The Impact of Aerosols Effects on Meteorology

AEROSOL-1 EXERCISE

Model: Enviro-HIRLAM

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Main Goal:

Study influence of anthropogenic emissions from **Paris metropolitan area** on a formation of meteorological and chemical fields due to inclusion of aerosols feedback mechanisms in the Enviro-HIRLAM model

Methodology of practical exercise:

1) Select date for experiments
2) Modify the Enviro-HIRLAM model by including:

- the calculation of the activated anthropogenic aerosol number concentration,
- wet deposition in the condensation scheme,
- parameterization of the effect of the Cloud Condensation Precipitation Evaporation processes (CCEP)
- dry deposition

2) Run model for the selected certain date in two ways - control run and modified run
3) Analyze and compare models results using Metgraph

Selection of specific date

Domain	Paris (P01)
Source of data	Atlas: Meteorological Situations, diagrams of vertical sounding
Date selected	19 July 2009
Reasons for selection	Convective regime; total cloudness; zero precipitation; no temperature inversion

Air temperature, °C	17,4±1,1
Cloudness	9
Major wind direction	SW
Wind velocity, m/s	5-7
Meteorological phenomena	none
Precipitation, mm	0

Central coordinates of the domain:

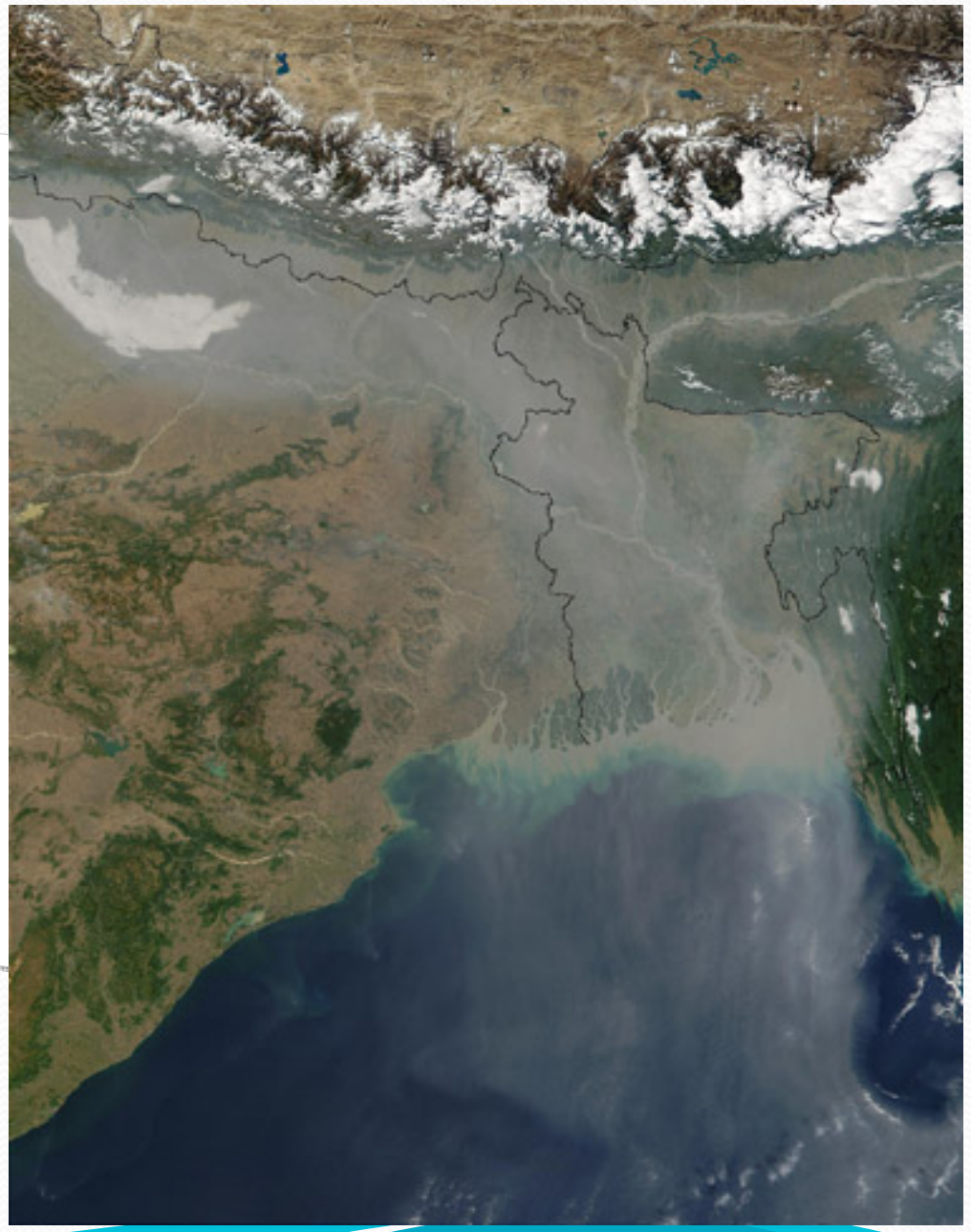
Latitude, deg: 2.7 °E

Longitude, deg: 48.8 °N

Control experiment
WITHOUT aerosols feedbacks

Modified experiment
WITH aerosols feedbacks

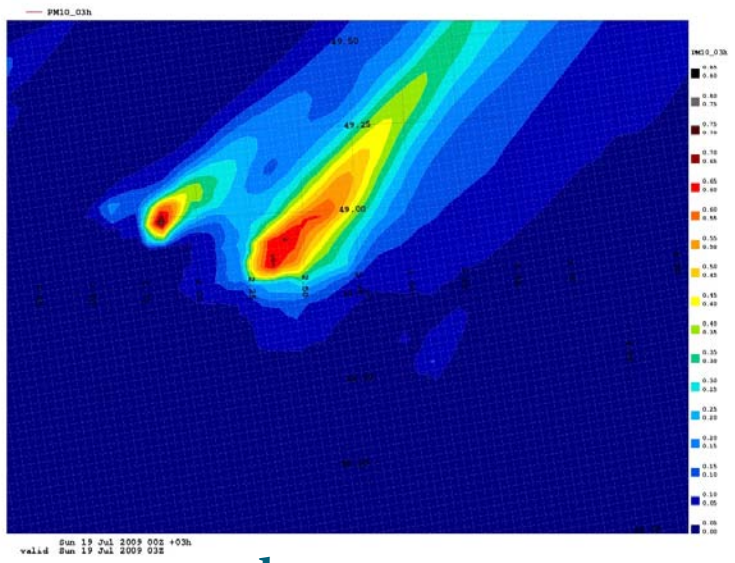
Sulfate aerosols
Forecast 24 hours



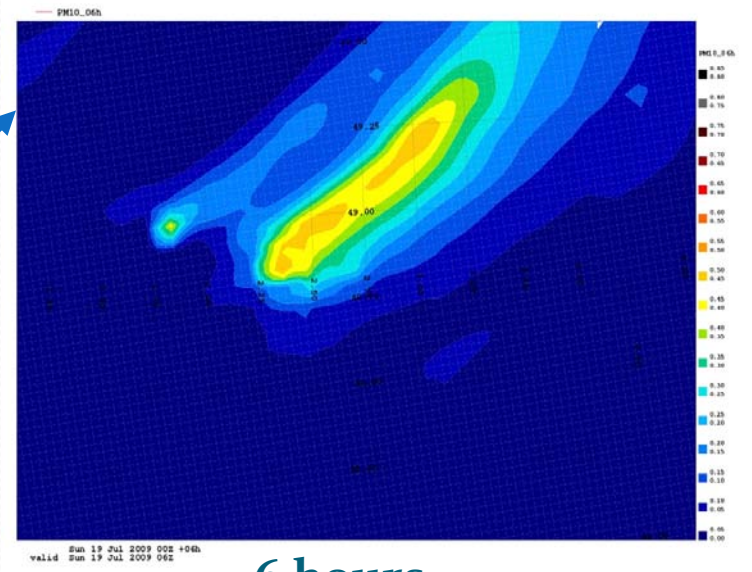
Aerosols feedbacks

- Direct effect: Decrease solar radiation and visibility, cooling effect
- Semi-direct effect: affect atmospheric boundary layer meteorology and photochemistry
- First indirect effect : influences cloud droplet size, cloud droplet number concentration, cloud-top reflectance
- Second indirect effect: cloud liquid water content and precipitation regime

