

III REUNION DE LA REDIBERICA MM5

Valencia, Junio 2005

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Lab. de Física de la Atmósfera-ULE

Tormentas severas. Precipitación de granizo.

- Radar meteorológico



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Tormentas severas. Precipitación de granizo.

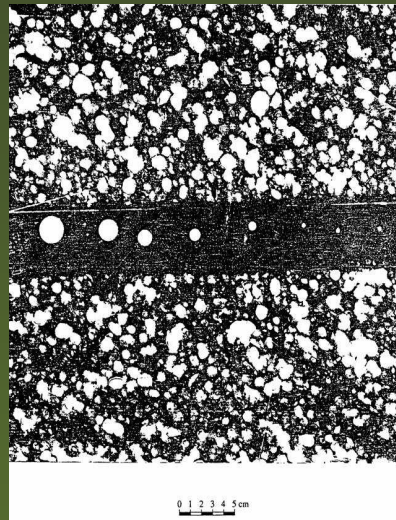
- Radar meteorológico
- Imágenes de satélite



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Tormentas severas. Precipitación de granizo.

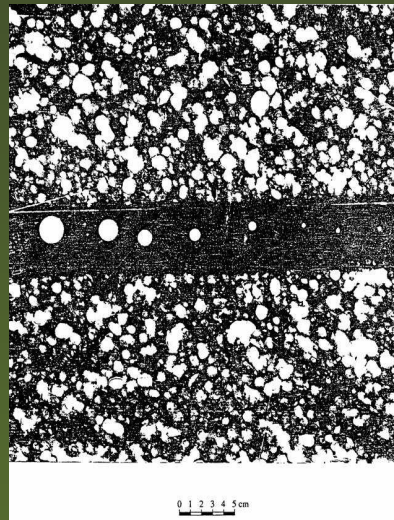
- Radar meteorológico
- Imágenes de satélite
- Medida del granizo en el suelo



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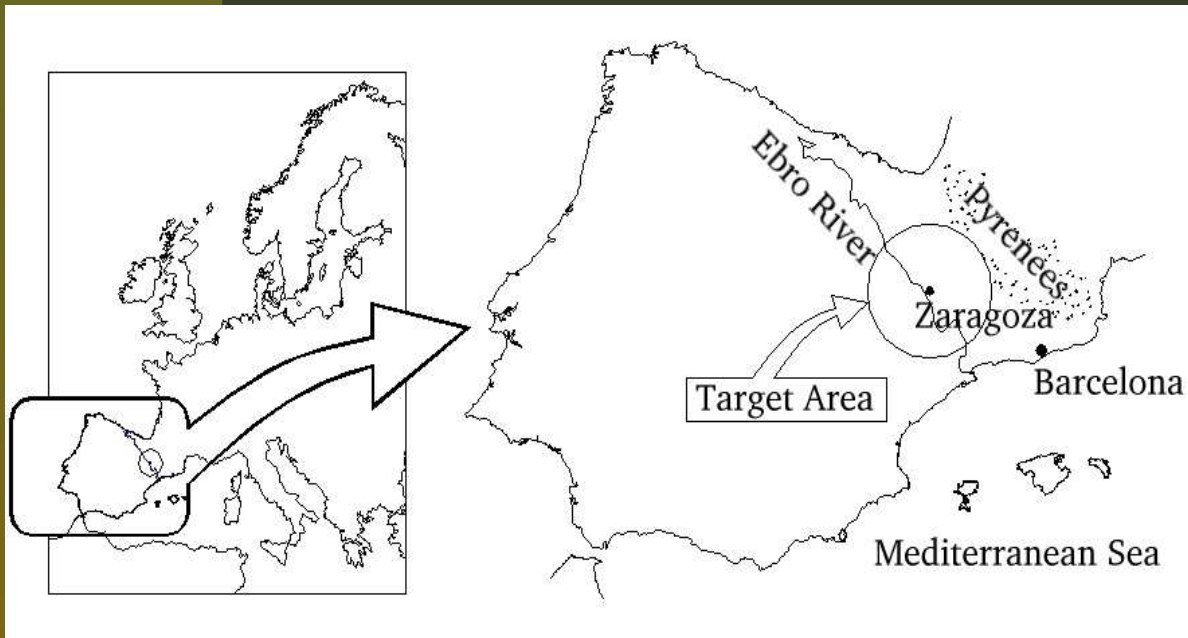
Tormentas severas. Precipitación de granizo.

- Radar meteorológico
- Imágenes de satélite
- Medida del granizo en el suelo
- Simulación numérica MM5



Introduction

Target Area: The Ebro Valley, northeast Spain



Severe storm in Alcañiz

- Time interval of the storm: 1530-1800 UTC
- Hail precipitation for 30 min aprox.
- Maximum precipitation rainfall rate of 92 l m^{-2}

Maximum hail size observed: 9-12 mm



Severe storm in Alcañiz

- Time interval of the storm: 1530-1800 UTC
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Street furniture ruined



Severe storm in Alcañiz

- Time interval of the storm: 1530-1800 UTC
- Hail precipitation for 30 min aprox.
- Maximum precipitation rainfall rate of 92 l m^{-2}

More than 300 cars were damaged



Radar images (TITAN)

Average values:

