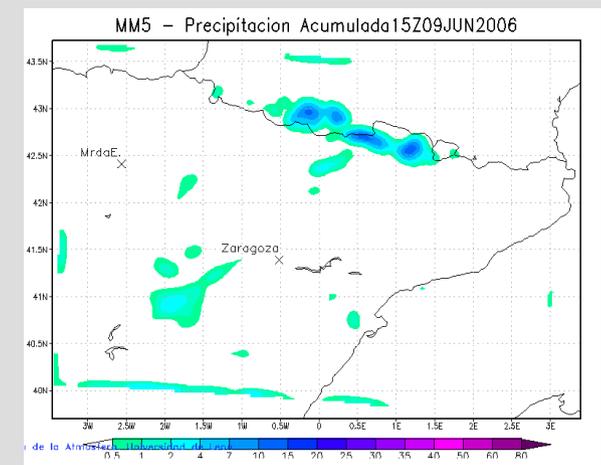
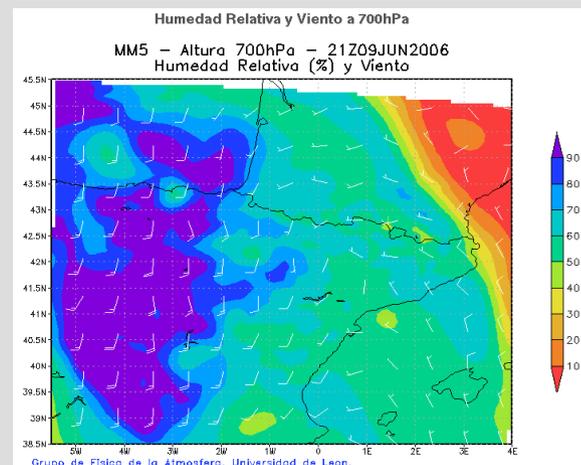
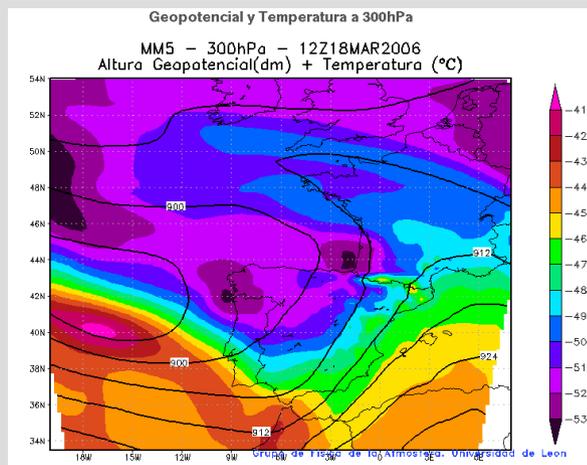
Inicio: mayo 2006

Hardware

- × 2 procesadores Intel Xeon 3066/512/533 INT-MPGA
- × 2 memorias DDR 512 MB Kingston 333 ECC REG

Paso 1. Objetivo

Realizar una simulación operativa a 48 h (fase experimental) en tres dominios anidados como **apoyo a radar ULE** en Zaragoza.



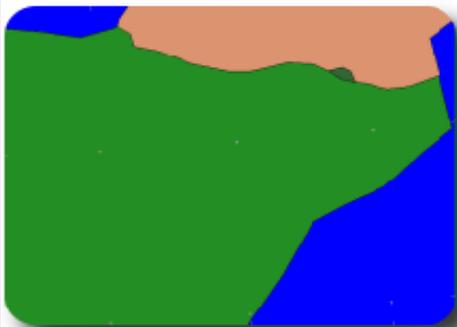
I. Simulación operativa en el GFA



Dominio 1: Suroeste Europeo.
50 x 50 puntos. 48 km



Dominio 2: NE peninsular.
52 x 52 puntos. 16 km



Dominio 3: Valle del Ebro.
76 x 100 puntos. 5,3 km

Inicialización: GFS

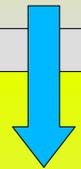
Cumulus parameterizations:

Betts-Miller / Grell / Explicit

PBL scheme: MRF

Moisture scheme:

Goddard microphysics



Inicialización: GFS

Cumulus parameterizations:

Anthes Kuo / Kain Fritsch 2 / explicit

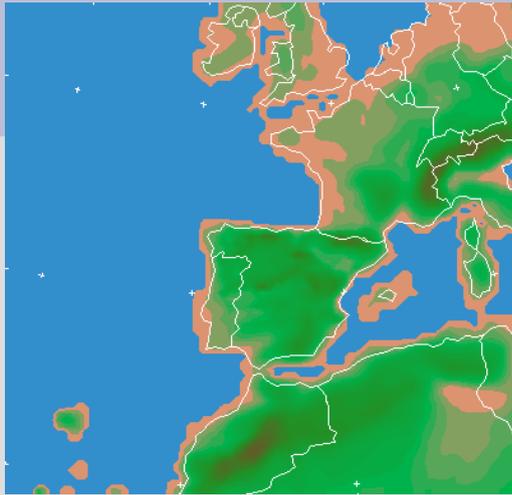
PBL scheme: MRF

Moisture scheme: Reisner graupel

(Numerical simulation and sensitivity study of a severe hailstorm in northeast Spain. 2007.

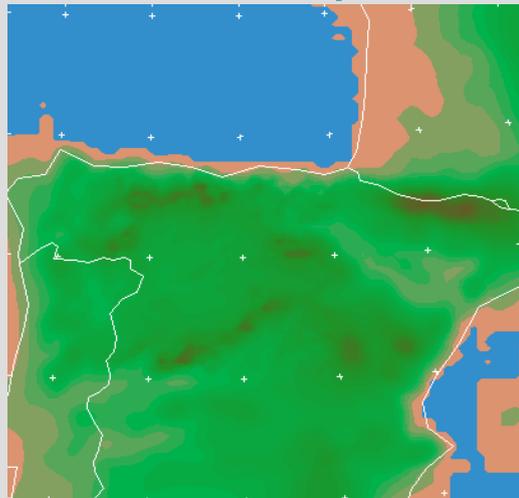
Garcia-Ortega et al., *Atmos. Res.*, 83, 225-241.)

