

# Air pollution modeling over complex terrain

## WRFchem applied for Switzerland

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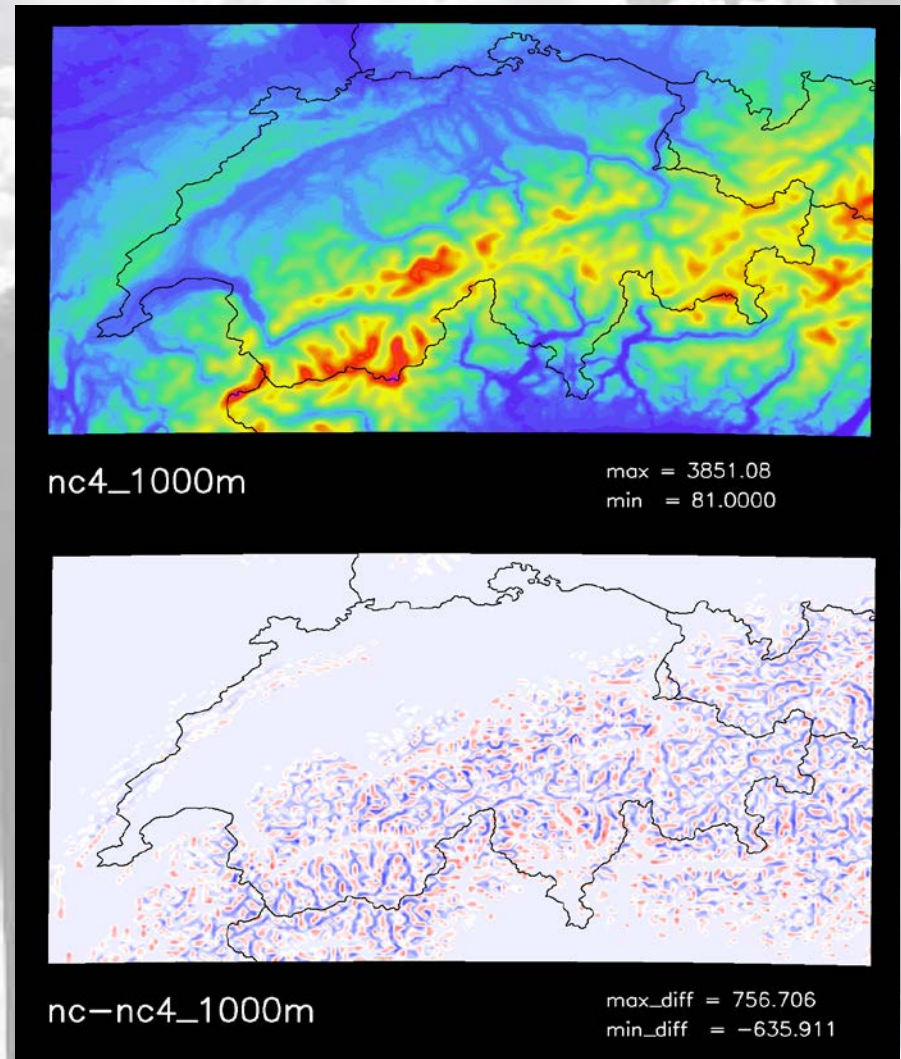
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# Method

- WRF with WRFchem extension
  - Swiss domain nested into European domain
  - Simulation for July and January 2002
- Swiss domain description
  - 2 km horizontal resolution
  - 210 x 135 grid points
  - 28 vertical sigma layers
  - Boundary conditions from nesting
- Additional European domain description
  - 30 km horizontal resolution
  - NCEP Reanalysis 2
  - Monthly mean values from LMDZ-INCA (1997-2001)
  - EMEP emissions data
- Topography smoothing for grid points > 1000 m altitude