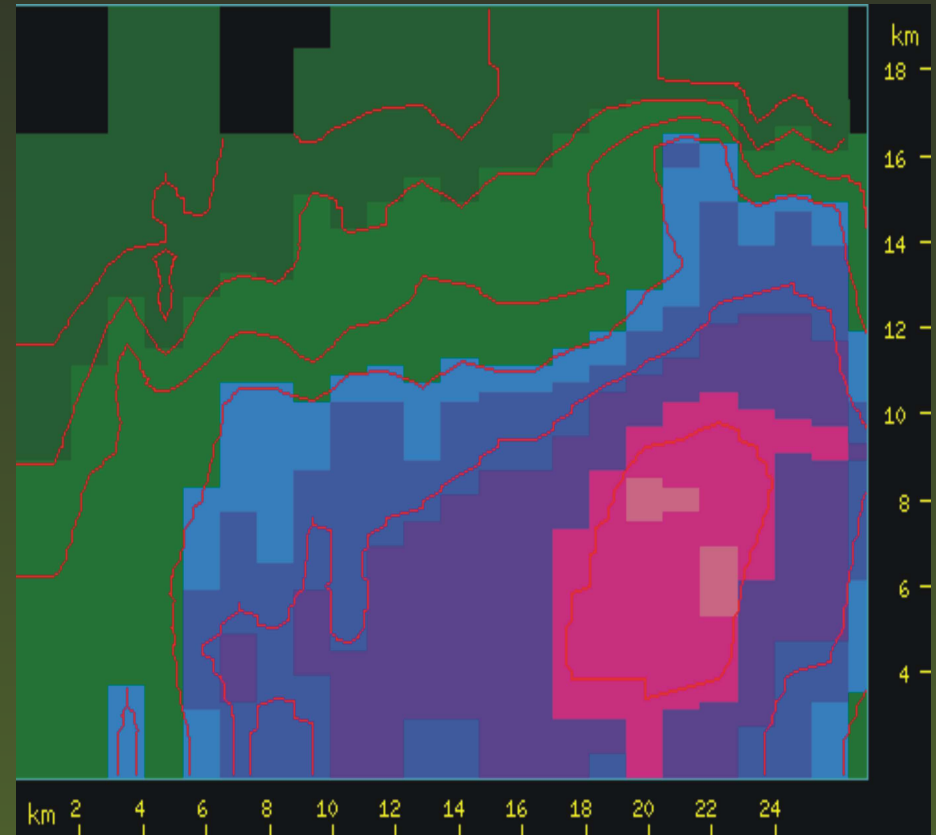
Start 1520 UTC

End 1800 UTC

Z_{max} 55.5 dBZ

Z_{med} 43.3 dBZ

Echo top > 18.0 km

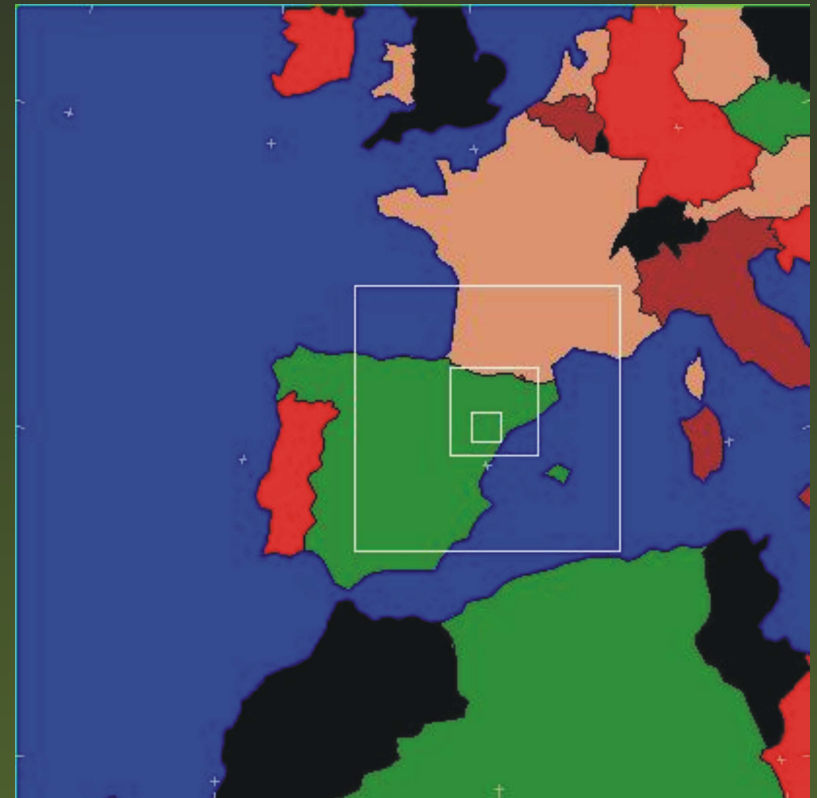


Vertical section of storm at 1623 UTC

Numerical simulation

MM5 Mesoscale Model

- **Four** nested domains.
- Horizontal mesh size of **18, 6, 2** and **0.67 km** respectively.
- Each of domains defined by a grid of **151 × 151** dots.
- **23** vertical sigma levels.
- The simulation started at **00 UTC** and finished at **12 UTC** of the following day.
- Moisture scheme: Reisner graupel.
- Cumulus parameterization: Kain-Fristch scheme.



Numerical simulation

Two objectives:

- I To study whether the model is able to reproduce the actual storm of Alcañiz.
- II To carry out a sensitivity experiment, with the *Factor Separation* technique (*Stein and Alpert, 1993*)*, to analyze the influence of physical relief and solar radiation on the development of the storm.

*Stein, U. and Alpert, P., 1993: Factor Separation in Numerical Simulations. *J. Atmos. Sci.*, 50, 2107-2115.

1^{er} Resultado

Diagnosis of the meteorological situation of August 16th 2003: an extreme hail event

E. García-Ortega^a, L. Fita^b, R. Romero^b, L. López^a, C. Ramis^b and
J. L. Sánchez^a

European Conference on Severe Storms

León, Spain. November 2004

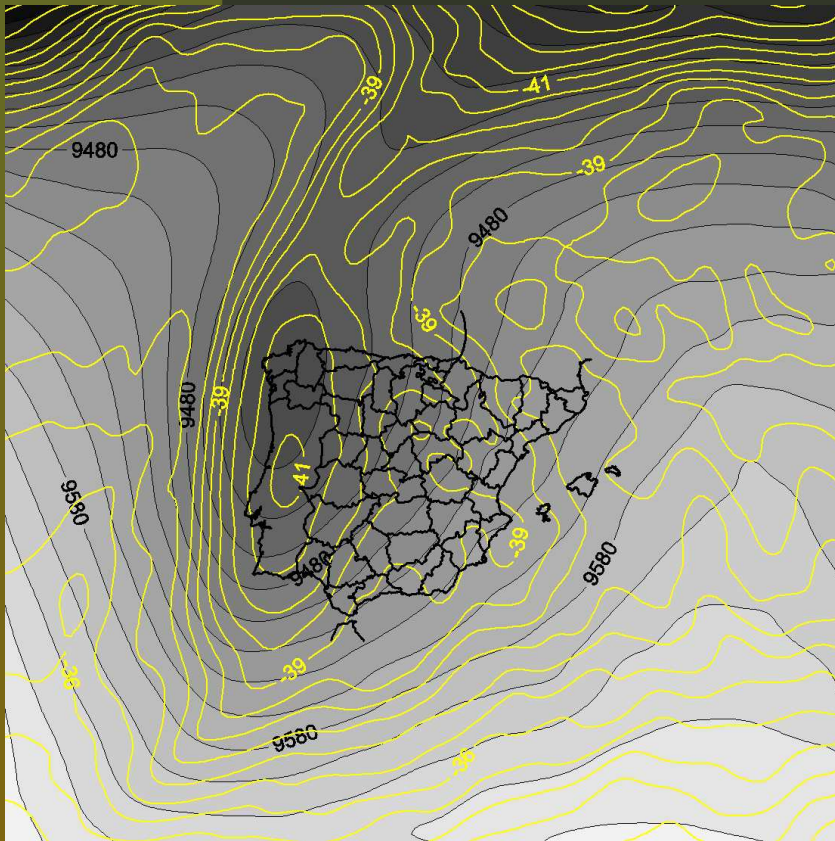
^aLaboratorio de Física de la Atmósfera. Instituto de Medio Ambiente.

Universidad de León. Spain. eduardo.garcia@unileon.es

^bGrup de Meteorologia. Departament de Física.

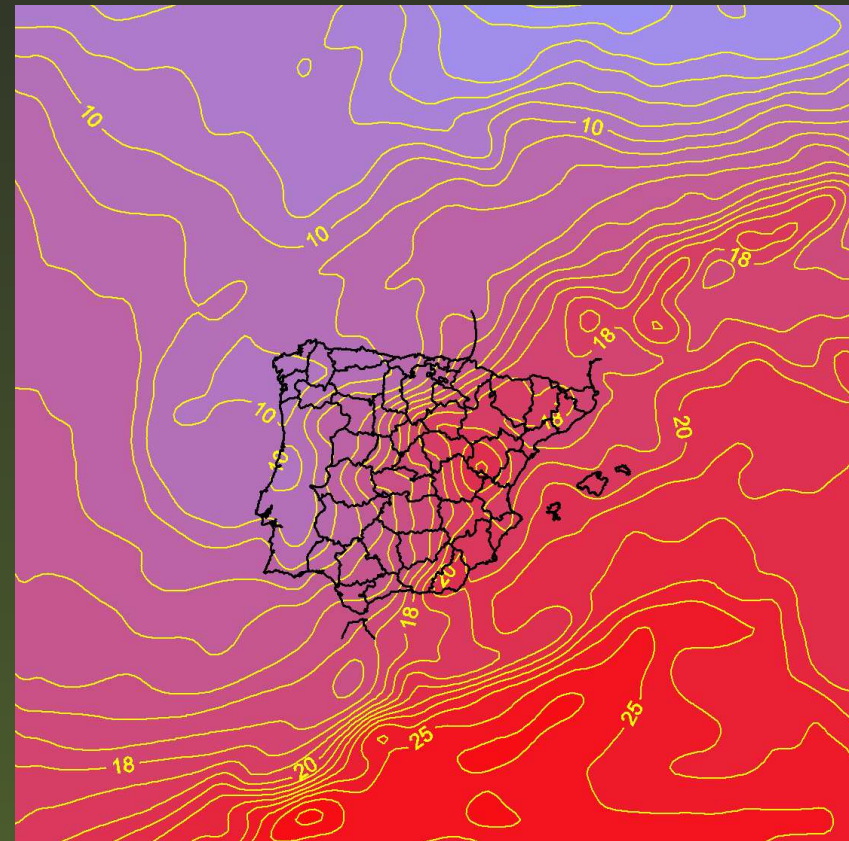
Universitat de les Illes Balears. Spain

Control experiment: domain 1



Isohyps (gpm) and *isotherms* (°C)