I. Simulación operativa en el GFA



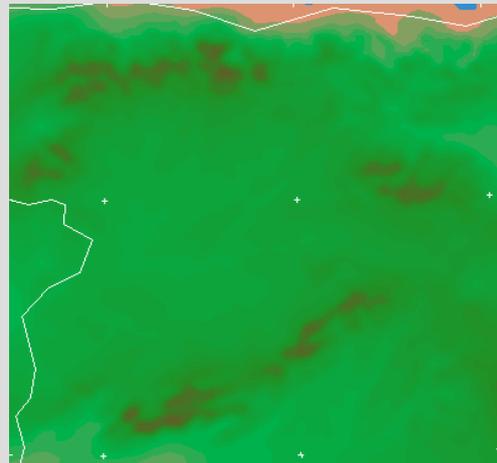
Dominio 1: 36 km

80 x 80 puntos



Dominio 2: 12 km

76 x 76 puntos



Dominio 3: 4 km

100 x 106 puntos

Paso 2. Objetivo

Desarrollo e implantación de un sistema de predicción meteorológica para Castilla y León (LE017B06).

Inicialización: GFS

Cumulus parameterizations:

Anthes Kuo /Kain Fritsch 2 /explicit

PBL scheme:MRF

Moisture scheme: Reisner graupel

(Numerical simulation and sensitivity study of a severe hailstorm in northeast Spain. 2007.

Garcia-Ortega et al., *Atmos. Res.*, 83, 225-241.)

I. Simulación operativa en el GFA

Problema: Tiempo de simulación Castilla y León, de 3h 45 min a 7 h.

Hardware

Inicio: junio 2007

- × 4 procesadores Intel Xeon MP Dual Core 7020 (2.67 FSB)
- × 1 Dimm memoria 512 Mb PC400 ECC + 2 Dimm 1024 Mb DDR2

Paso 3. Objetivo

Predicción diaria a 48/72 horas, centrada en

Castilla y León y Valle del Ebro

- × Desarrollo de los proyectos LE017B06 y LE004A06
- × Radar ULE (SEVERUS) y CHEBRO

I. Simulación operativa en el GFA

Paso 3. Objetivo

Predicción diaria a 48/72 horas, centrada en **Castilla y León y Valle del Ebro (núm. dominios por decidir)**

- × Desarrollo de los proyectos LE017B06 y LE004A06
- × **Radar ULE:** Observaciones, análisis y modelización de las situaciones de granizo y lluvias intensas para la mejora de la predicción a corto plazo (SEVERUS, ULE/UB) y **Confederación Hidrográfica del Ebro** (fase de pruebas de inicialización modelo hidrológico y asistencia técnica -nowcasting via radar-)

I. Simulación operativa en el GFA

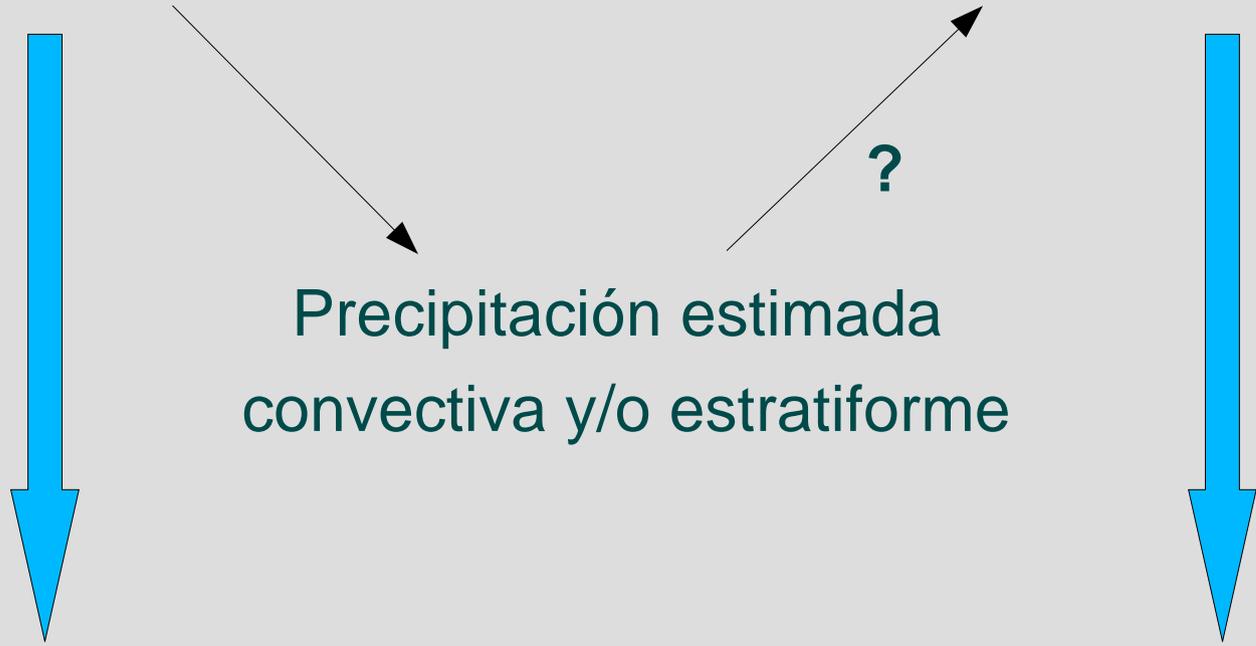
Futuro próximo

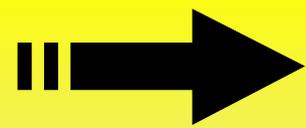
Radar ULE

MM5 Valle del Ebro

Precipitación estimada
convectiva y/o estratiforme

Mejora en la **toma de decisiones** y modelo hidrológico?





