

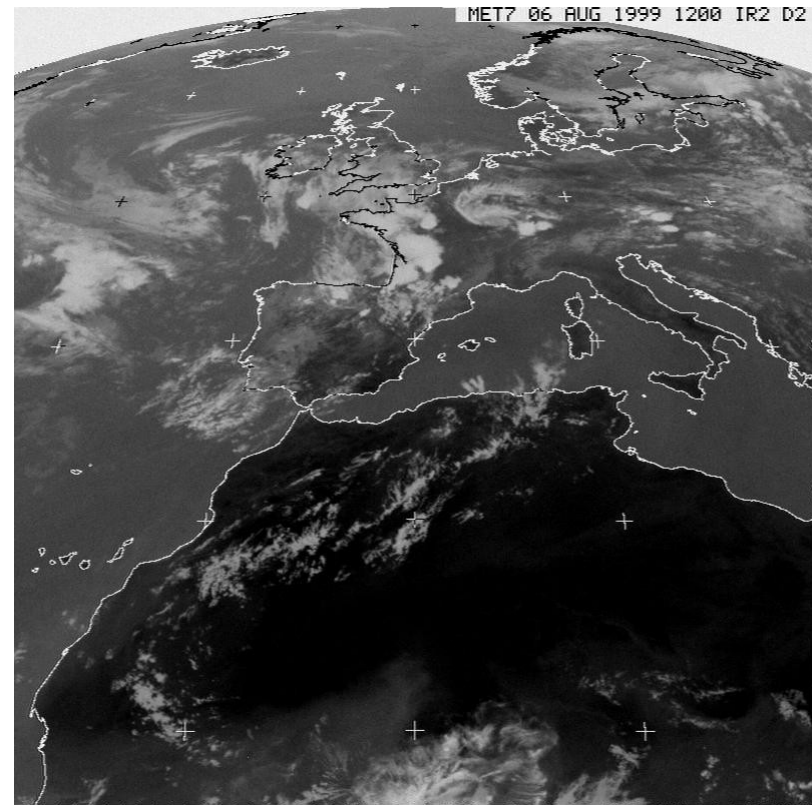
# **BOLCHEM air quality model: evaluation over Italy during few periods of 1999**

# Modeled episodes

**1999: 4 clear sky periods** selected based on *Meteosat Images of Europe*

- **January:** 20-25 {Wednesday to Monday}
- **June:** 1-4 {Tuesday to Thursday}
- **July:** 1-5 {Thursday to Sunday}
- **August:** 5-8 {Thursday to Saturday}

The period studied starts on first day at 00 UTC and ends last day at 00 UTC.



# Emissions, initial and boundary conditions

- The chemical fields are driven by hourly surface emissions and 3 hourly lateral boundary conditions after the initialisation. Emissions, initial and boundary conditions were derived from EMEP and provided by ENEA for the year 1999.
- The emission inventory includes also the ship emissions.
- Point source emissions are taken into account.

# Model configuration and meteorological inputs

- Horizontal resolution :  $0.2^{\circ} \times 0.2^{\circ}$ ;
- Vertical resolution : **33 sigma levels** from surface to the tropopause. The lower layer is approximately 30m above the surface;
- The meteorological fields : **ECMWF**. Lateral boundary conditions are updated every 6 hours. Weather fields re-initialized every 48 hours in order to avoid an excessive error growth in the meteorological forecast.

# Observational dataset used for evaluation

The model runs are on 20km resolution grid, therefore the model results are only compared with observations at rural and semi-rural locations.



# Analysis of the model predictions

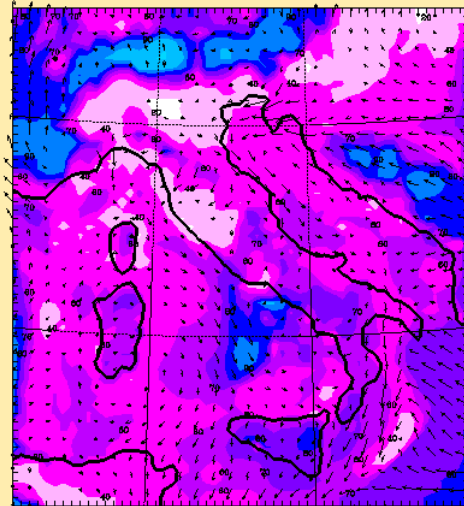
Gases under investigation: **O3 and NO2**

- **Spatial distribution** of gases during the modeled episodes
- **Time series** of observed and predicted mixing ratio of gases at sites

# Spatial distribution of O3 over Italy: January, June, July

O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 20/01/1999 0000 UTC  
 FORECAST HOUR + 36 VALID AT 21/01/1999 12 UTC  
 INTERVAL 0.00

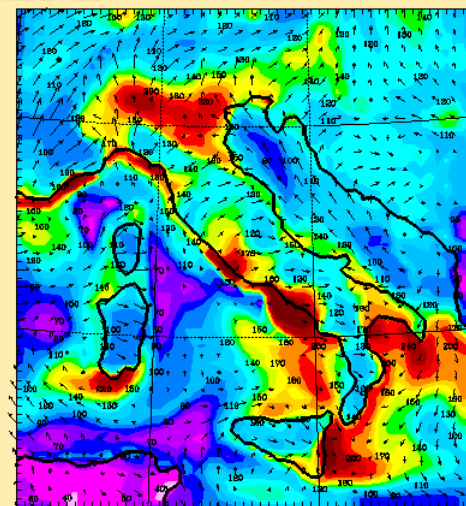


BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
 SAPRC-90



O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 01/08/1999 0000 UTC  
 FORECAST HOUR + 36 VALID AT 02/08/1999 12 UTC  
 INTERVAL -0.106

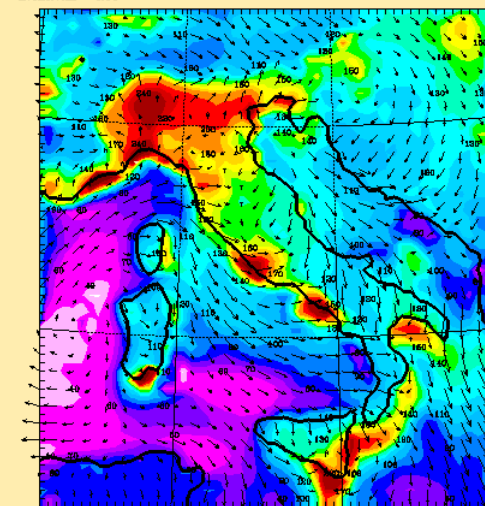


BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
 SAPRC-90



O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 01/07/1999 0000 UTC  
 FORECAST HOUR + 36 VALID AT 02/07/1999 12 UTC  
 INTERVAL 4.69