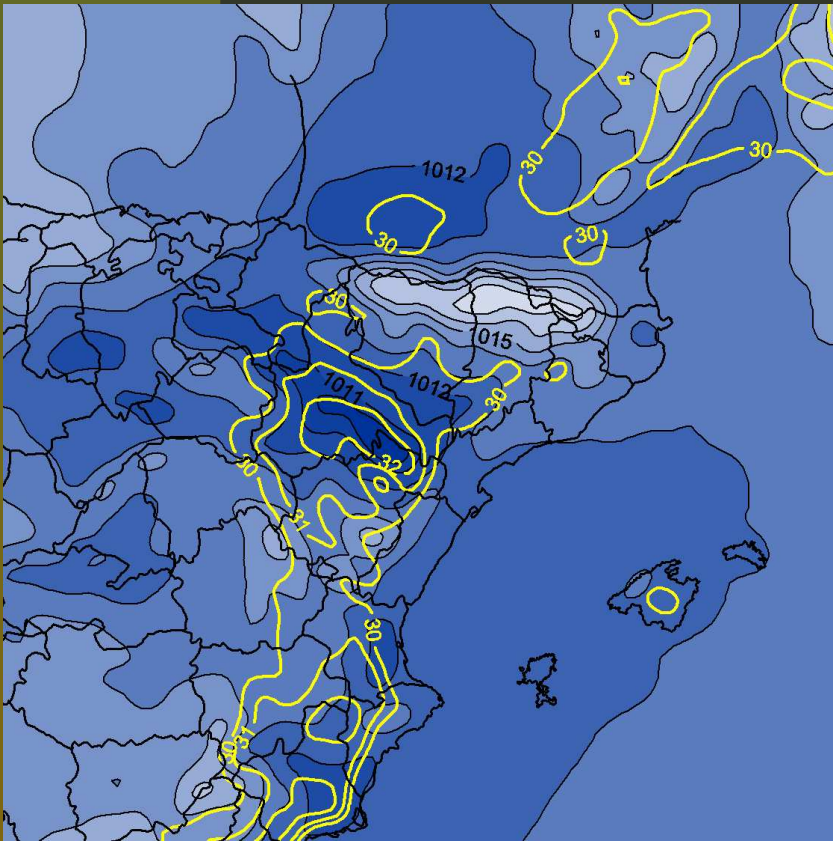
300 hPa at 1200 UTC



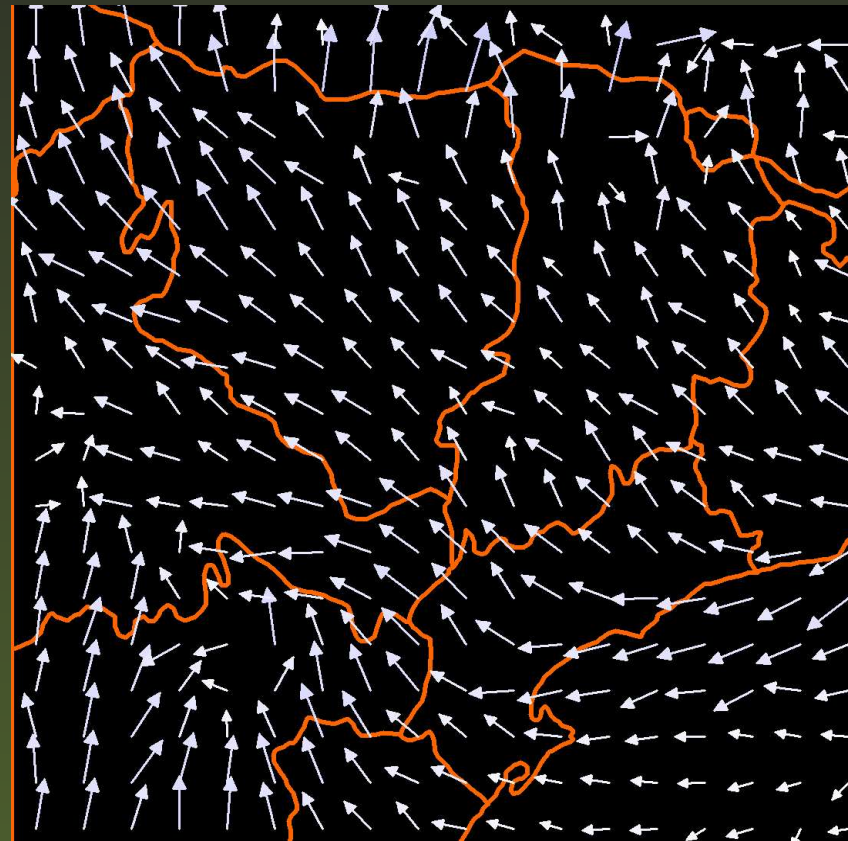
Isotherms (°C)

850 hPa at 1200 UTC

Control experiment: domains 2/3



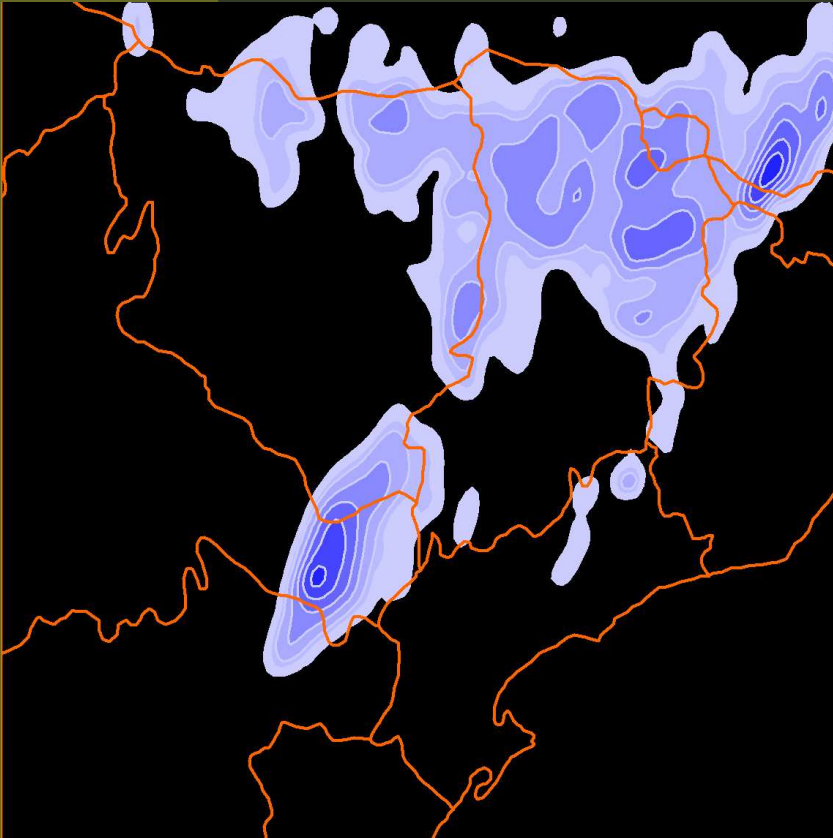
Sea level pressure -blue color scale- (hPa)
and isotherms with $T > 30^{\circ}\text{C}$ at 1200 UTC