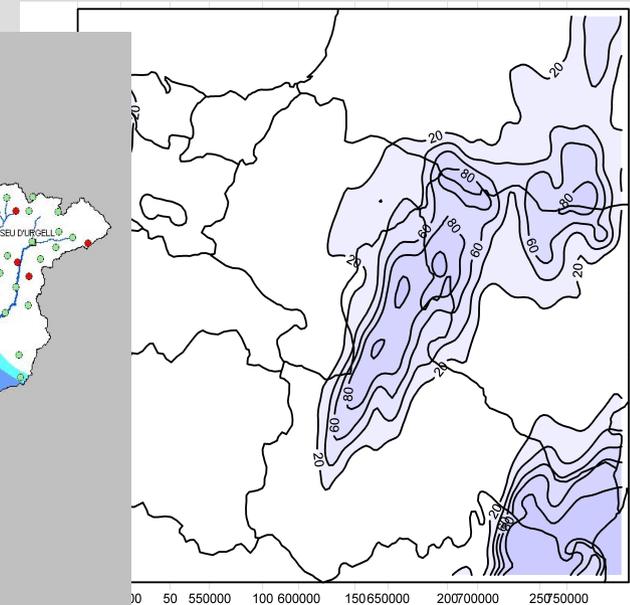
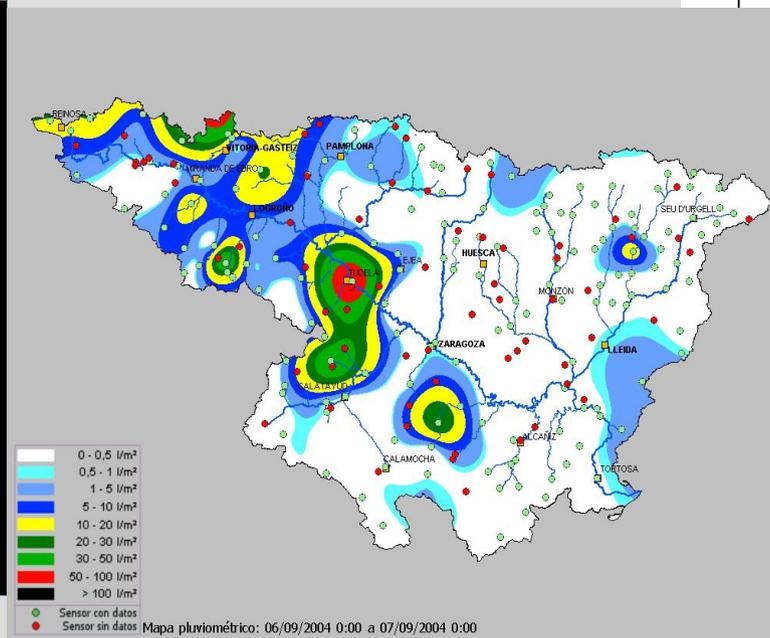
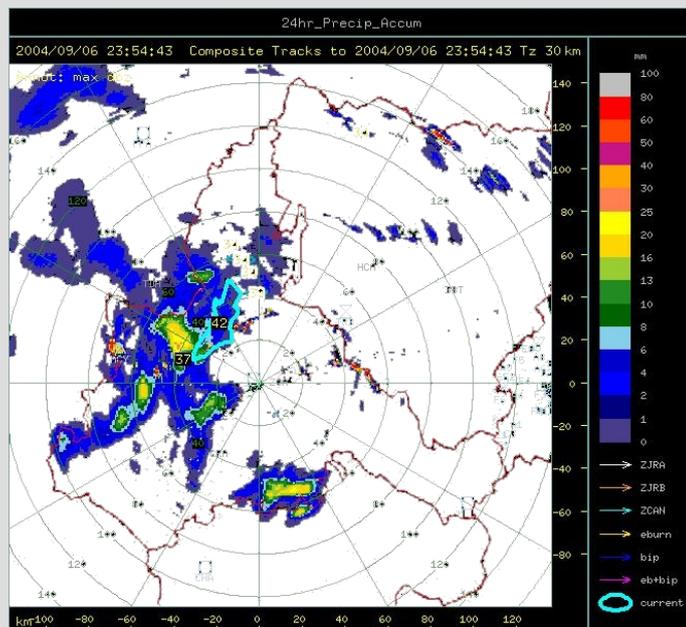
**MM5 en la ULE:
operativo / investigación**

II. Investigación

II. Investigación en el GFA

Estudio de casos de precipitaciones intensas (lluvia/granizo) :

- **El Valle del Ebro**
- Estado de Mendoza (Argentina)