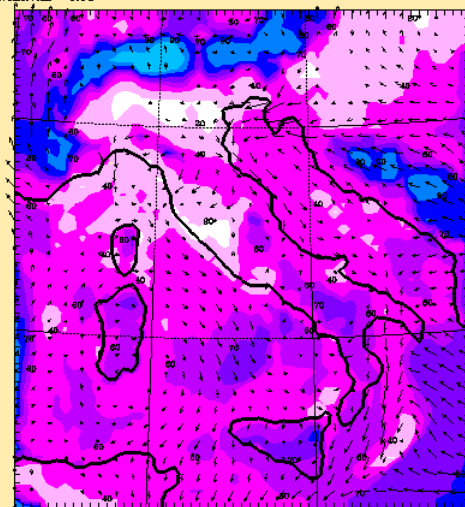


BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
 SAPRC-90

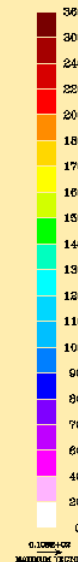


O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

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 FORECAST HOUR + 36 VALID AT 21/01/1999 12 UTC  
 INTERVAL 0.00

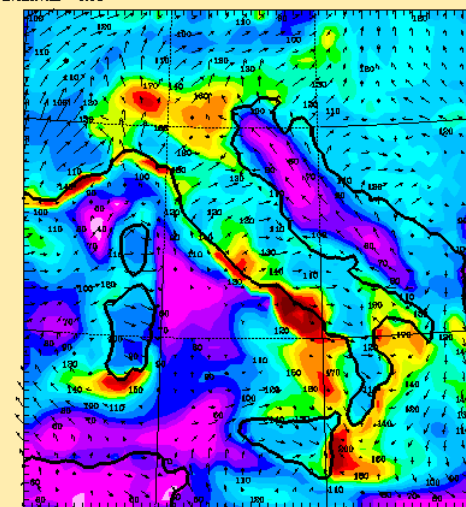


BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
 CB4+S02



O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 01/08/1999 0000 UTC  
 FORECAST HOUR + 36 VALID AT 02/08/1999 12 UTC  
 INTERVAL 0.00

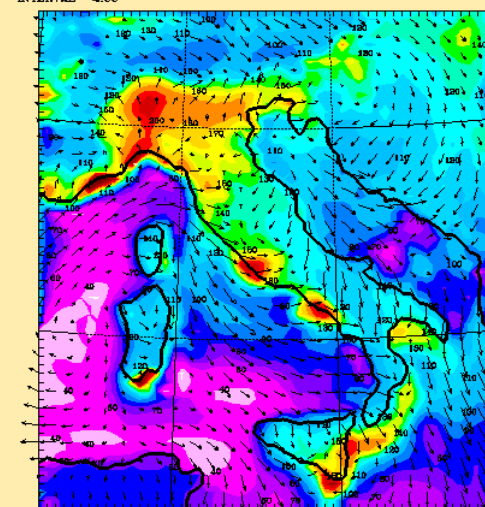


BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
 CB4+S02



O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 01/07/1999 0000 UTC  
 FORECAST HOUR + 36 VALID AT 02/07/1999 12 UTC  
 INTERVAL 4.69



BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
 CB4+S02



# Spatial distribution of O3 over Italy: August

O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 05/08/1999 0000 UTC

FORECAST HOUR + 36 VALID AT 06/08/1999 12 UTC

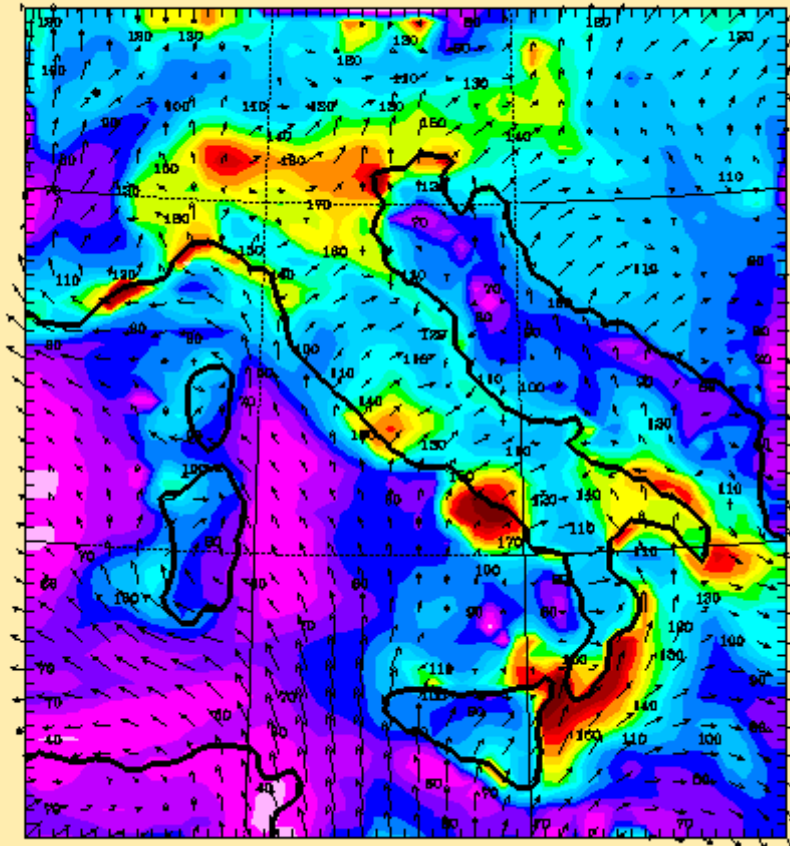
INTERVAL -0.257

O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 05/08/1999 0000 UTC

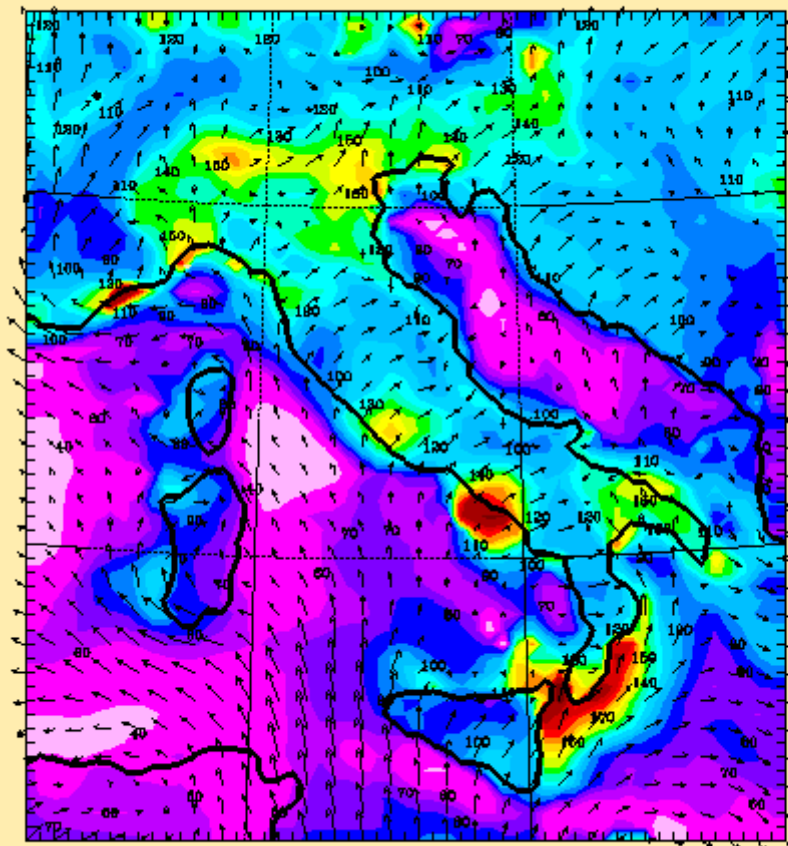
FORECAST HOUR + 36 VALID AT 06/08/1999 12 UTC

INTERVAL -0.257



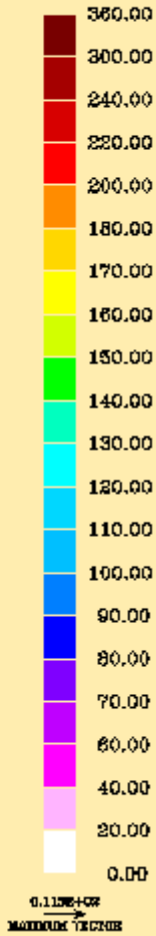
BOLCHEM MODEL, ISAC-CNR, BOLOGNA

SAPRC-90



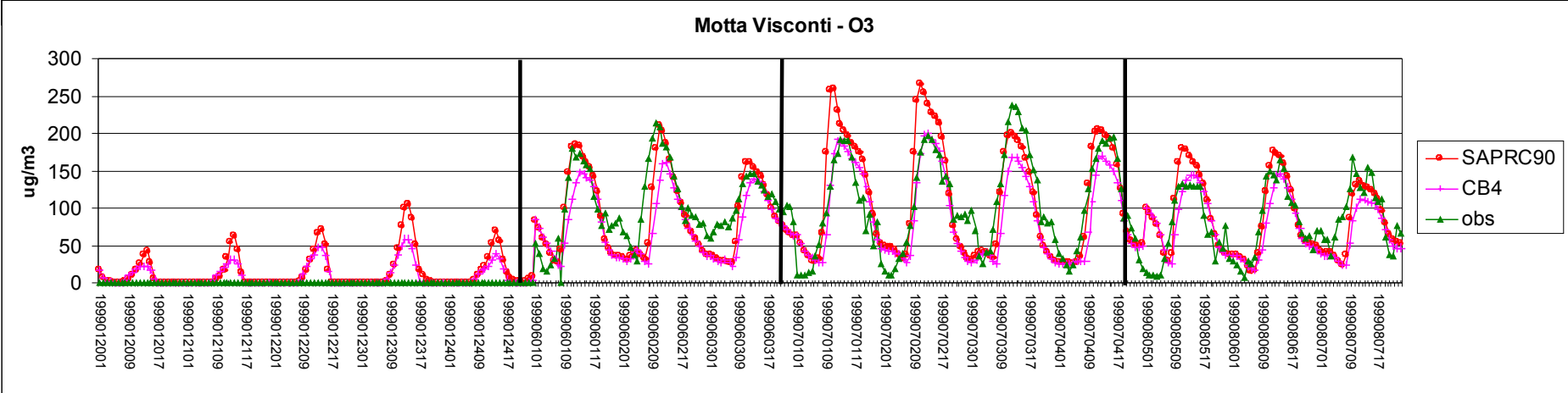
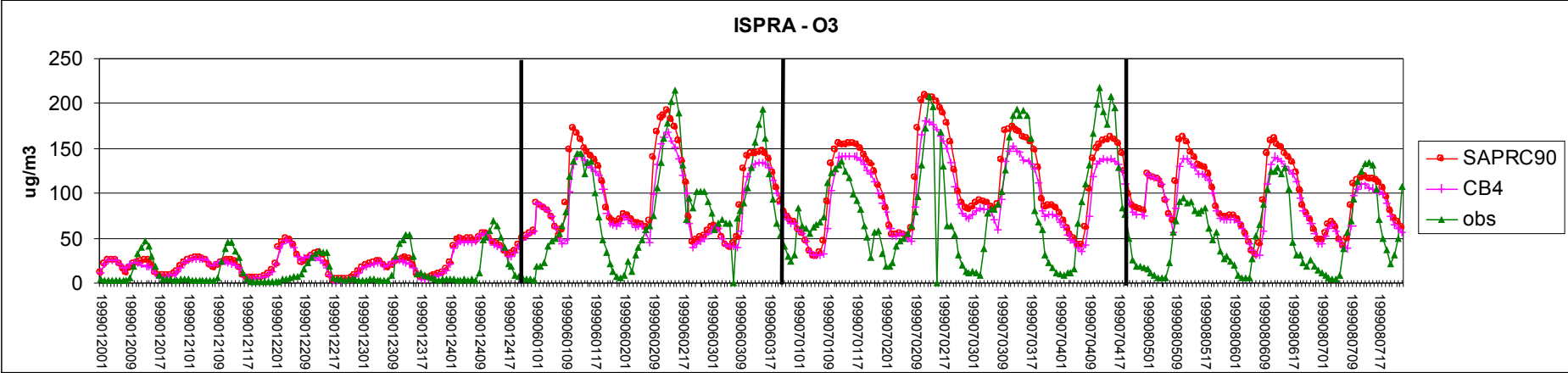
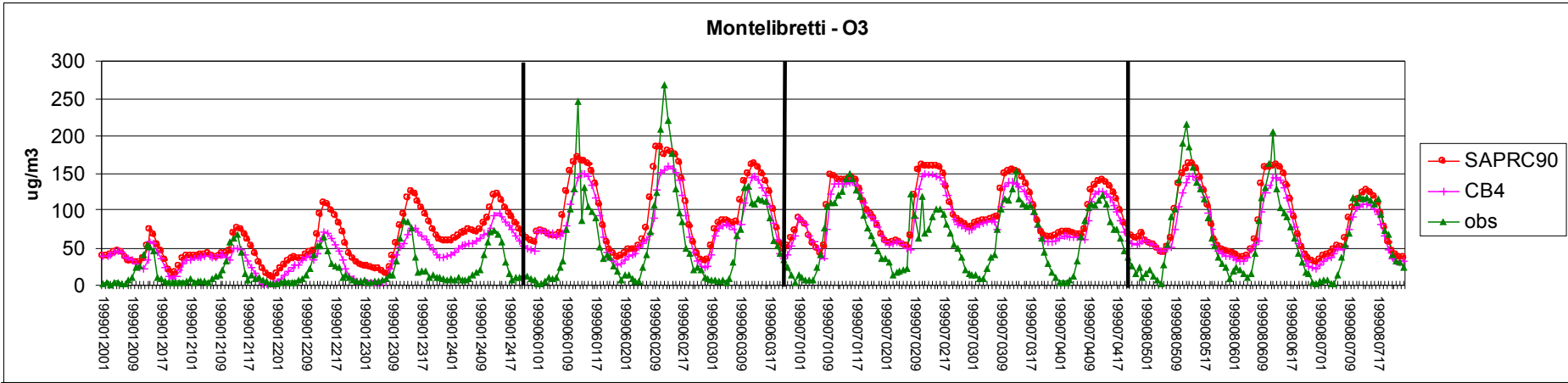
BOLCHEM MODEL, ISAC-CNR, BOLOGNA