Wind field (longest vector is 12 m s^{-1})
900 hPa at 1200 UTC

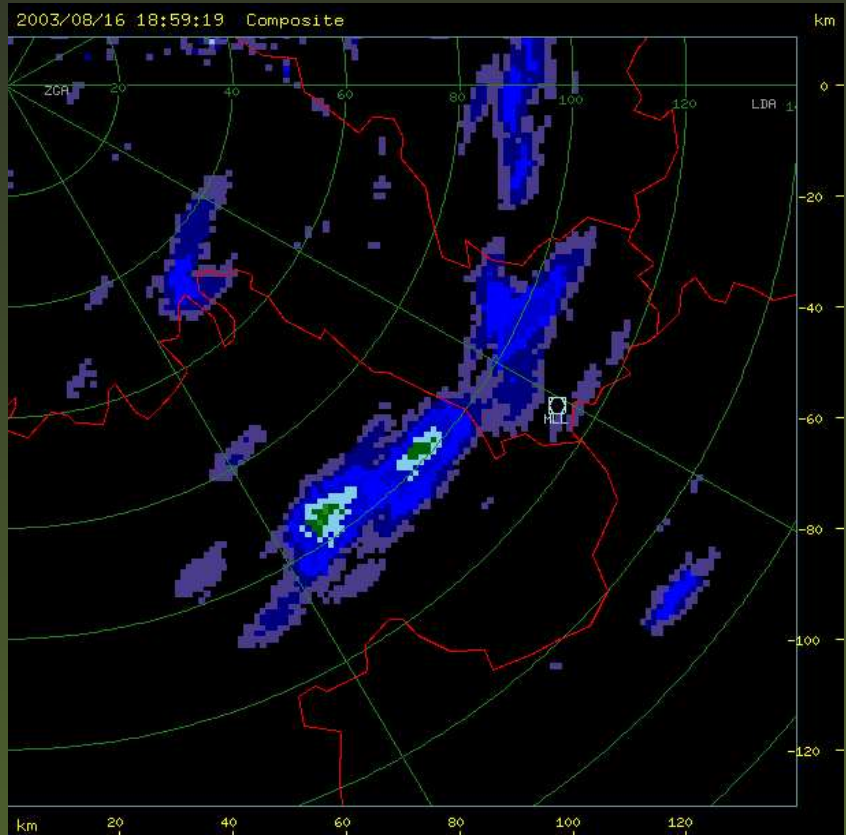
Radar images vs. MM5

Spatial comparison



Precipitation area between 1500 - 1830 UTC

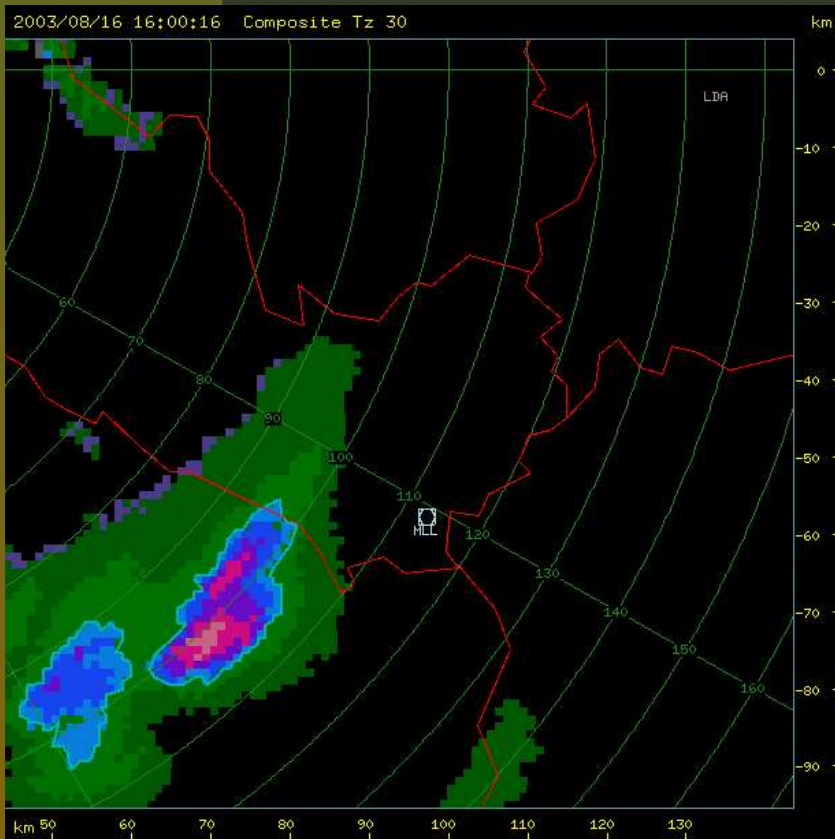
(Domain 3)



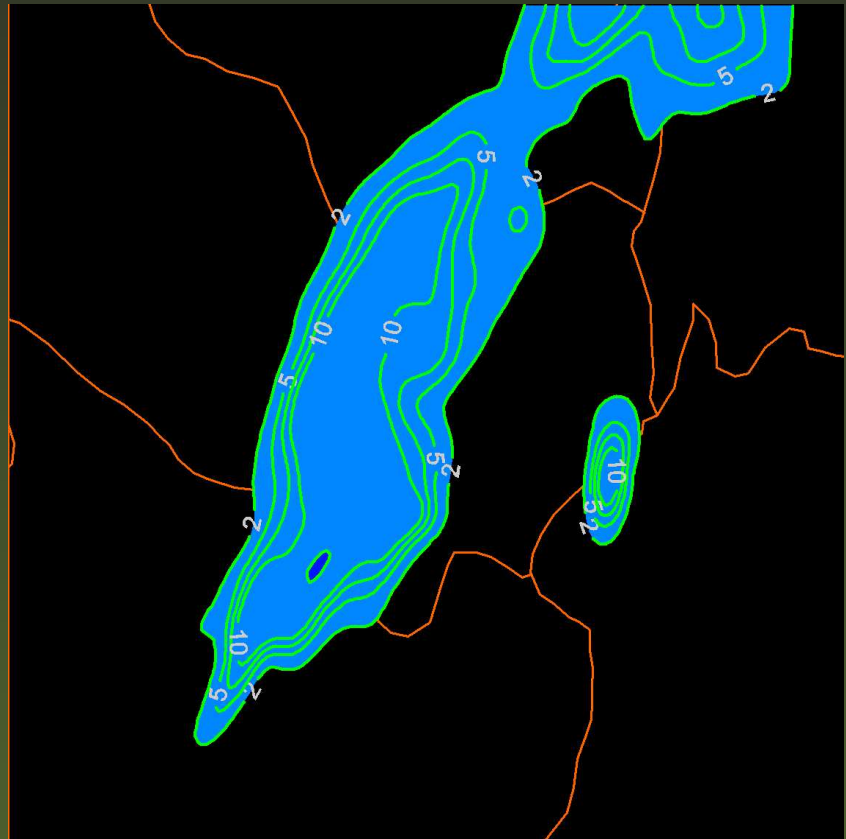
Radar: total precipitation in the study area

Radar images vs. MM5

Temporal-spatial comparison



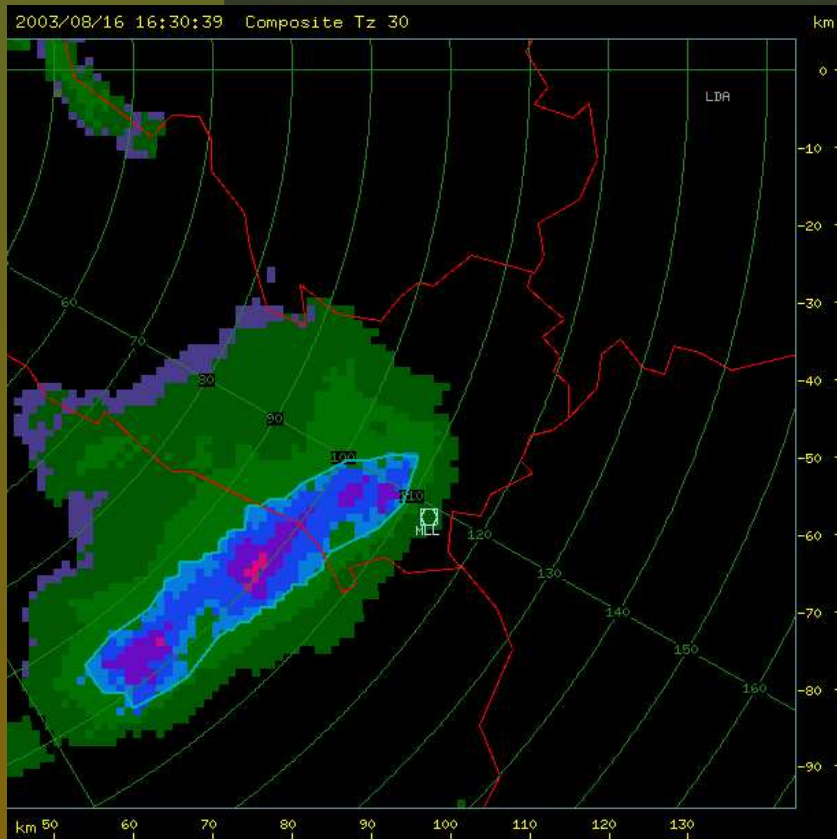
Composite image of Z at 1600 UTC



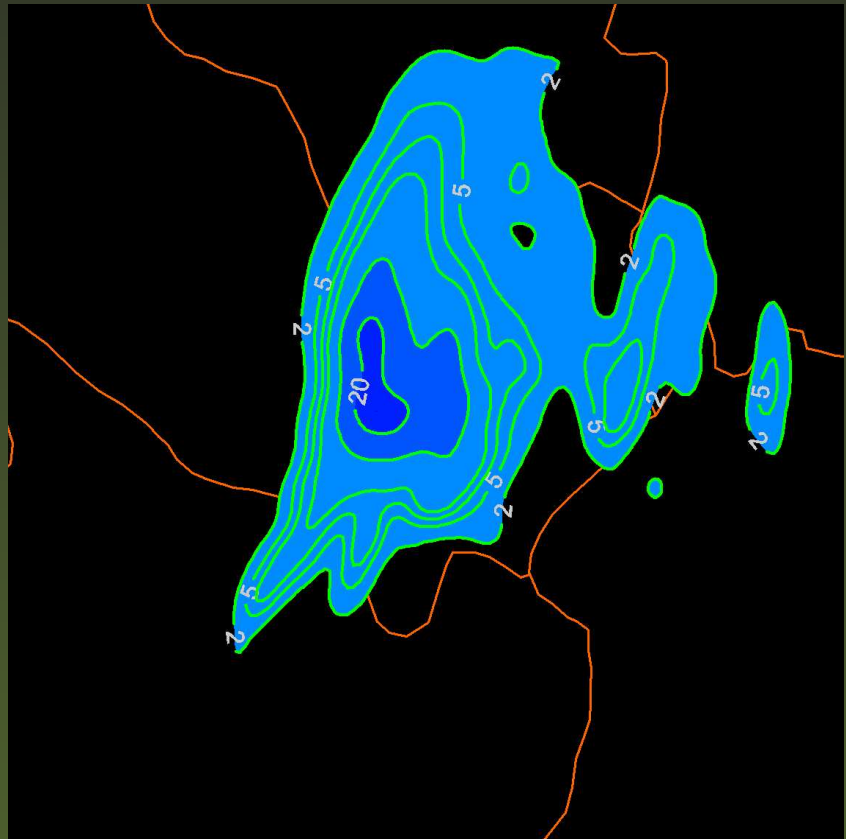
Accumulated precipitation field (1530-1600 UTC)