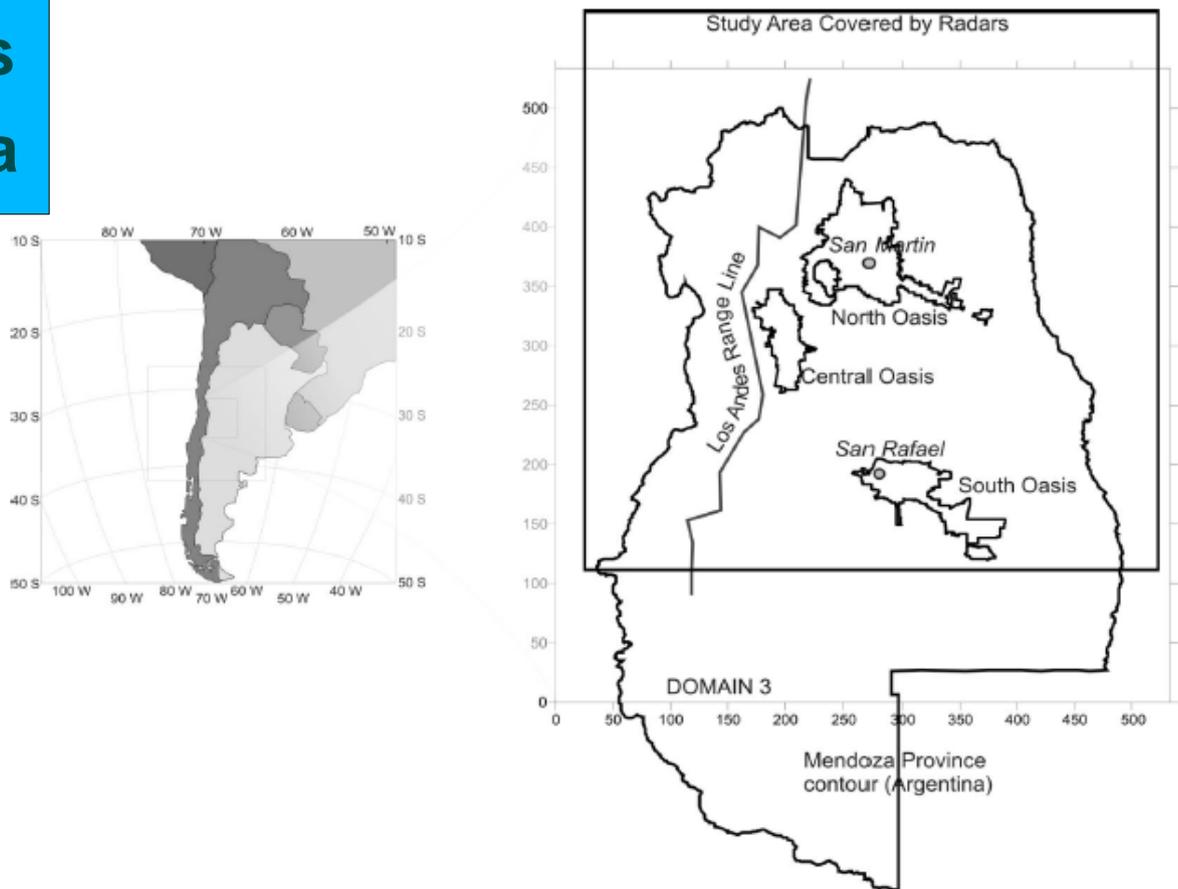


II. Investigación en el GFA

Estudio de dos casos
de convección severa

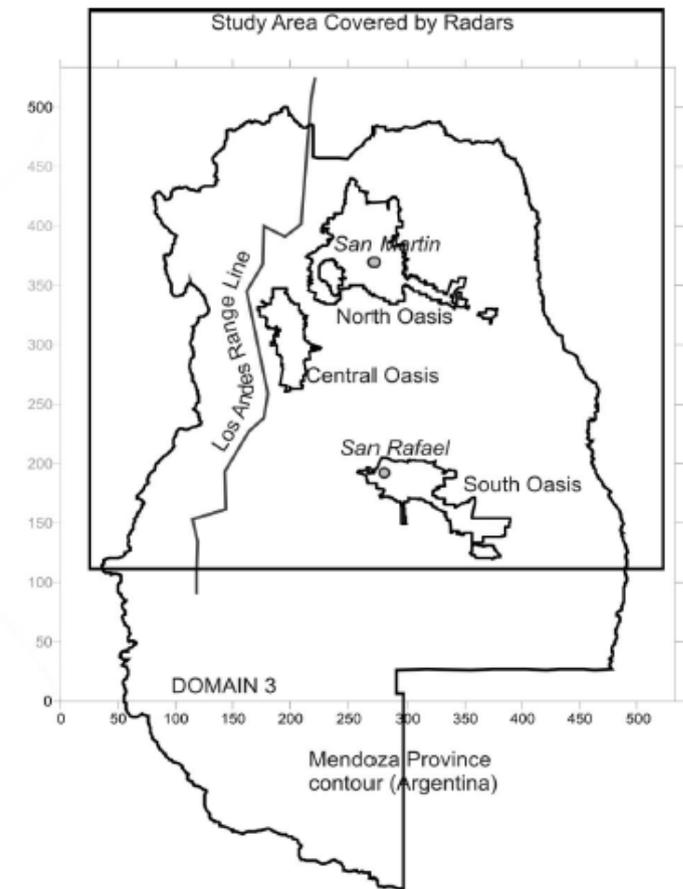
Estado de Mendoza
(Argentina)
Área de estudio

Fig. 1. Target area. The axis figures of the domain 3 area are expressed in km. The thicker line box corresponds to the study area covered by radars.



II. Investigación en el GFA

Fig. 1. Target area. The axis figures of the domain 3 area are expressed in km. The thicker line box corresponds to the study area covered by radars.