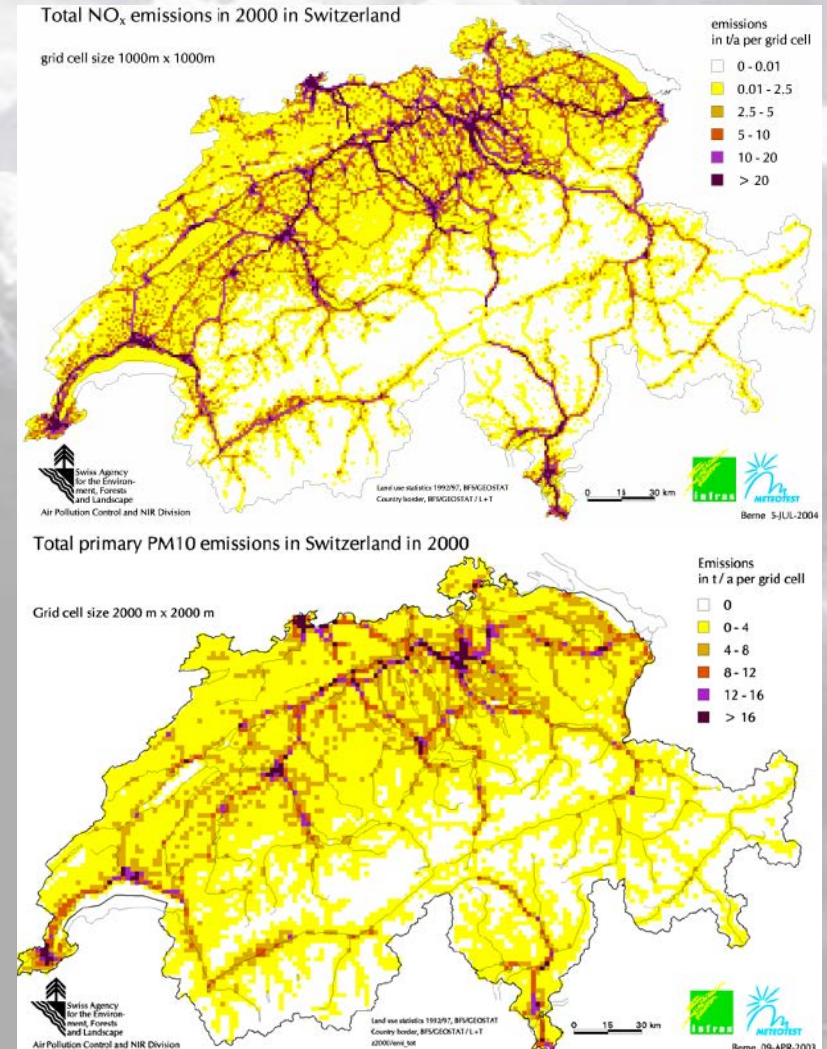
# WRF / WRFchem options

- Physics options
  - Ferrier scheme (Microphysics)
  - RRTM scheme (Longwave radiation)
  - Dudhia scheme (Shortwave radiation)
  - Monin-Obukhov (Janjic Eta) Similarity scheme (Surface layer)
  - Noah Land-Surface Model
  - Mellor-Yamada-Janjic TKE scheme (Planetary Boundary Layer)
  - Betts-Miller-Janjic scheme (Cumulus parametrization)
- Chemistry options
  - CBMZ chemical mechanism
  - MOSAIC using 4 sectional aerosol bins
  - Fast-J photolysis option
  - Biogenic emissions from MEGAN