Radar images vs. MM5

Temporal-spatial comparison



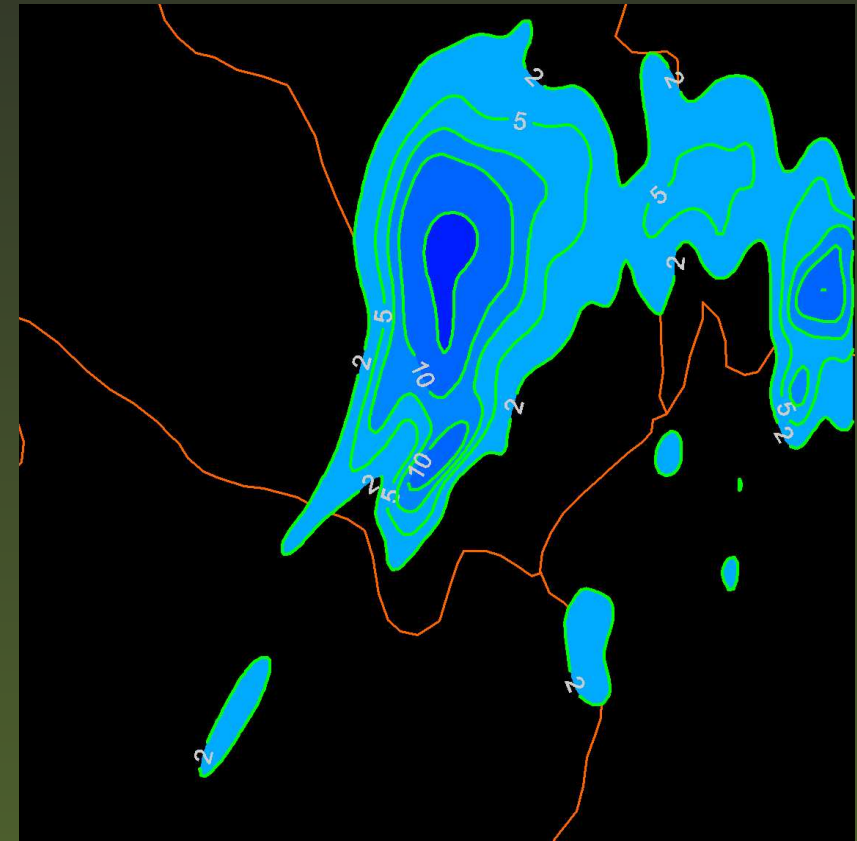
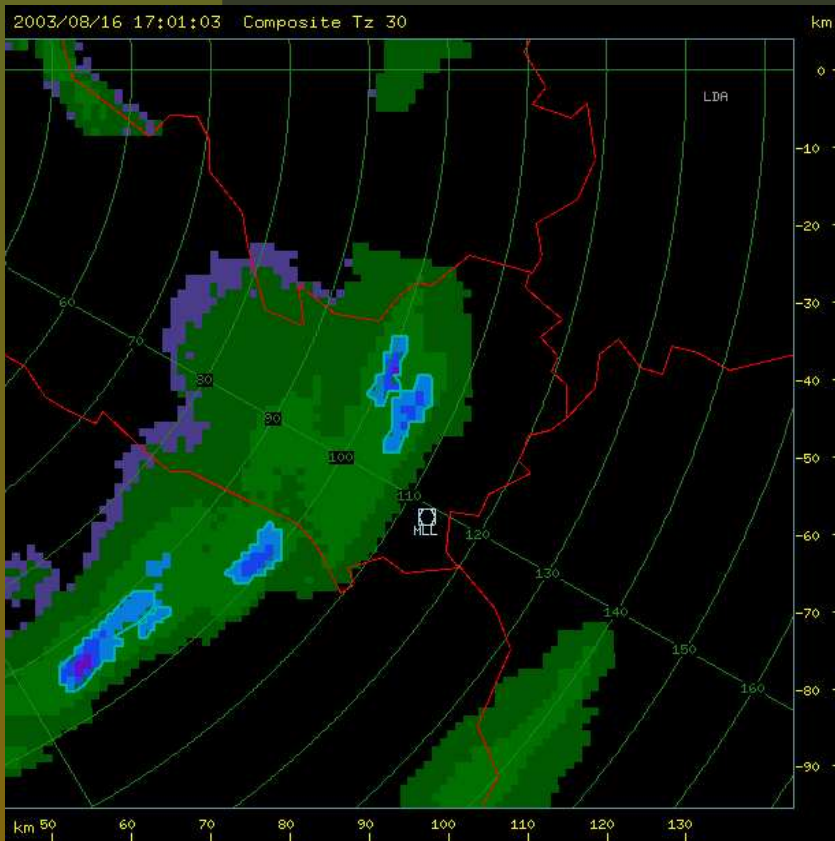
Composite image of Z at 1630 UTC



Accumulated precipitation field (1600-1630 UTC)

Radar images vs. MM5

Temporal-spatial comparison

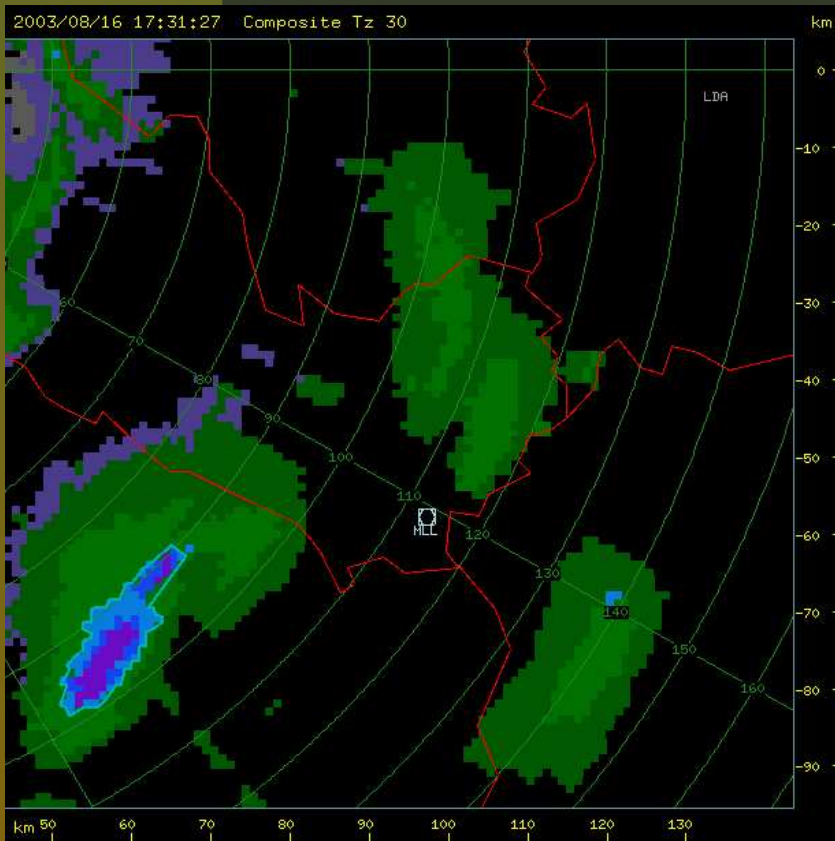


Composite image of Z at 1700 UTC

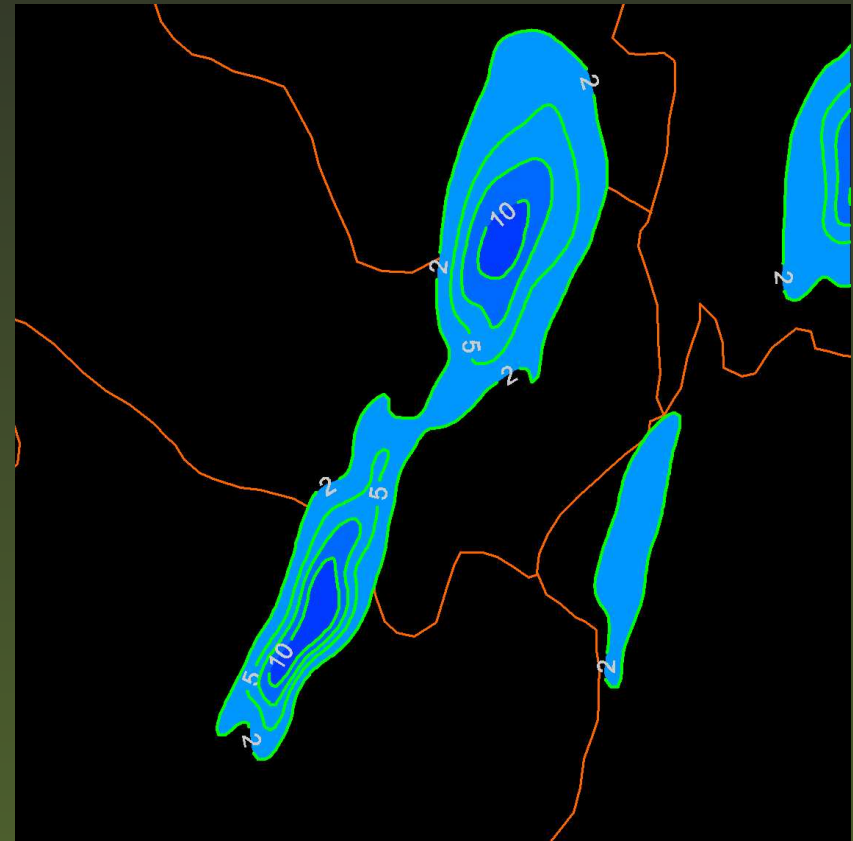
Accumulated precipitation field (1630-1700 UTC)