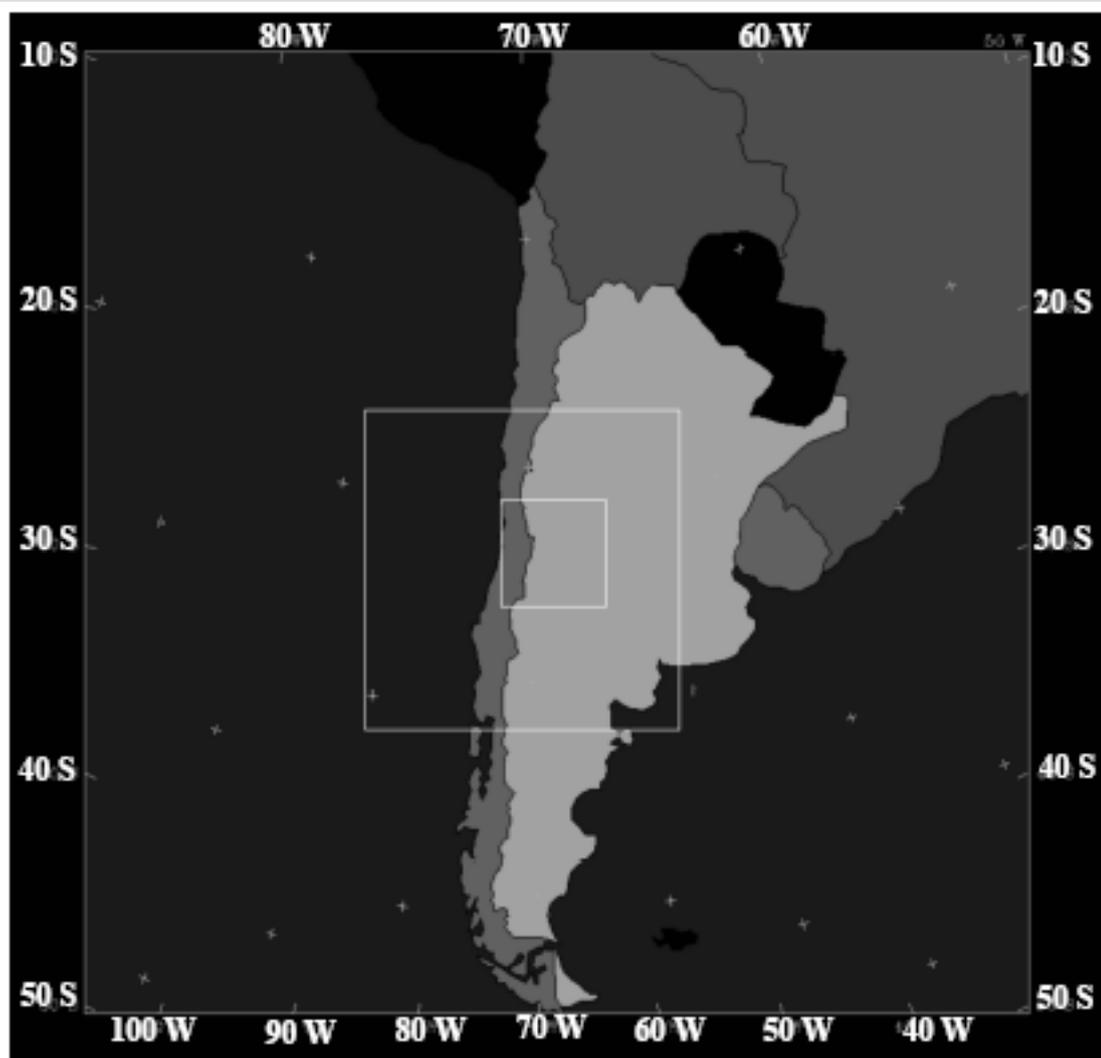


II. Investigación en el GFA

Simulación con tres dominios anidados con resoluciones espaciales de 4, 12 y 36 km.

Caso 1: 20041224 (00h) /
20041225 (06h)

Caso 2: 20050105 (00h) /
20050106 (06h)



II. Investigación en el GFA

Fig. 3. Total precipitation estimated by the S-band radars a) from 1800 UTC (23 December 2004) to 0600 UTC (24 December 2004); b) from 1800 UTC (4 January 2005) to 0600 UTC (5 January 2005). Areas with precipitation over 5 mm are in light grey. Areas with precipitation over 60 mm are in dark grey.

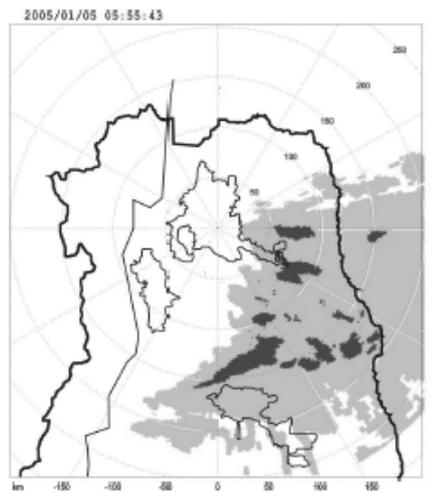
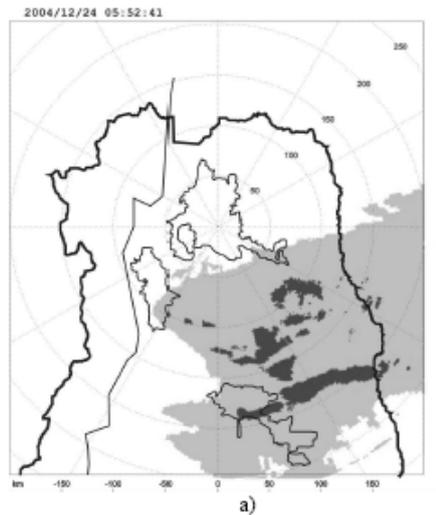
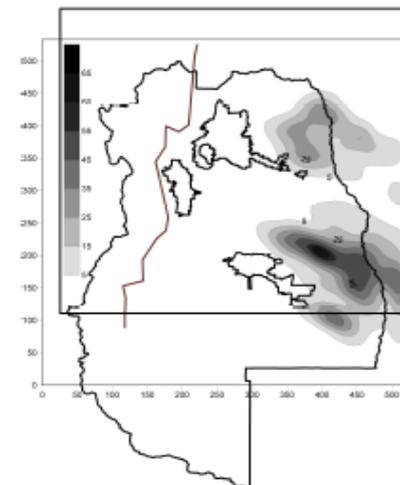
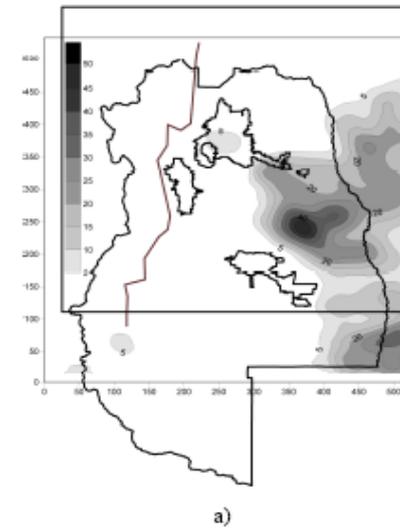
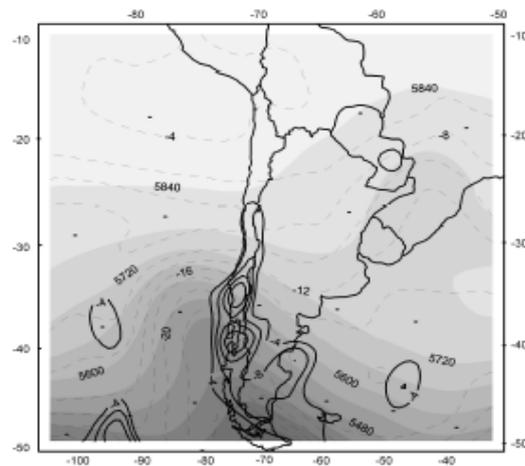


Fig. 8. Simulated total precipitation field (mm) for domain 3, a) from 1800 UTC (23 December 2004) to 0600 UTC (24 December 2004); b) from 1800 UTC (4 January 2005) to 0600 UTC (5 January 2005). The box in bold line represents the study area covered by radars.