Dispersion of PM10 plume and wind velocity/direction

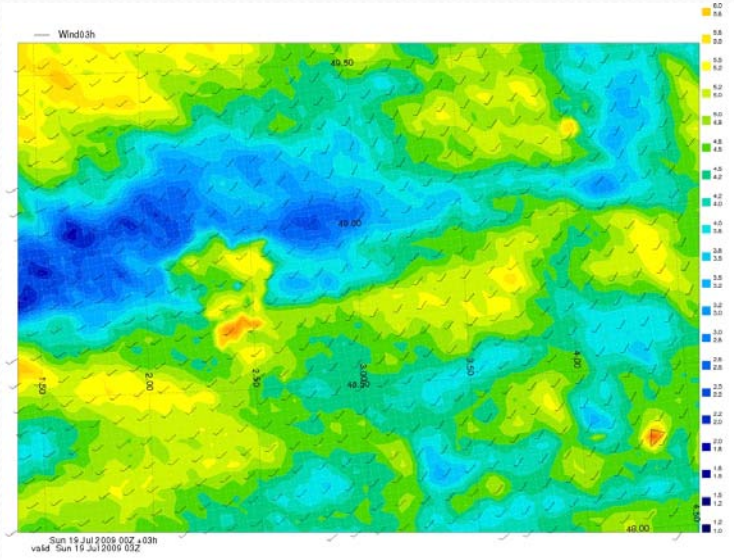


PM10

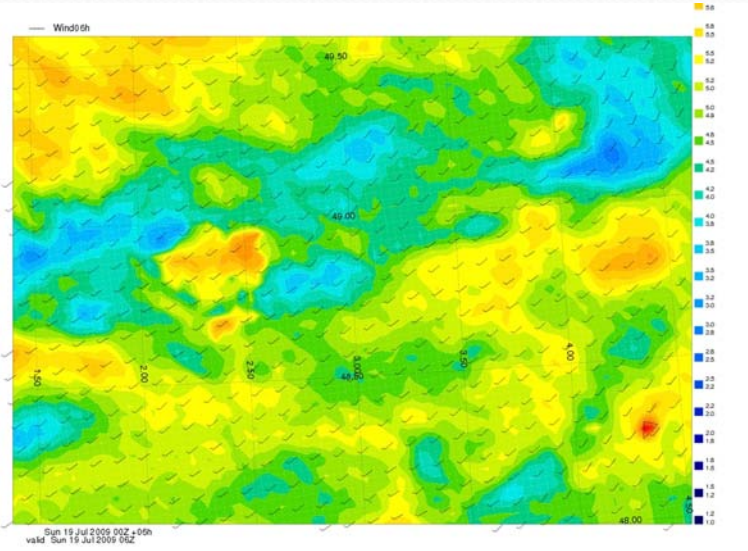


3 hours

6 hours

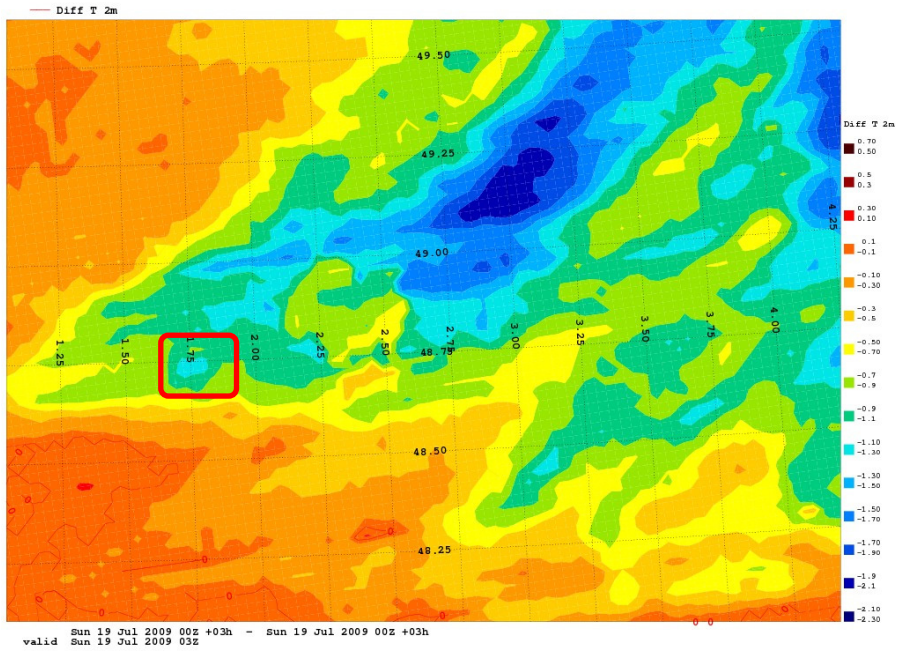


wind

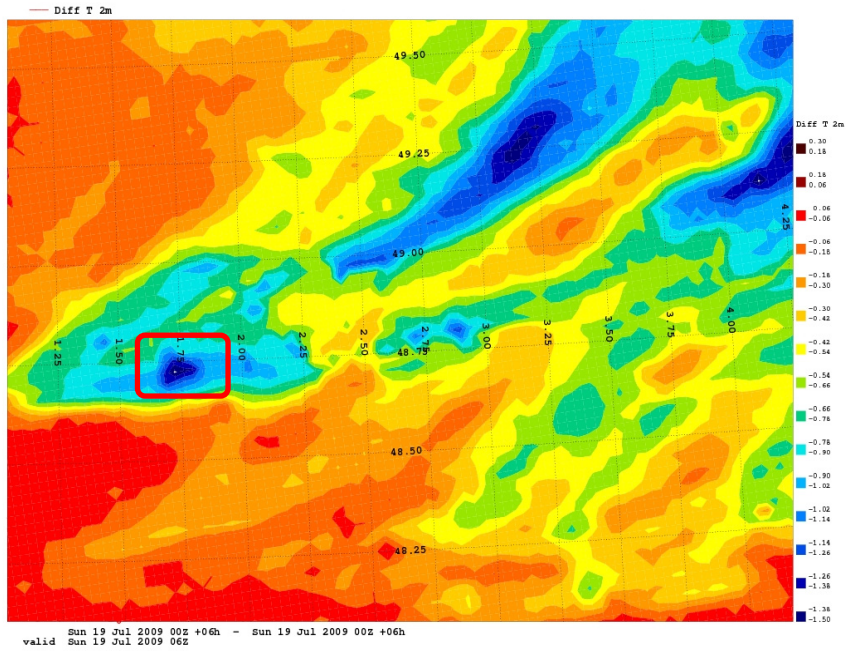