CB4+S02

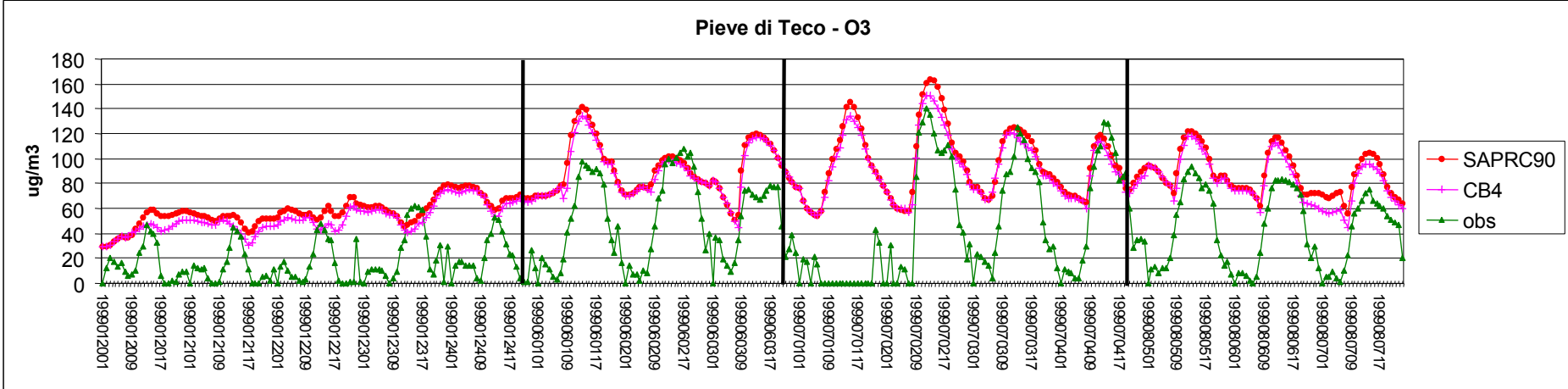
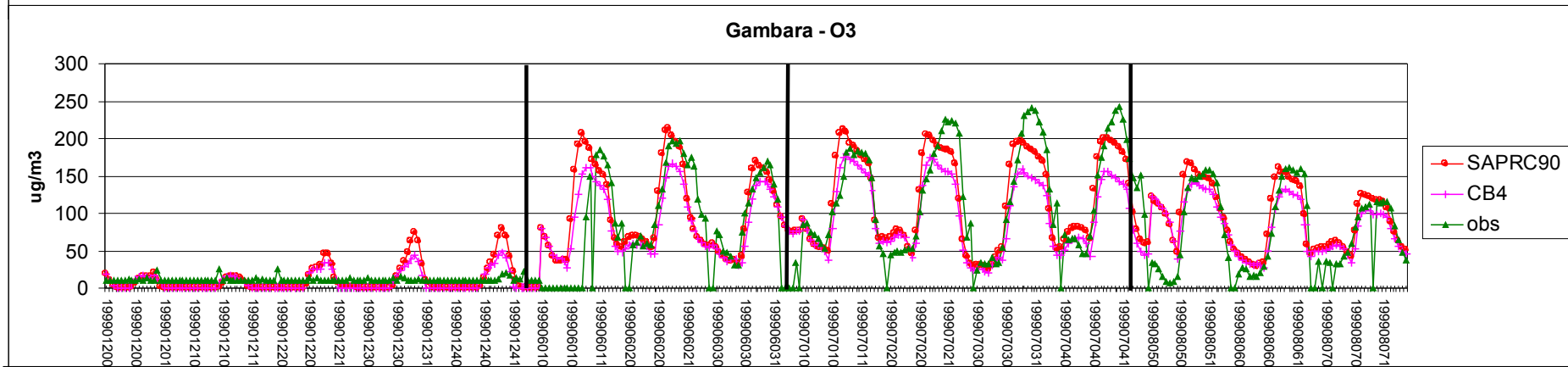
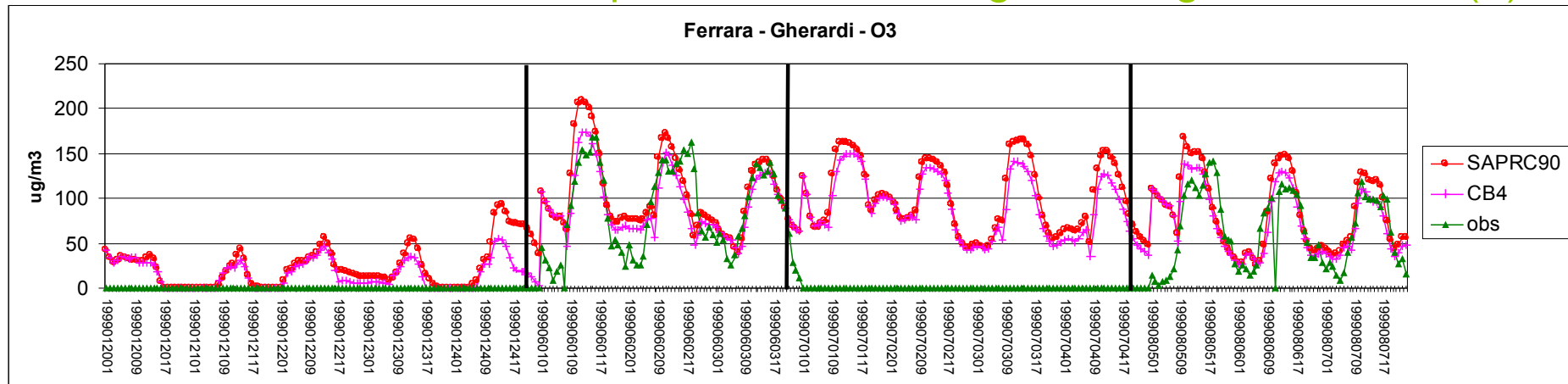