II. Investigación en el GFA

Fig. 7. Geopotential (gpm, shaded areas), temperature ($^{\circ}\text{C}$, dashed line) and negative temperature advection under $-4 \text{ K}/12 \text{ h}$, (500 hPa) at 1200 UTC in domain 1, a) 23 December 2004; b) 4 January 2005.



a)

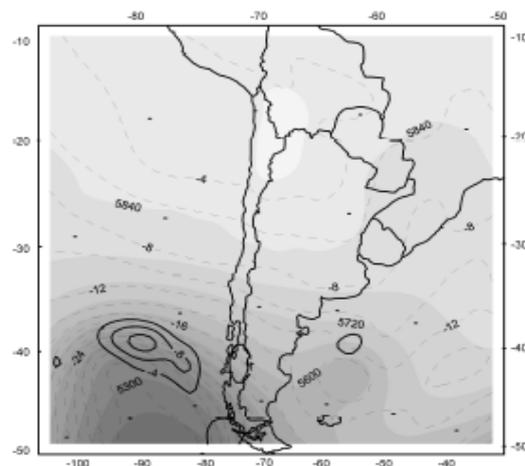
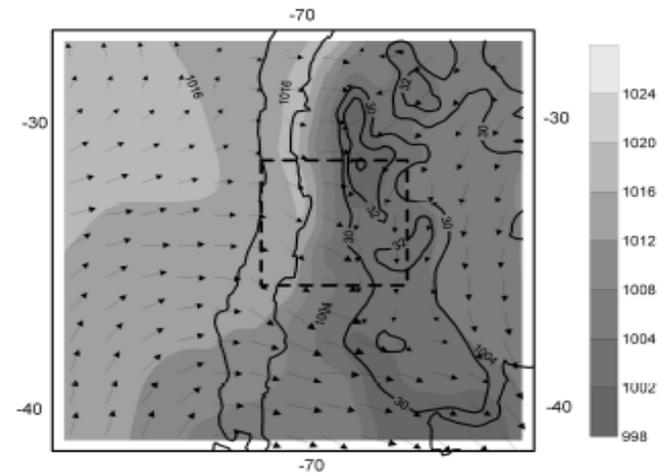
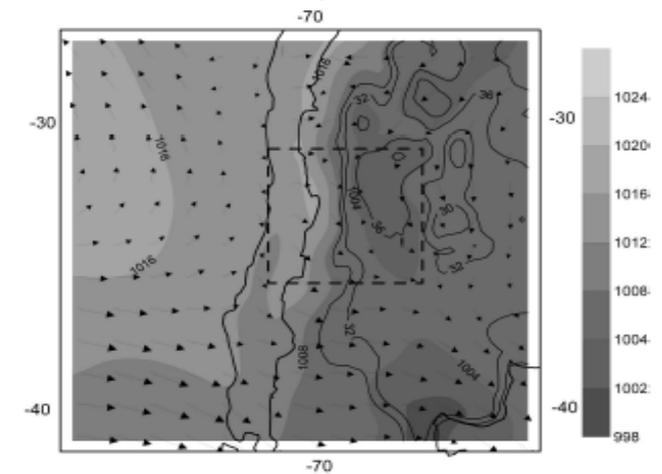


Fig. 9. Sea level pressure (hPa, shaded), surface temperature (isotherms of $T > 30^{\circ}\text{C}$, continuous line) and horizontal component of wind field at 850 hPa, at 1800 UTC for domain 2, a) 23 December 2004 -Maximum wind speed is 22.4 ms^{-1} -; b) 4 January 2005 -Maximum wind speed is 20.0 ms^{-1} -. The box in dashed line shows the third domain.



a)

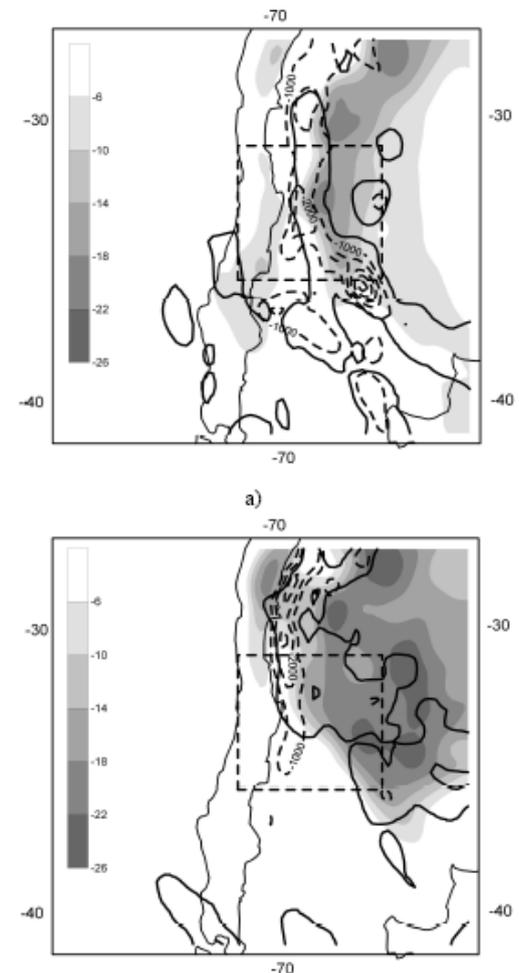


II. Investigación en el GFA

Desarrollo de la convección en base a la definición del índice FACD (Favorable Area for Convection Development):

- Water vapor flux divergence averaged (WVFD) in the layer 1000-700 hPa
- Vertical component of wind at 700 hPa
- Convective instability (CI): Difference between the eq. potential temperature at 500 and 1000 hPa.

Fig. 10. Convective instability -CI- (K, shaded areas), water vapor flux divergence -WVFD- averaged in the layer 1,000-700 hPa ($10^{-3} \text{ g m}^{-2} \text{ s}^{-1}$, dashed line), favorable areas for convection development -FACD- (continuous line) at 2100 UTC in domain 2, a) 23 December 2004; b) 4 January 2005. The box in dashed line shows the third domain.



II. Investigación en el GFA

Simulación sin topografía

Fig. 11. Sea level pressure (hPa, shaded), surface temperature (isotherms of $T > 30^{\circ}\text{C}$, continuous line) and horizontal component of wind field at 850 hPa, at 1800 UTC for domain 2, a) 23 December 2004 –Maximum wind speed is 17.2 ms^{-1} –; b) 4 January 2005 –Maximum wind speed is 18.2 ms^{-1} – as simulated by the flat terrain experiment. The box in dashed line shows the third domain.