Temperature

Aerosols experiment minus control experiment



3 hours



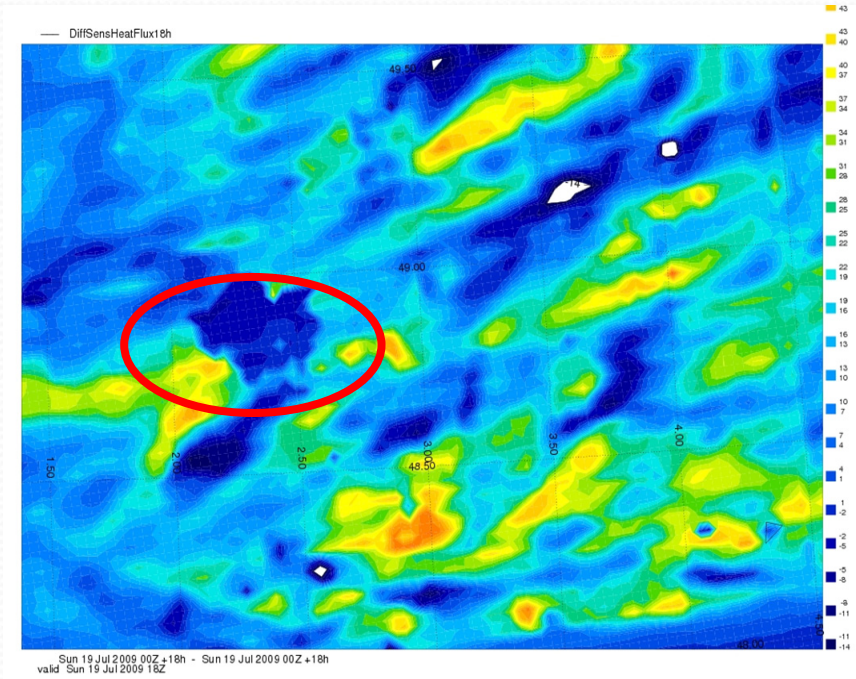
6 hours

Direct effect

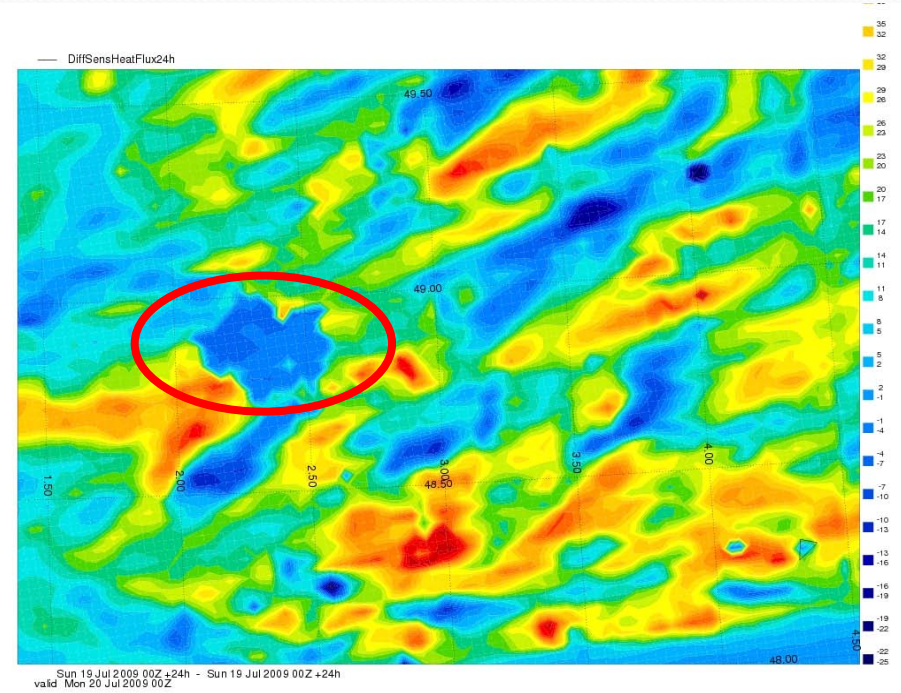
Diff-T values are lower, specially in Paris