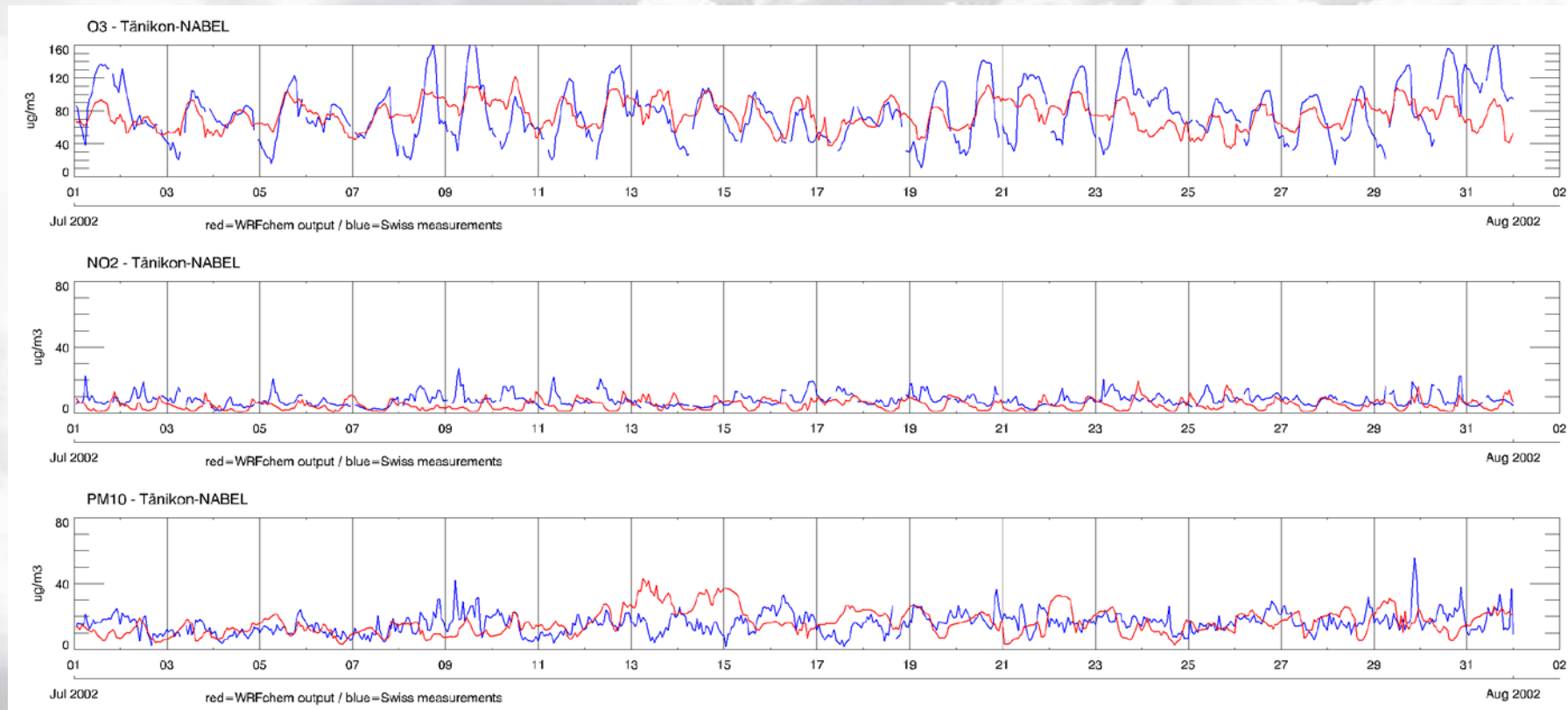


# Anthropogenic emissions

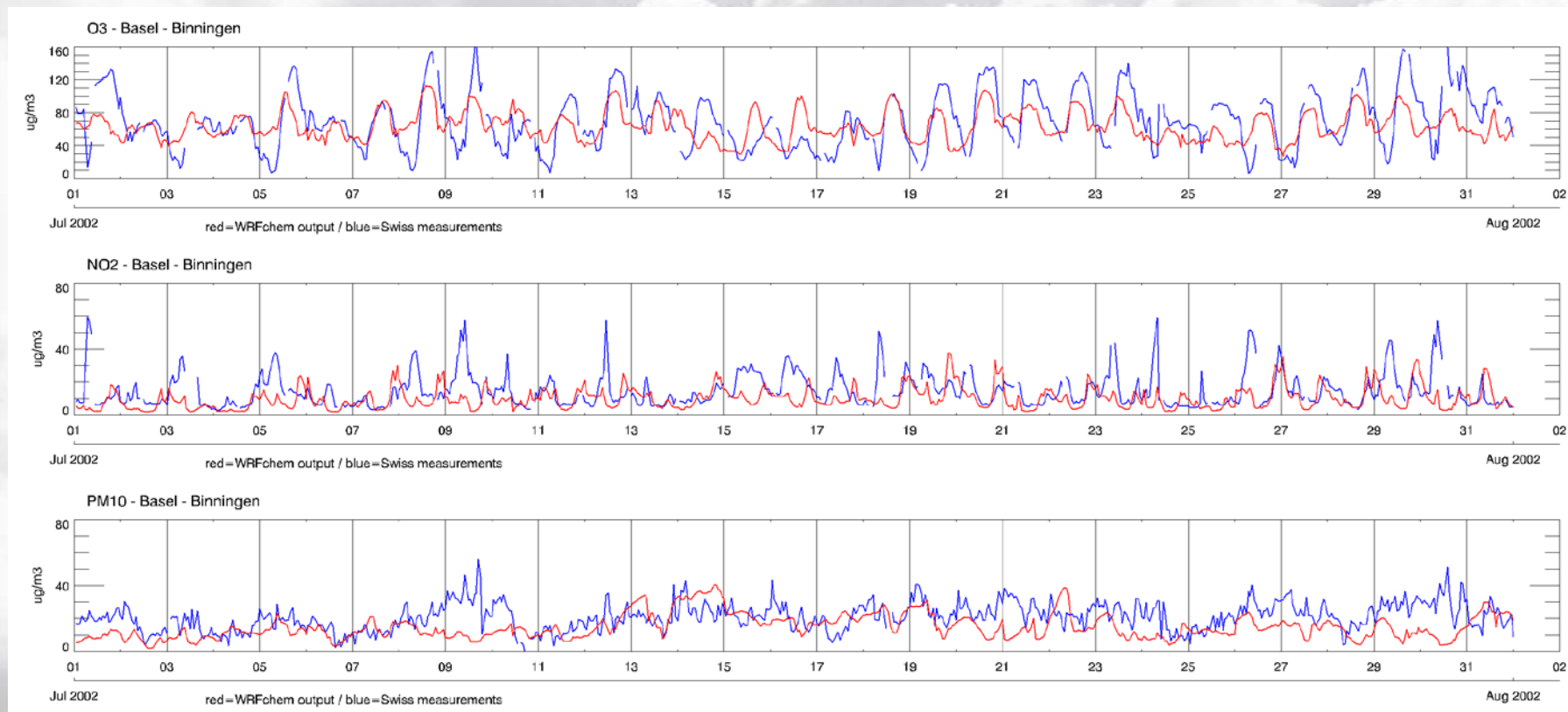
- $PM_{10}$ ,  $PM_{2.5}$  and  $NO_x$  emissions obtained from SAEFL
- Other needed pollutants generated with similar approach
- Yearly emissions (2000) scaled to 2002
- Spatial disaggregation with inverse next neighbour method
- Disaggregation to hourly emissions (GENEMIS project)
- Vertical disaggregation into lowest 6 sigma layers
- Chemical species disaggregation to the CBMZ mechanism