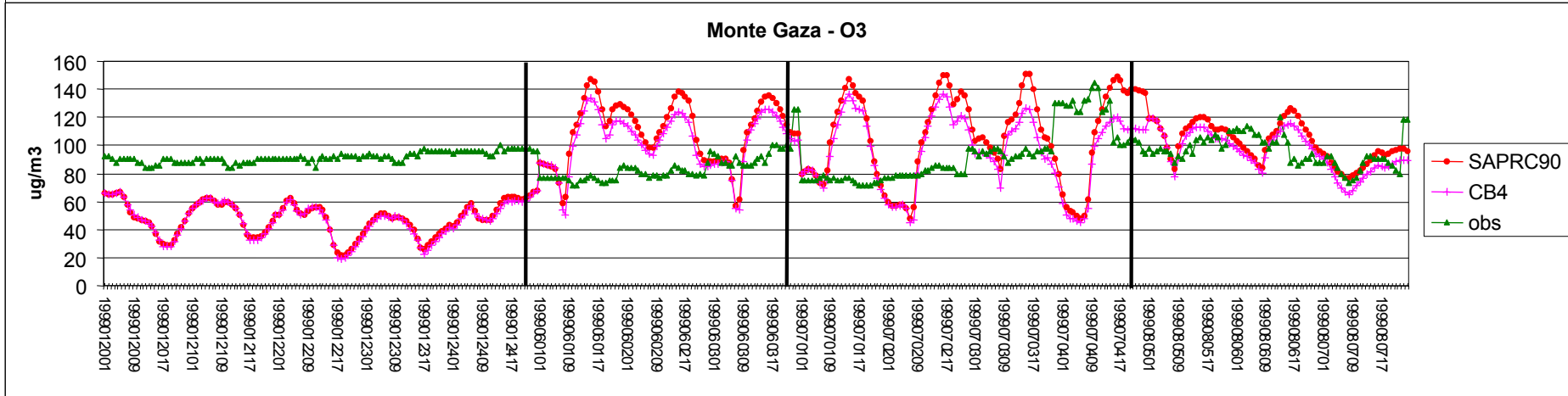
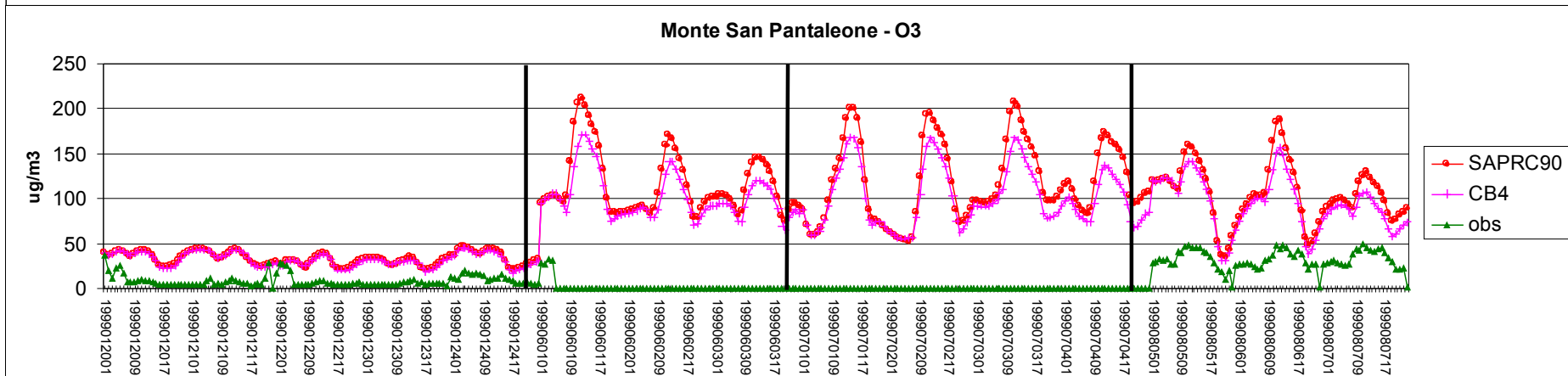
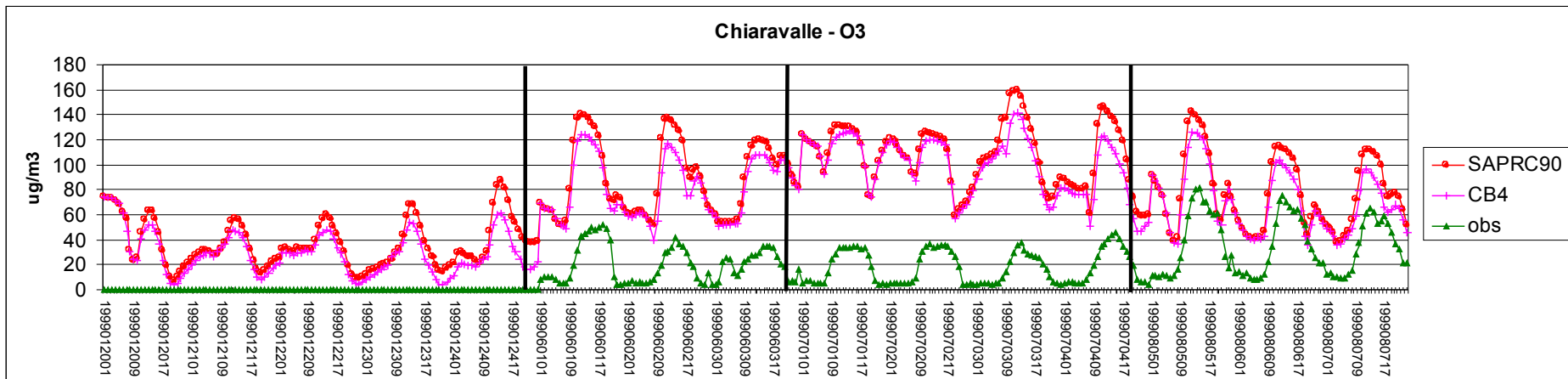
# Time series of observed and predicted O3 mixing ratio of gases at sites (1)