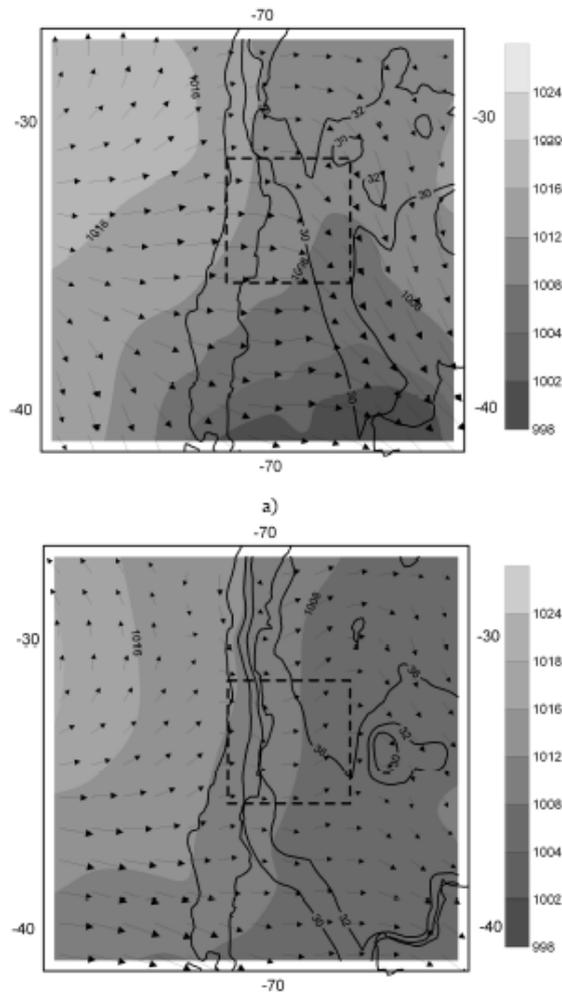
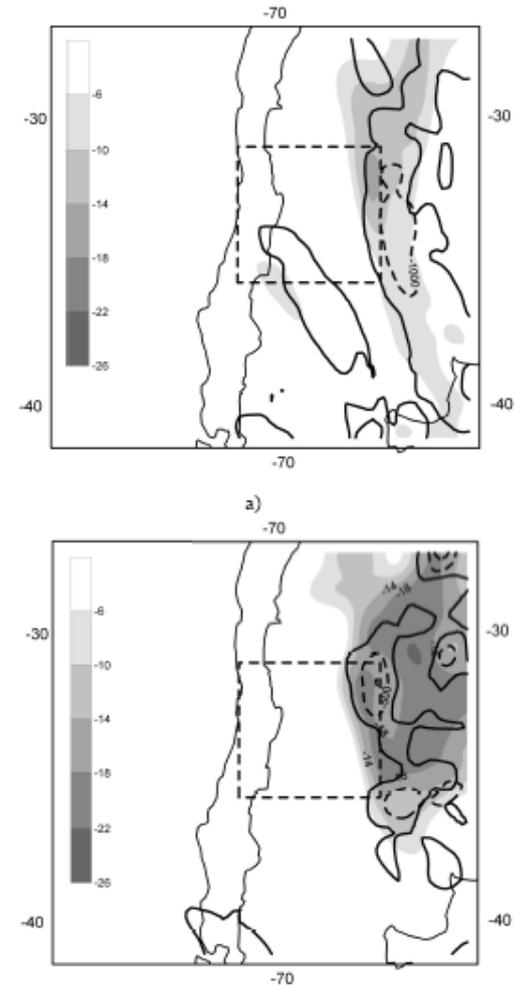


Fig. 12. Convective instability –CI– (K , shaded areas), water vapor flux divergence –WVFD– averaged in the layer 1,000–700 hPa ($10^{-3}\text{ g m}^{-2}\text{ s}^{-1}$, dashed line), favorable area for convection development –FACD– (continuous line) at 2100 UTC in domain 2, a) 23 December 2004; b) 4 January 2005, as simulated by the flat terrain experiment. The box in dashed line shows the third domain.



II. Investigación en el GFA

Simulación sin radiación solar

Fig. 13. Sea level pressure (hPa, shaded), surface temperature (isotherms of $T > 18^{\circ}\text{C}$, continuous line) and horizontal component of wind field at 850 hPa, at 1800 UTC for domain 2, a) 23 December 2004 –Maximum wind speed is 23.7 ms^{-1} –; b) 4 January 2005 –Maximum wind speed is 18.4 ms^{-1} – as simulated by the non-solar radiation experiment. The box in dashed line shows the third domain.