Radar images vs. MM5

Temporal-spatial comparison



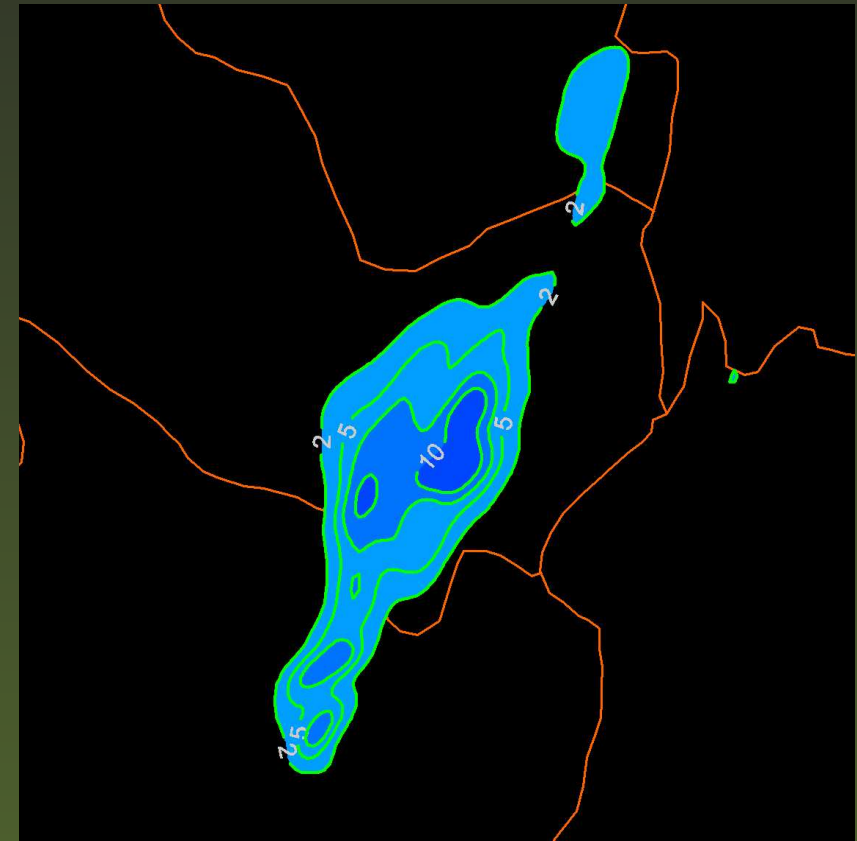
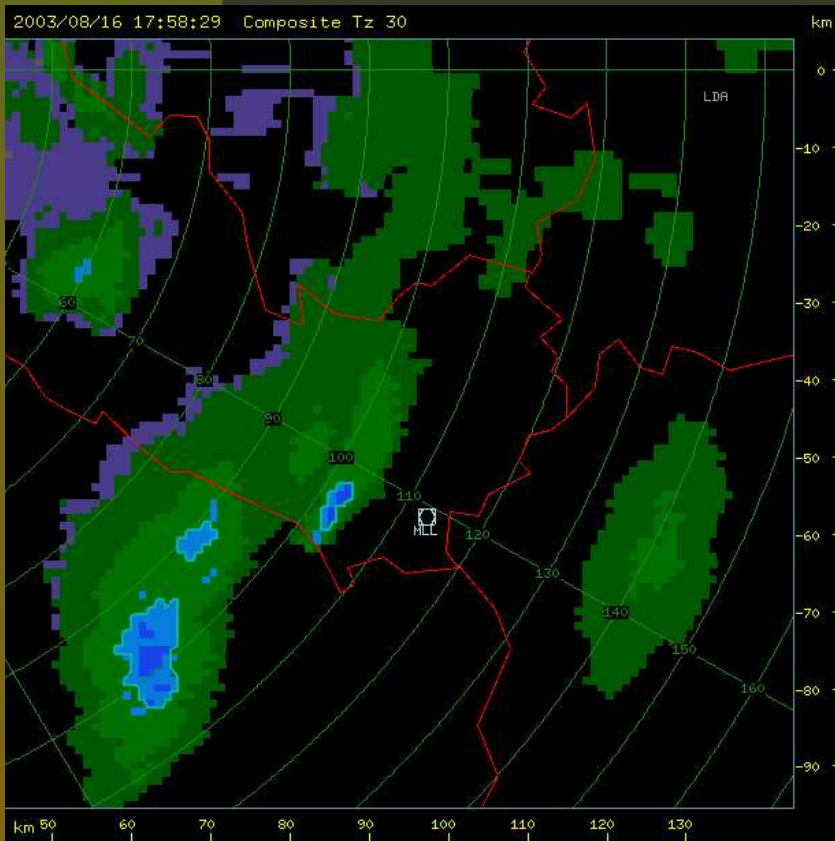
Composite image of Z at 1730 UTC



Accumulated precipitation field (1700-1730 UTC)

Radar images vs. MM5

Temporal-spatial comparison



Composite image of Z at 1800 UTC

Accumulated precipitation field (1730-1800 UTC)

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

E. García-Ortega^a, L. Fita^b, R. Romero^b, L. López^a, C. Ramis^b and
J. L. Sánchez^a

Atmospheric Research

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^bGrup de Meteorologia. Departament de Física.

Universitat de les Illes Balears. Spain

Sensitivity experiment

Four simulations were performed:

- Control simulation: f_{12}
- A simulation without solar radiation: f_1
- A simulation without orography: f_2
- A simulation without both: f_0

Rainfall induced by ...

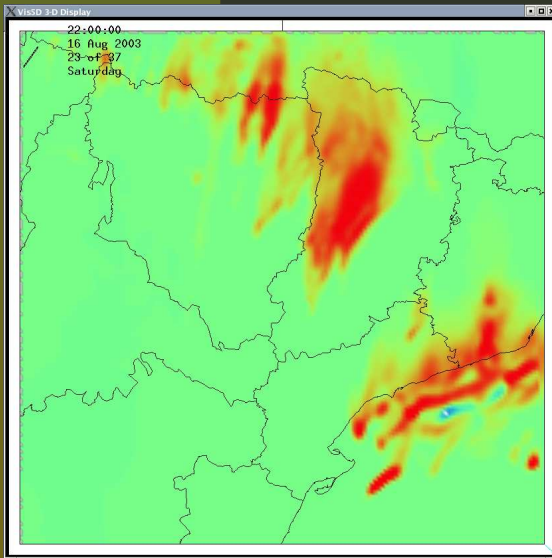
$$\text{terrain: } \hat{f}_1 = f_1 - f_0$$