# Time series of observed and predicted O3 mixing ratio of gases at sites (2)



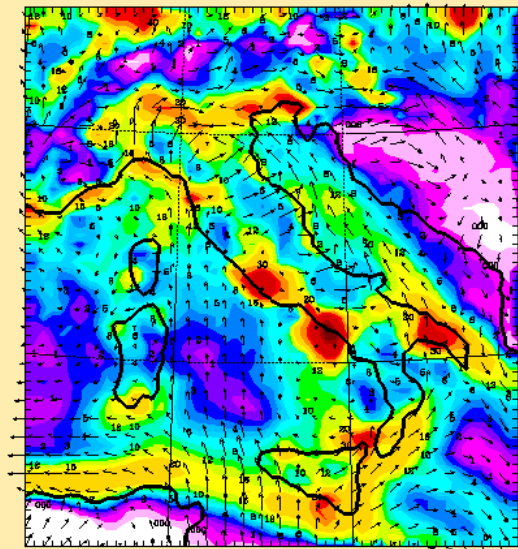
# Time series of observed and predicted O3 mixing ratio of gases at sites (3)



# Spatial distribution of NO2 over Italy

NO2 LIVELLO BOLCHEM 1 (MICROGR/M3)

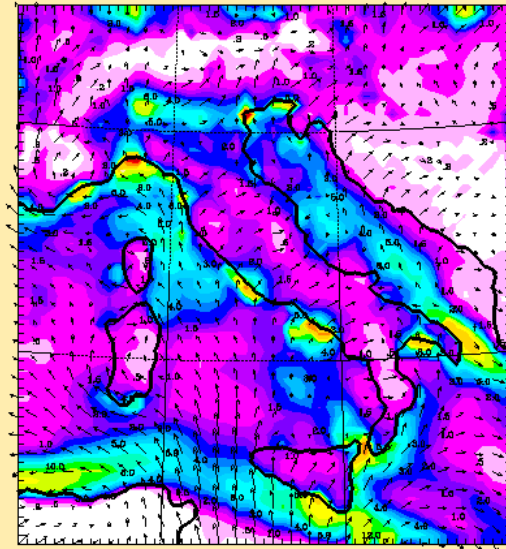
INITIAL DATE 05/08/1999 0000 UTC  
FORECAST HOUR + 21 VALID AT 06/08/1999 21 UTC  
INTERVAL 0.00



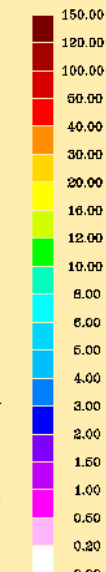
BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
CB4+SD3

NO2 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 05/08/1999 0000 UTC  
FORECAST HOUR + 35 VALID AT 06/08/1999 12 UTC  
INTERVAL 0.00

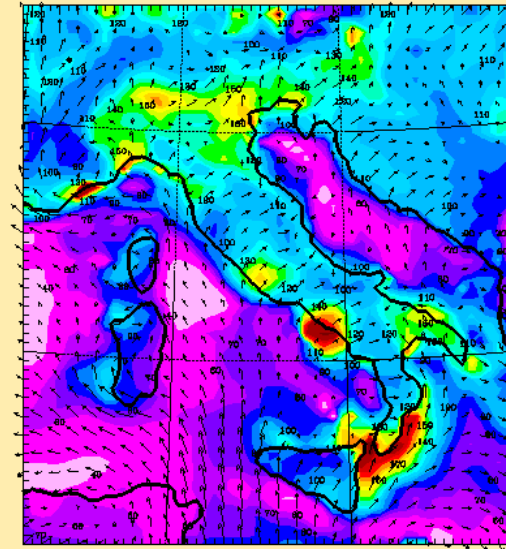


BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
CB4+SD3

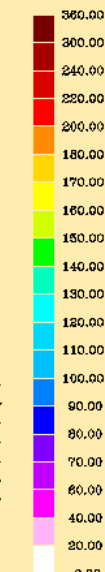


O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 05/08/1999 0000 UTC  
FORECAST HOUR + 35 VALID AT 06/08/1999 12 UTC  
INTERVAL -0.257

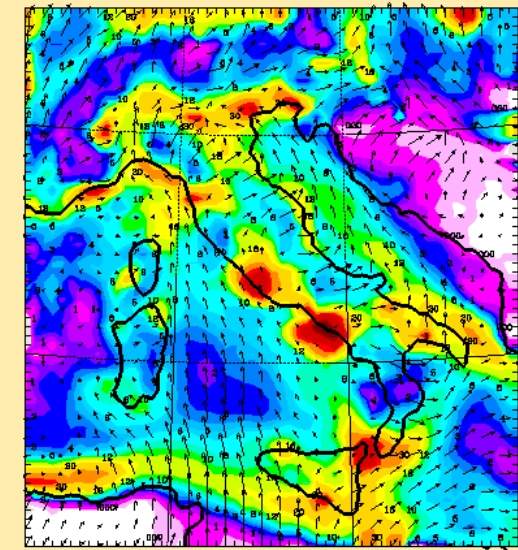


BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
CB4+SD3



NO2 LIVELLO BOLCHEM 1 (MICROGR/M3)

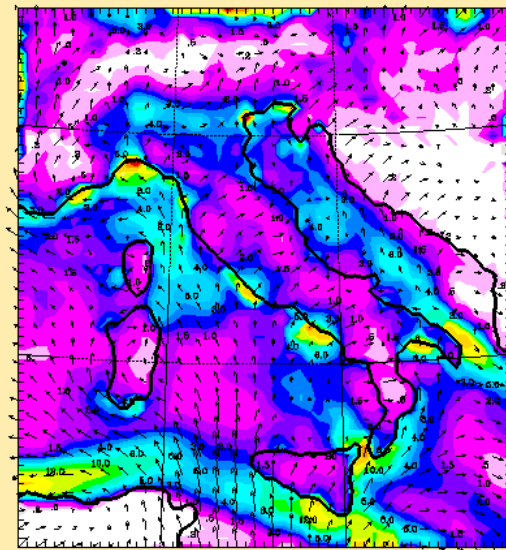
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FORECAST HOUR + 45 VALID AT 06/08/1999 21 UTC  
INTERVAL -0.924



BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
SAPRC-90

NO2 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 05/08/1999 0000 UTC  
FORECAST HOUR + 35 VALID AT 06/08/1999 12 UTC  
INTERVAL -0.257

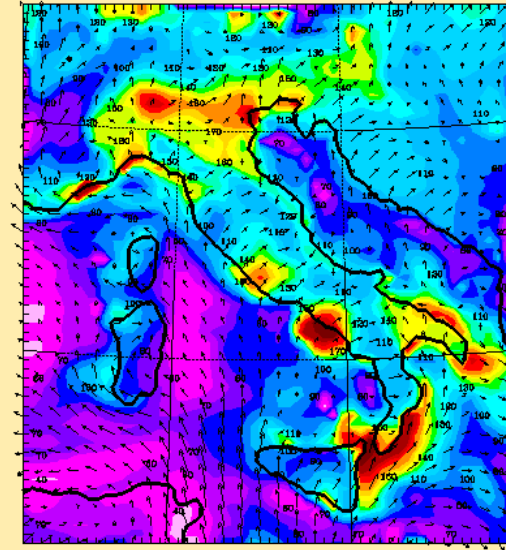


BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
SAPRC-90

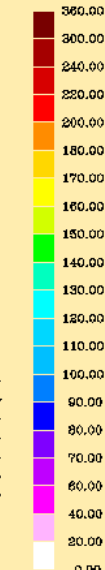


O3 LIVELLO BOLCHEM 1 (MICROGR/M3)