Sensible heat flux

Aerosols experiment minus control experiment



18 hours



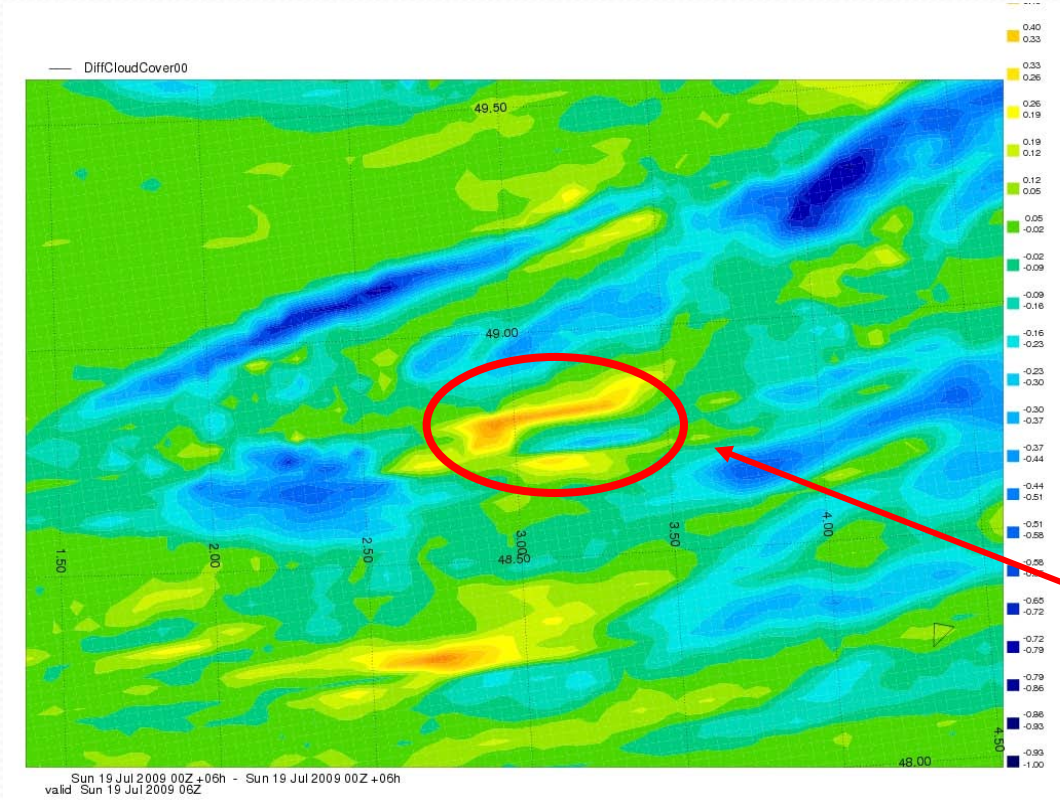
24 hours

Direct effect

Diff-SHF is lower in Paris area

Total cloudness

Aerosols experiment minus control experiment



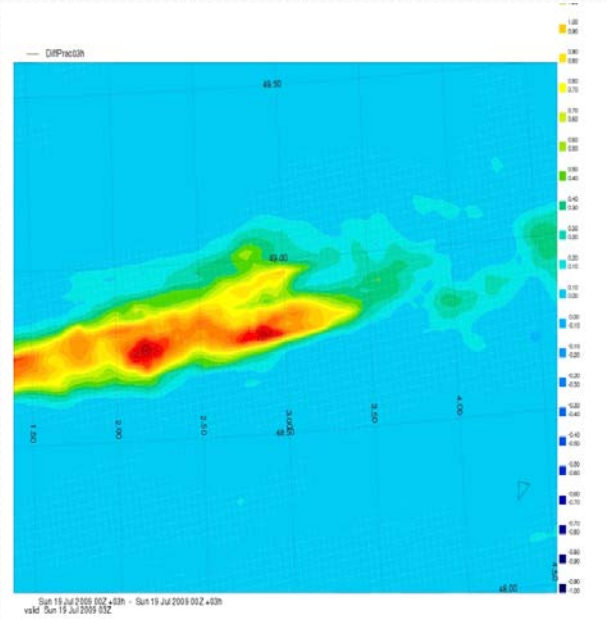
Paris area

06 hour

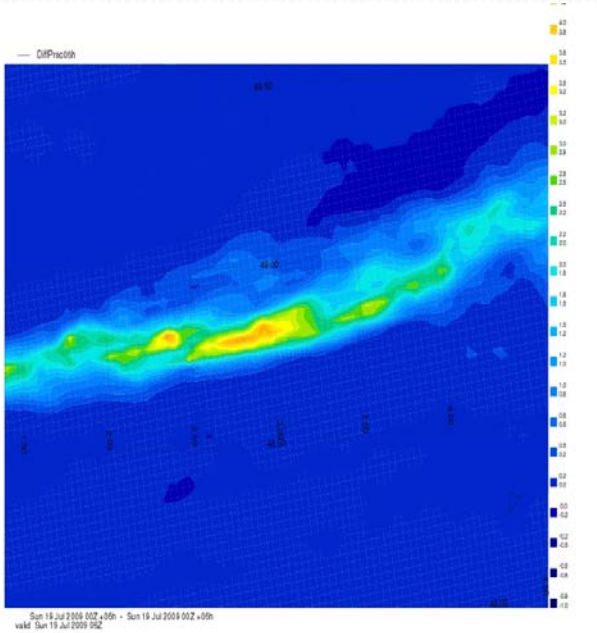
The first indirect effect

Total precipitation

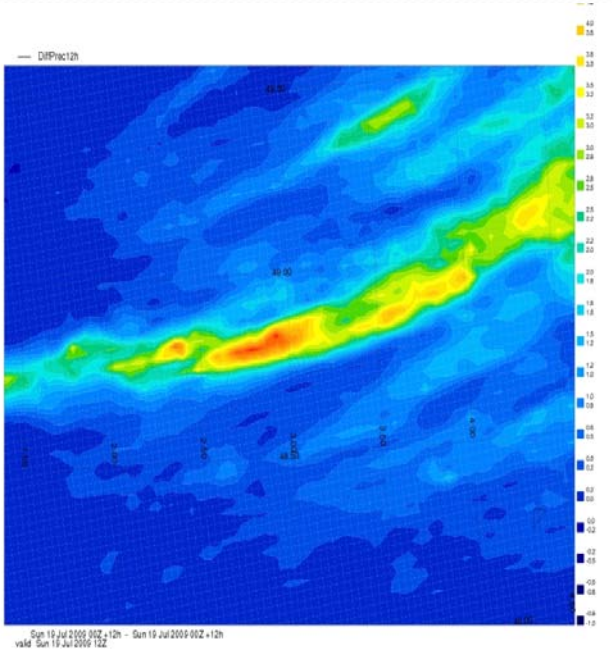
Aerosols experiment minus control experiment



03 hour



06 hour



12 hour

The second indirect effect

Conclusions:

- We have found obvious **EFFECTS OF AEROSOL EMISSIONS** appeared around Paris on the following parameters:
  - Air temperature: decrease at 2 m (**Direct effect**)
  - Heat fluxes: decrease in sensible heat flux (**Direct effect**)
  - Total cloud cover: increase (**The first indirect effect**)
  - Total precipitation: increase (**The second indirect effect**)
- We have found impact of winds to the dispersion of aerosols

THANK YOU!!!