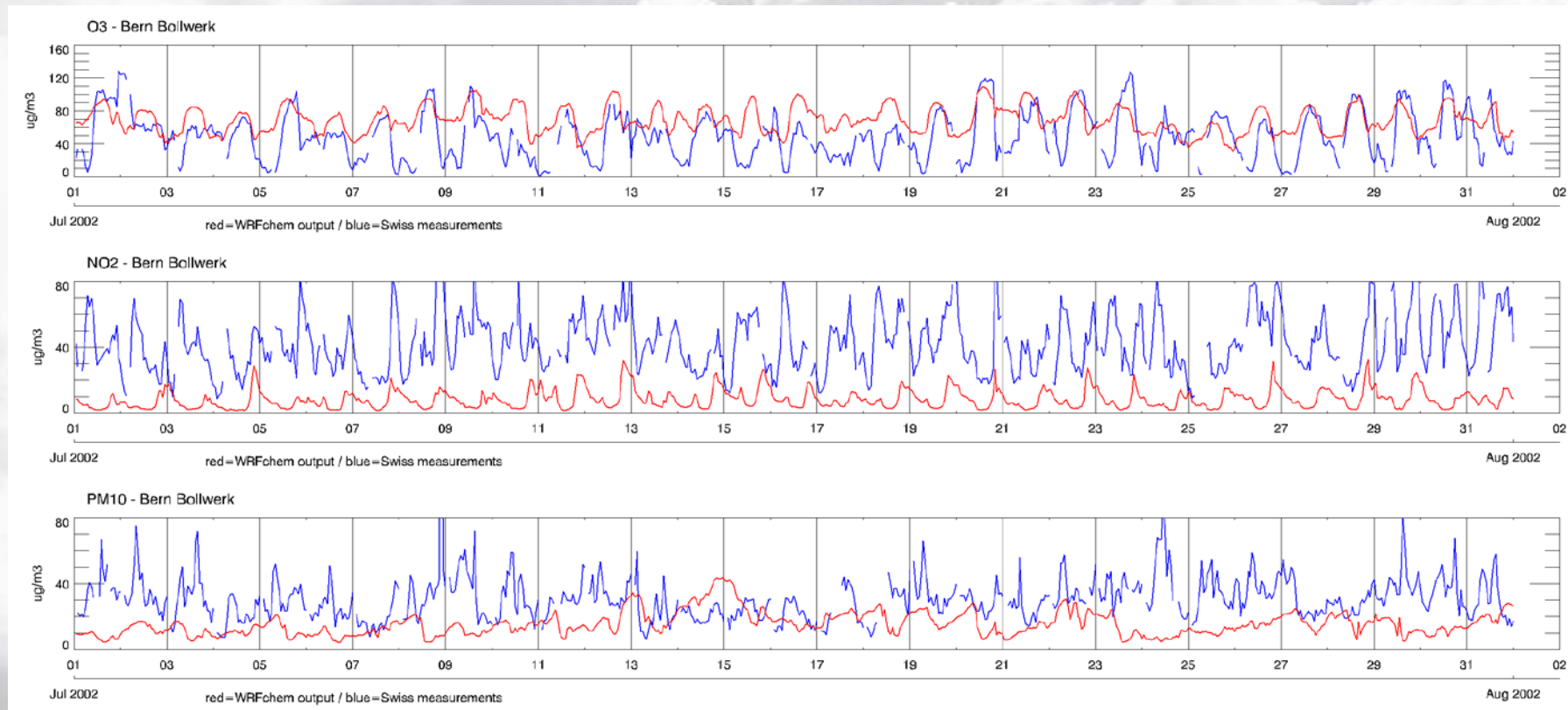
# Rural station - Tänikon



# Suburban station – Basel-Binningen

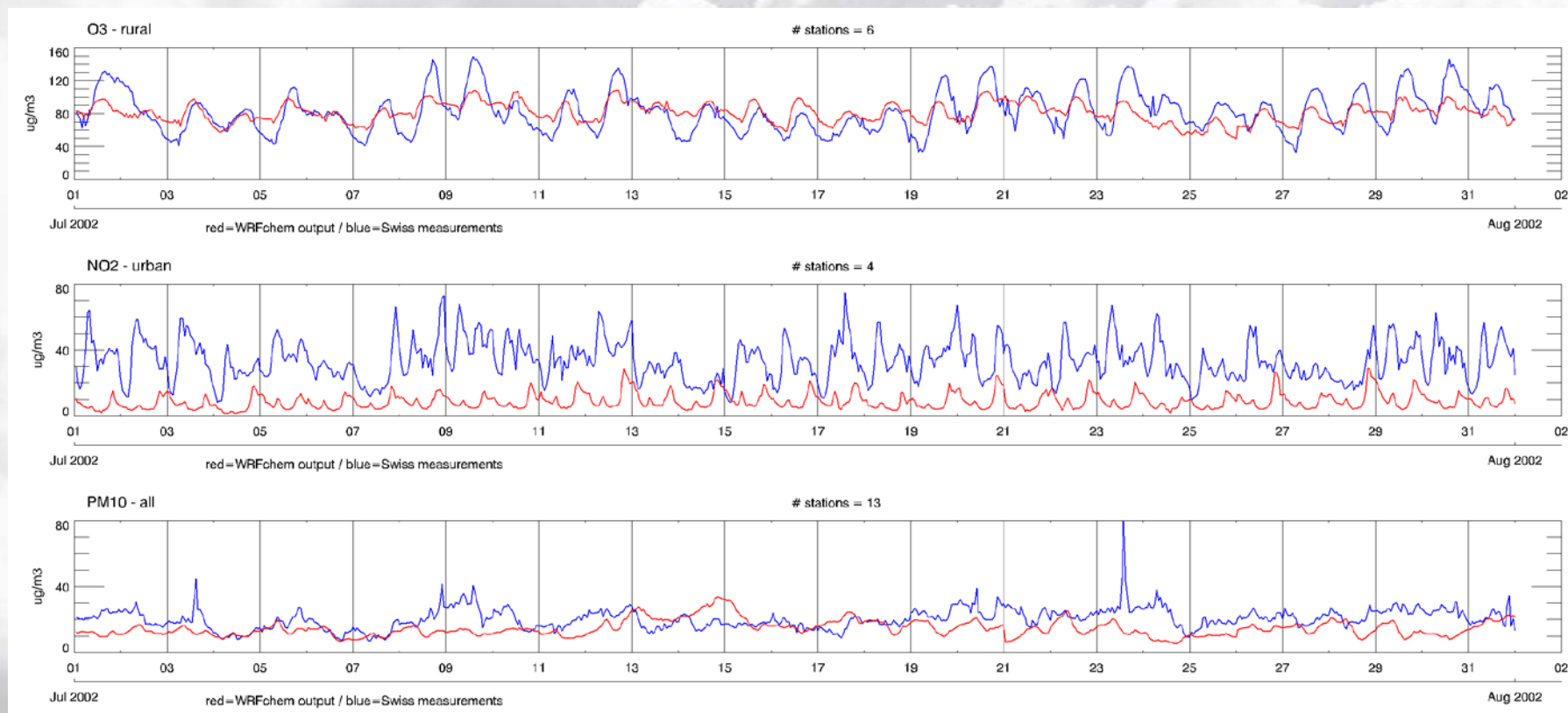


# Urban station – Bern-Bollwerk



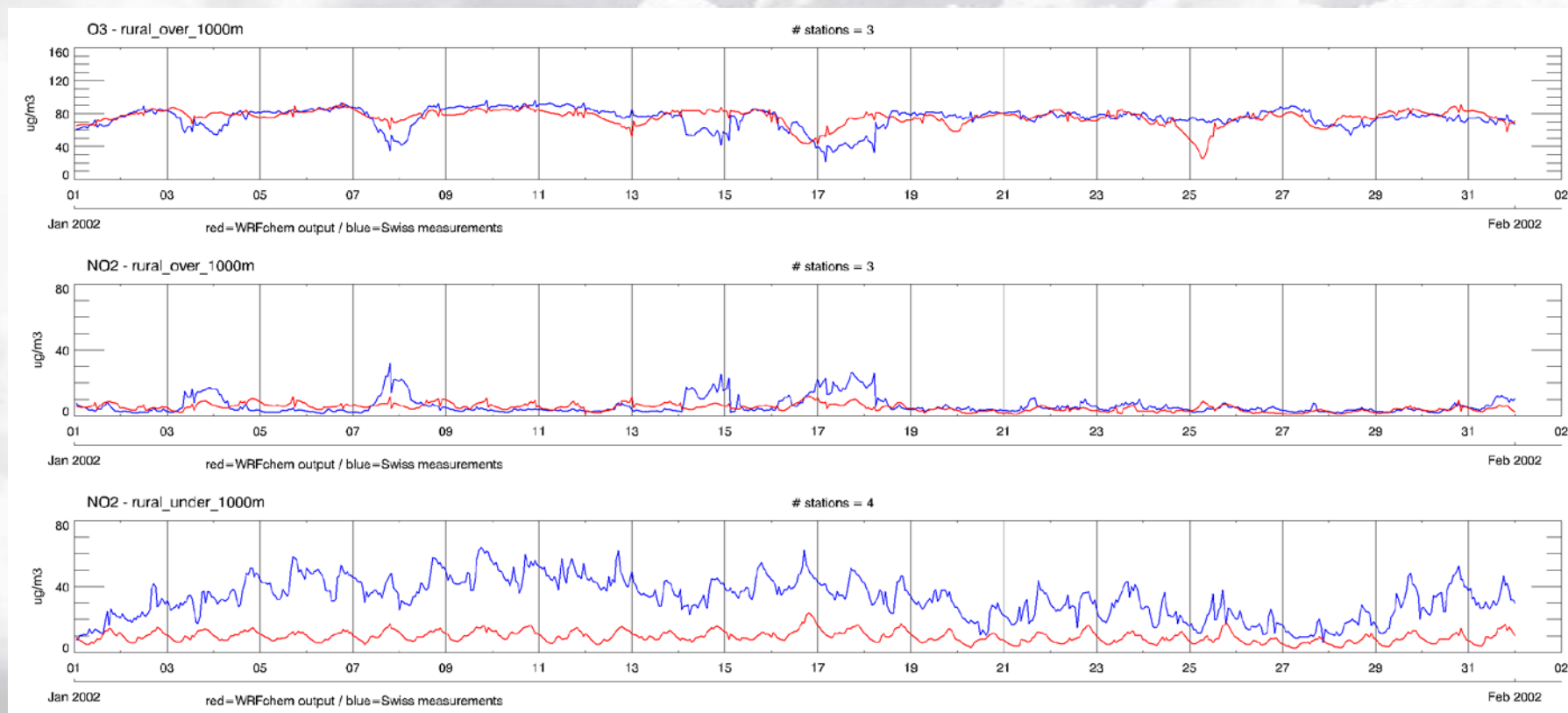


# Overview – July 2002





# Overview – January 2002



# Conclusions

- Results from July are satisfying for rural and suburban stations
- Results from January are satisfying for rural stations over 1000 m altitude, but not below (for  $O_3$  and  $NO_2$ )
- Results from January for  $PM_{10}$  for rural stations are satisfying
- 2 km resolution can not represent urban stations and stations directly beside a highway (January & July 2002)

## Acknowledgment

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