INITIAL DATE 05/08/1999 0000 UTC  
FORECAST HOUR + 35 VALID AT 06/08/1999 12 UTC  
INTERVAL -0.257

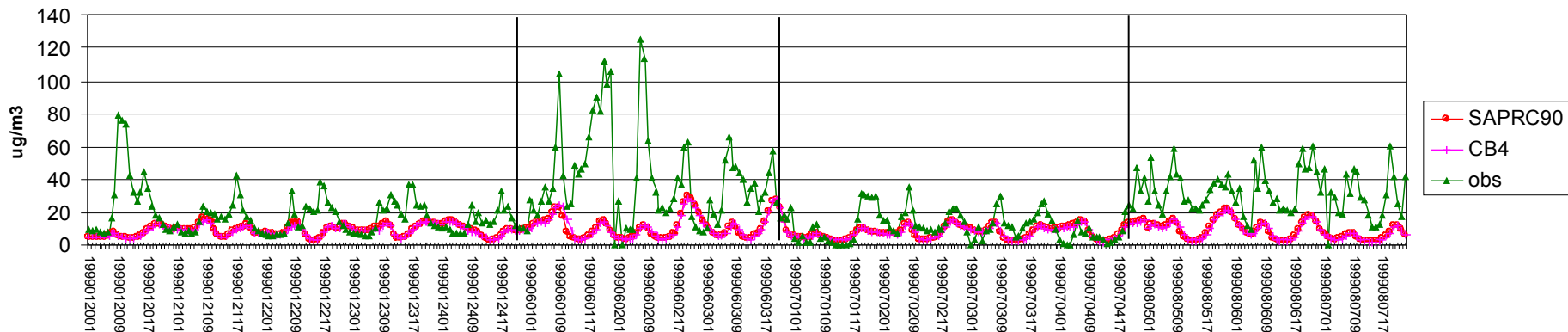


BOLCHEM MODEL, ISAC-CNR, BOLOGNA  
SAPRC-90

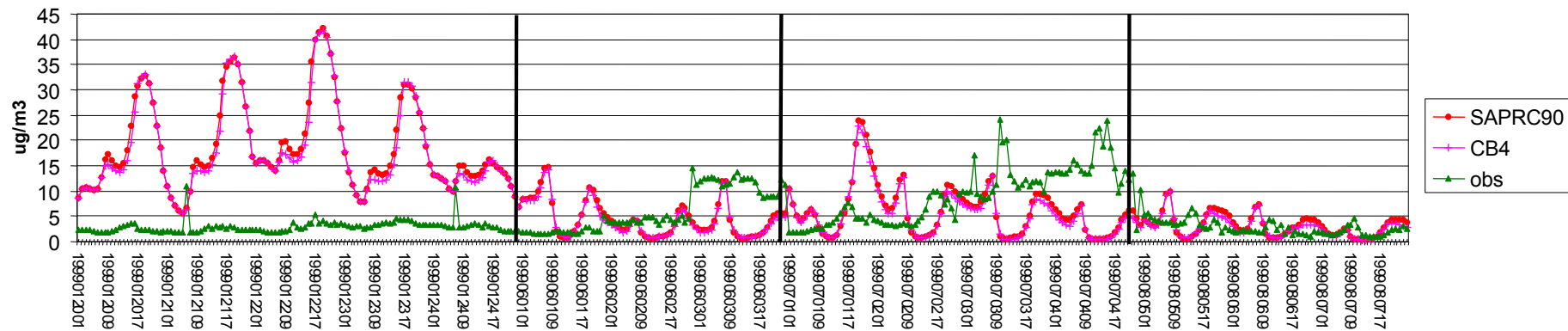


# Time series of observed and predicted NO2 mixing ratio of gases at sites

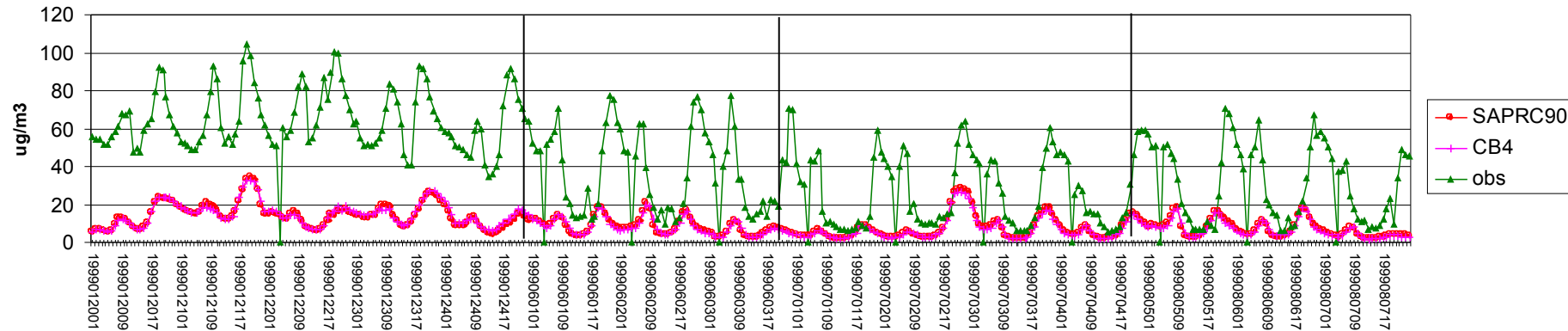
## Bocca di Falco - NO2



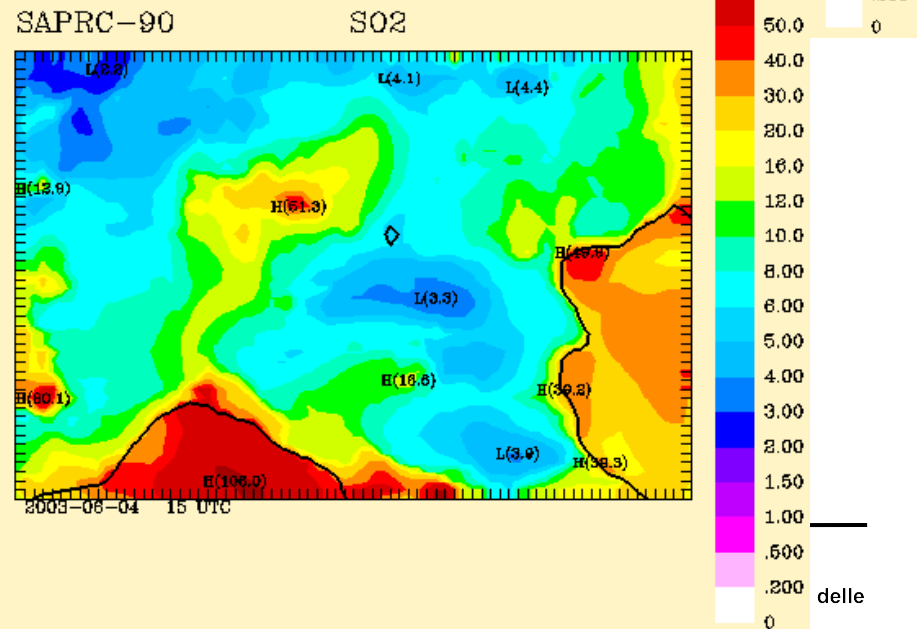
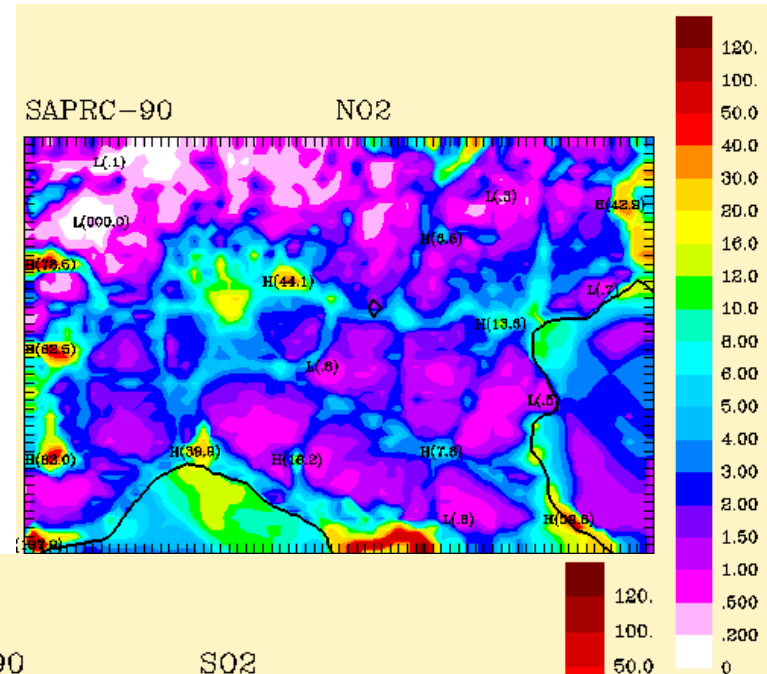
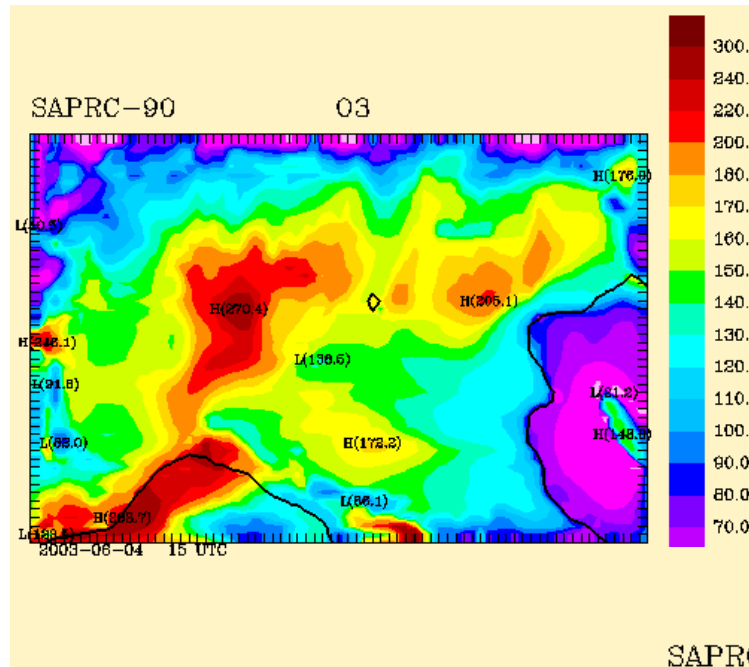
## Monte Gaza - NO2



## Pescara D'Annunzio - NO2



# High resolution example: One way Nesting



4<sup>th</sup> June 2003, 15 UTC

Horiz. Res.: 0.06°x0.06°

# Considerazioni finali

- Allo stato attuale di sviluppo, il modello fornisce **buoni risultati** per le concentrazioni di O<sub>3</sub> confrontandolo con centraline sparse sul territorio italiano.
- Ci sono **problemi con alcuni siti**, soprattutto con NO<sub>2</sub>.  
Possibili cause:
  - rappresentatività delle singole stazioni/risoluzione,
  - locazione delle stazioni (costa, orografia complessa)
  - Errori nell'inventario delle emissioni
  - Deficit in qualche parametrizzazione nel modello