$$\text{solar radiation: } \hat{f}_2 = f_2 - f_0$$

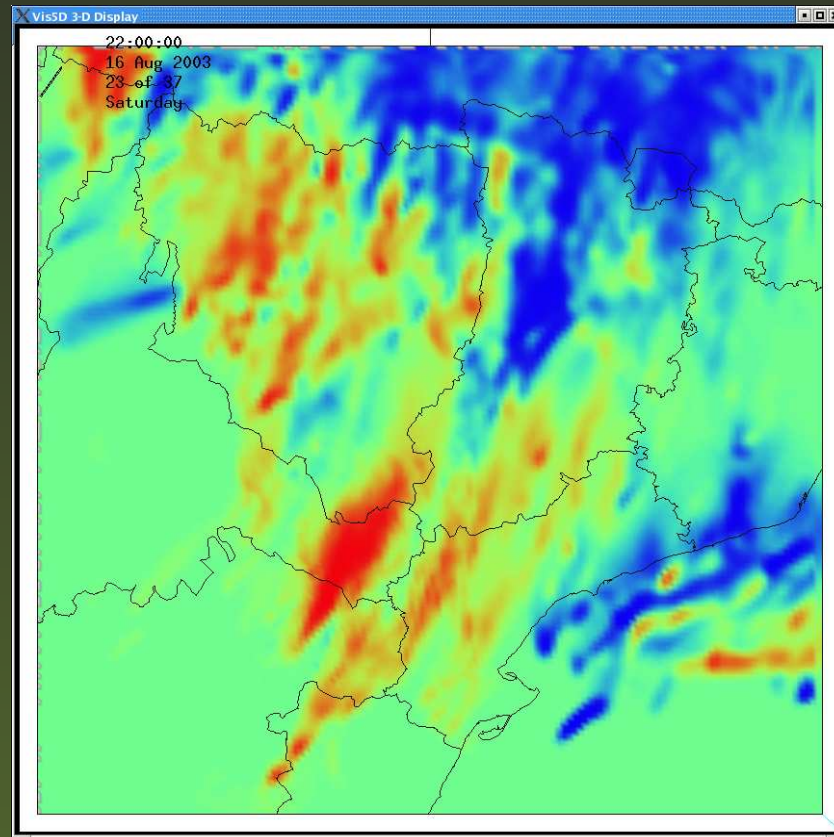
$$\text{synergic effect: } \hat{f}_{12} = f_{12} - (f_1 + f_2) + f_0$$

Precipitation area

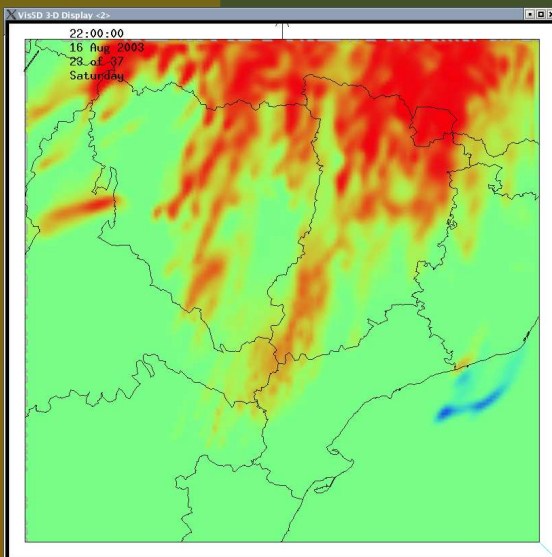
Induced by terrain \hat{f}_1



Induced by synergic effect \hat{f}_{12}

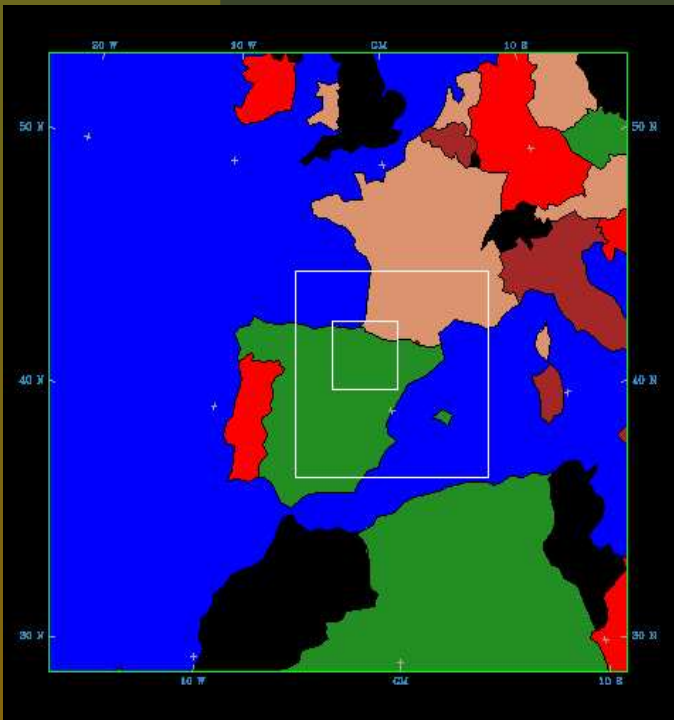


Induced by radiation \hat{f}_2



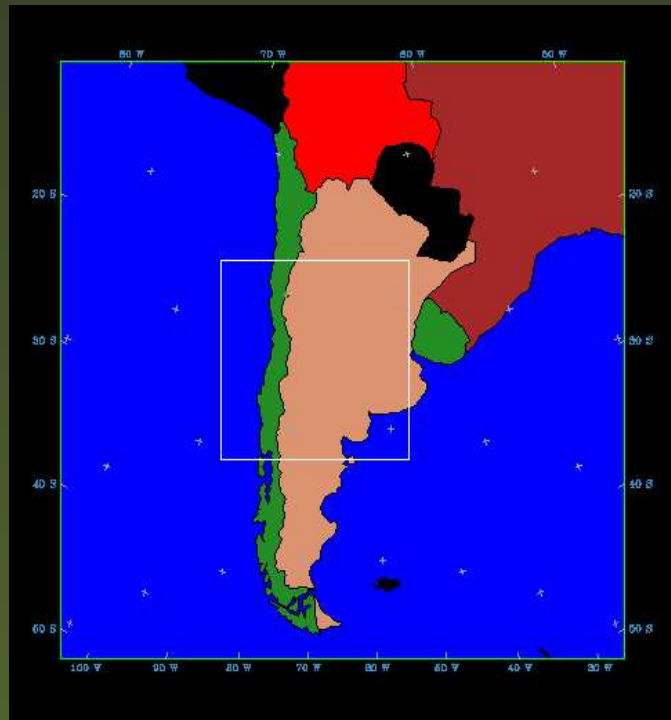
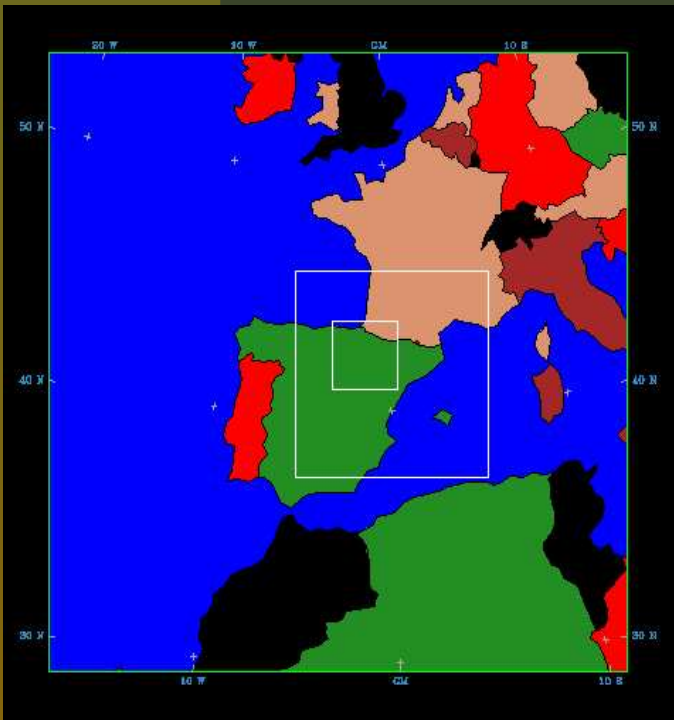
... y ahora qué ?

- Estudio inversión de PV (Aragón)