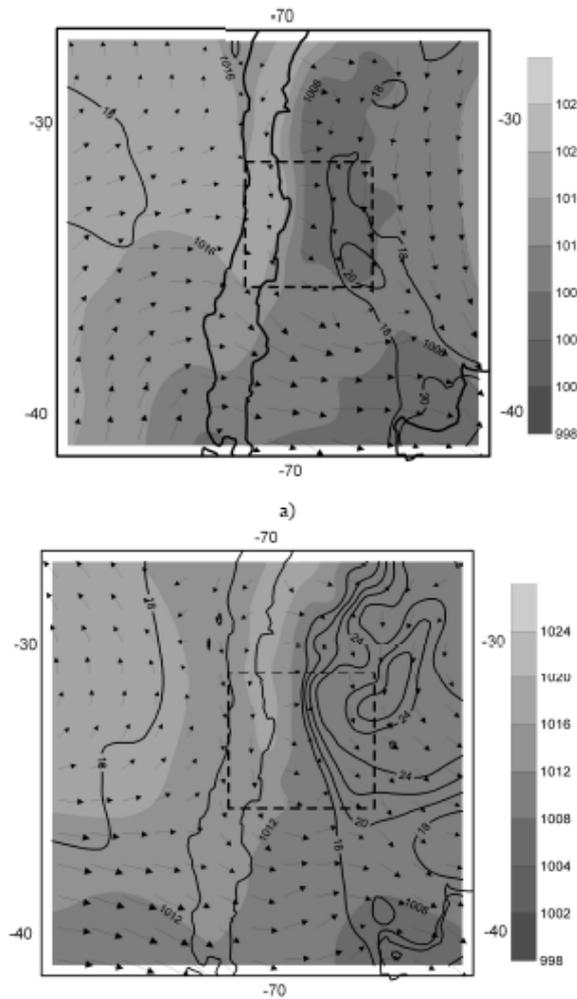
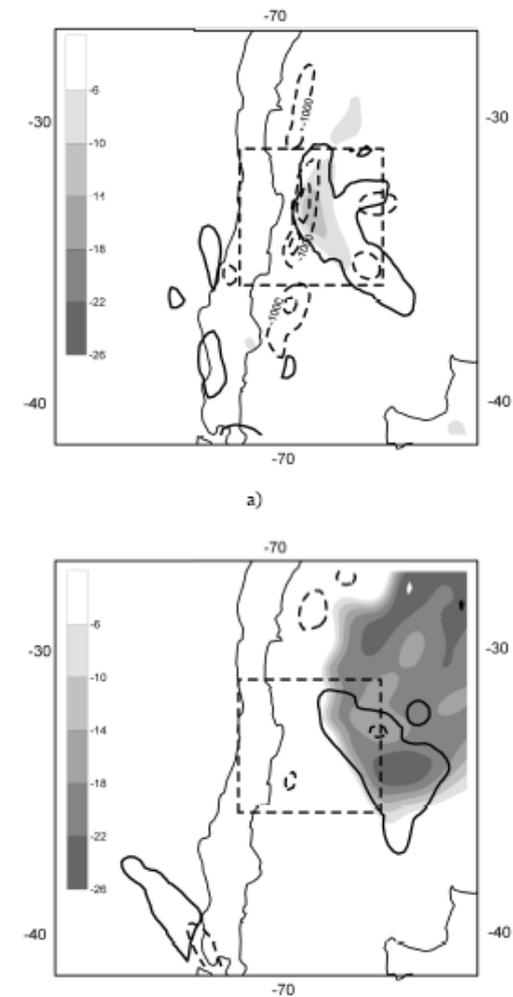


Fig. 14. Convective instability –CI– (K, shaded areas), water vapor flux divergence –WVFD– averaged in the layer 1,000–700 hPa ($10^{-3}\text{ g m}^{-2}\text{ s}^{-1}$, dashed line), favorable area for convection development –FACD– (continuous line) at 2100 UTC in domain 2, a) 23 December 2004; b) 4 January 2005, as simulated by the non-solar radiation experiment. The box in dashed line shows the third domain.



II. Investigación en el GFA

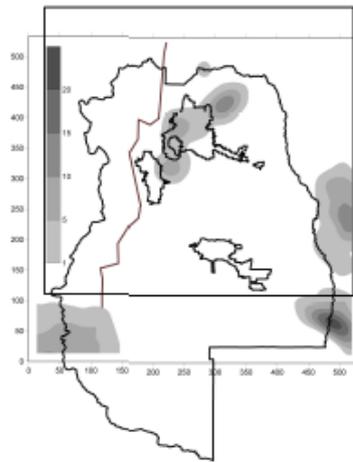
Precipitación inducida por:

la topografía

/

sinergia topografía y radiación

Fig. 16. Simulated precipitation field (mm) induced by topography in domain 3, a) from 1900 UTC (23 December 2004) to 0600 UTC (24 December 2004); b) from 1900 UTC (4 January 2005) to 0600 UTC (5 January 2005). The box in bold line represents the study area covered by radars.



a)

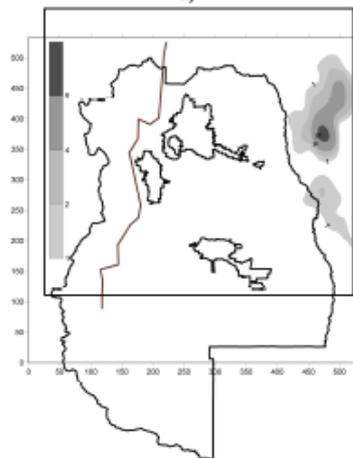
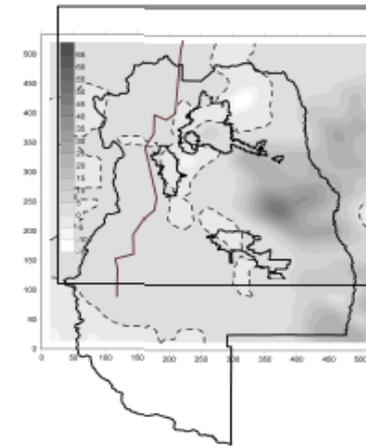
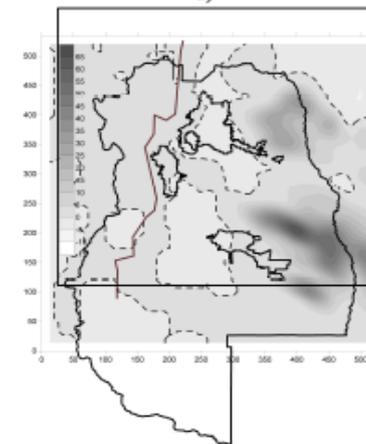


Fig. 17. Simulated precipitation field (mm) induced by the interaction between topography and solar radiation in domain 3, a) from 1900 UTC (23 December 2004) to 0600 UTC (24 December 2004); b) from 1900 UTC (4 January 2005) to 0600 UTC (5 January 2005). The areas in dashed line correspond to negative precipitation. The box in bold line represents the study area covered by radars.



a)



IV Reunión de la Redibérica del MM5

Planes de futuro

Predicción operativa:

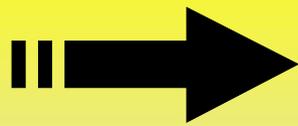
- Validación de las salidas del operativo.
- Predicción de eventos de importancia en Castilla y León (nieblas, nieve, tormentas)

Investigación:

- **Casos de estudio** en Castilla y León, Valle del Ebro y Mendoza (convección severa)
- Inversión de PV

IV Reunión de la Redibérica del MM5

Aveiro – 26/27 Abril 2007



**Muito obrigado
Muchas gracias**

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Grupo de Física de la Atmósfera. Universidad de León
http://gfa.unileon.es/prediccion_mm5
<http://gfa.unileon.es/>**