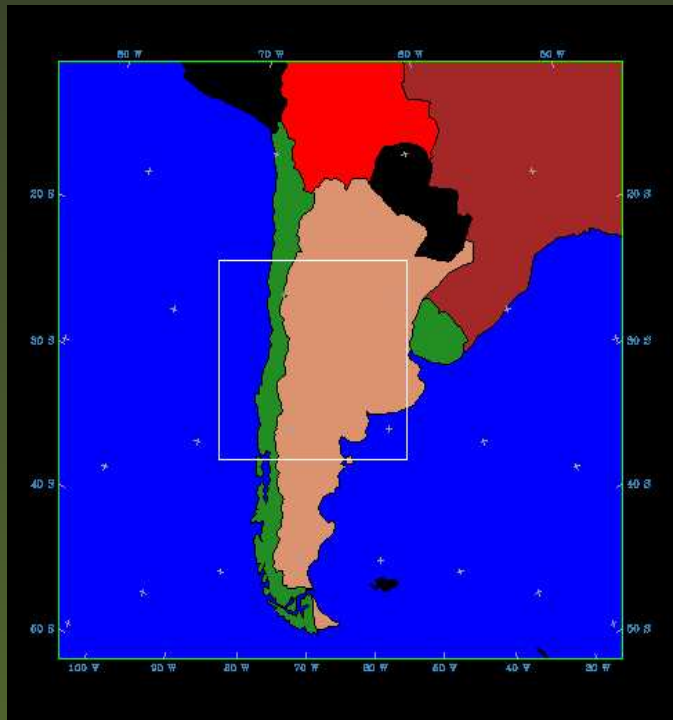
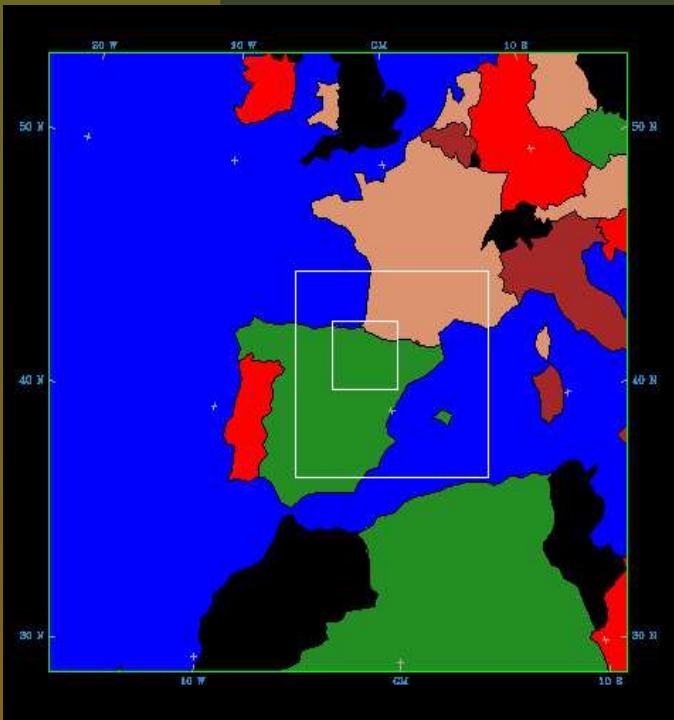
... y ahora qué ?

- Estudio inversión de PV (Aragón)
- Proyecto con Gobierno de Mendoza (Argentina)



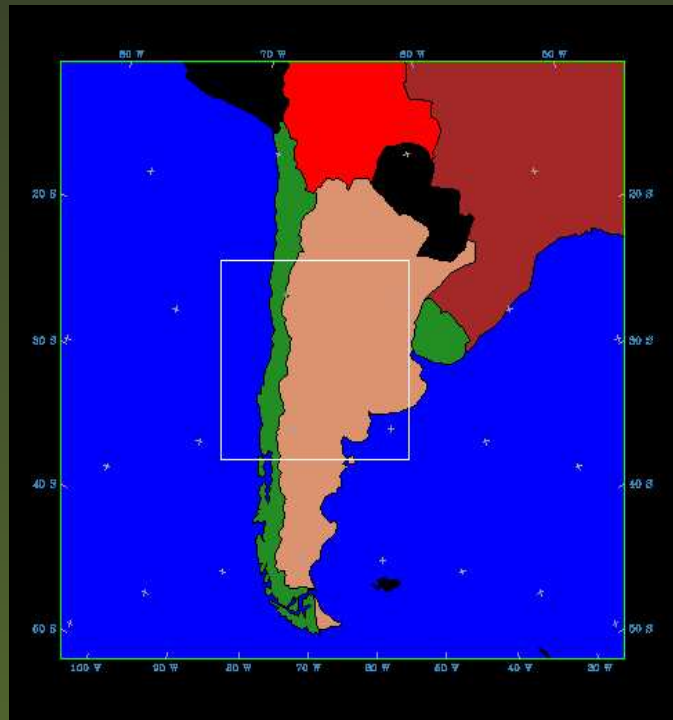
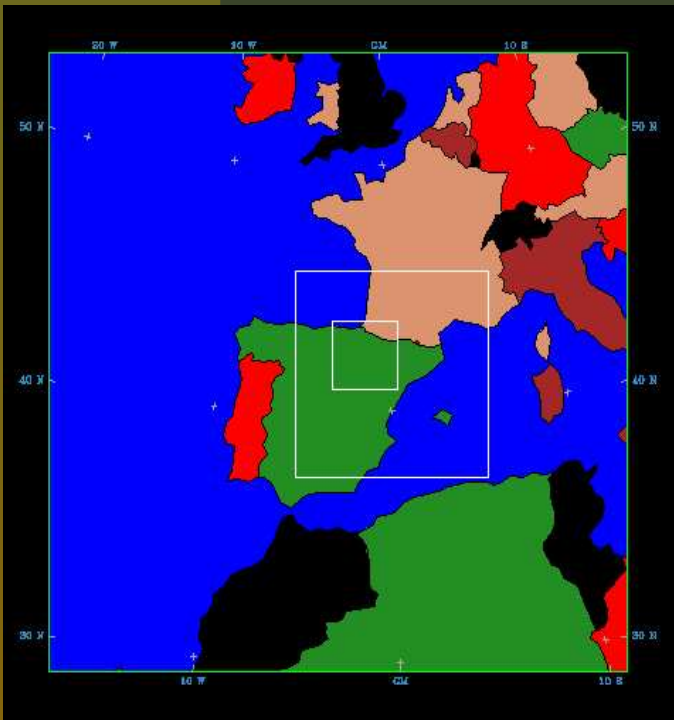
... y ahora qué ?

- Uso de distintas parametrizaciones



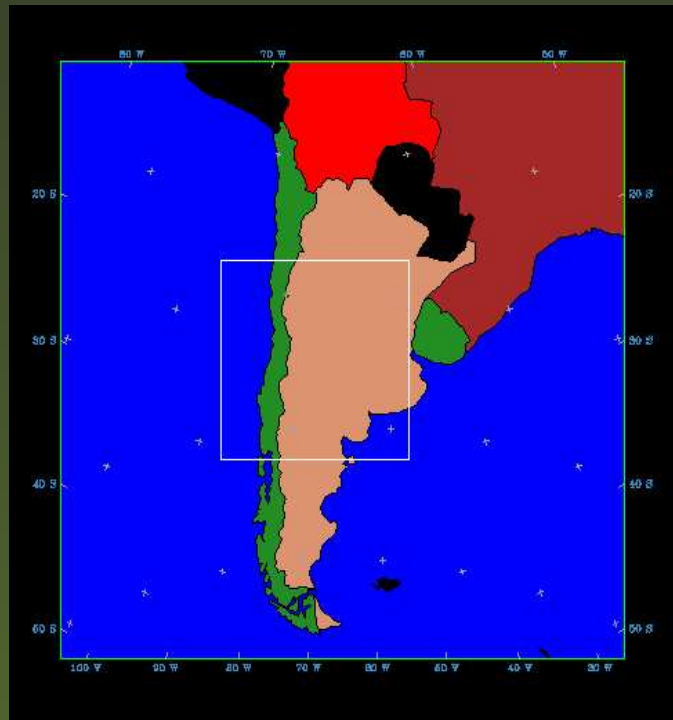
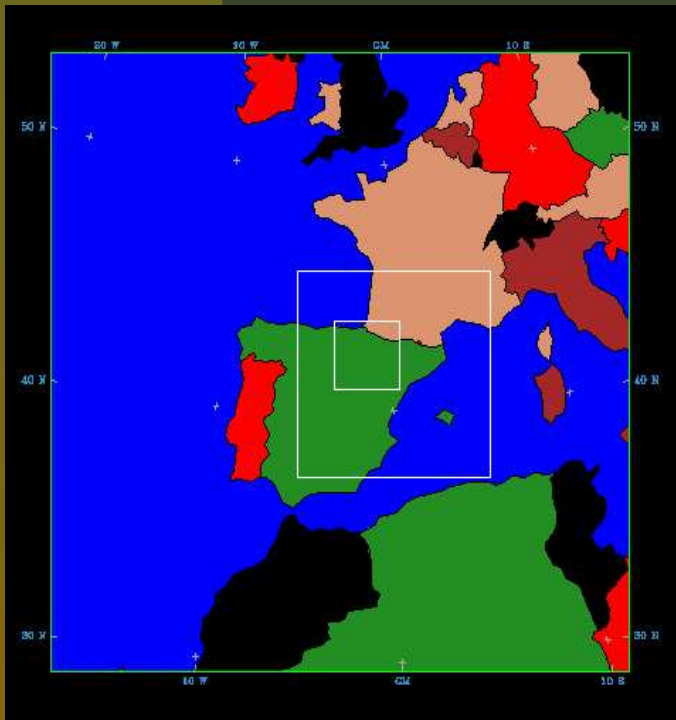
... y ahora qué ?

- Uso de distintas parametrizaciones
- Simulación de radar meteorológico (bandas C y S)



... y ahora qué ?

- Uso de distintas parametrizaciones
- Simulación de radar meteorológico (bandas C y S)



... queda mucho por aprender!

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