COMBINED USE OF SPACE-BORNE OBSERVATIONS OF NO2 AND REGIONAL CTM MODELS FOR AIR QUALITY MONITORING IN NORTHERN ITALY

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QUITSAT : integration of satellite, ground-based and mathematical modelling data (2006 – 2009)

Monitoring

PM and gaseous pollutants (O_3, NO_2, SO_2, HCHO) monitoring

Forecast

Real time gaseous and PM forecast

Planning

Sustainable emission scenarios assessment

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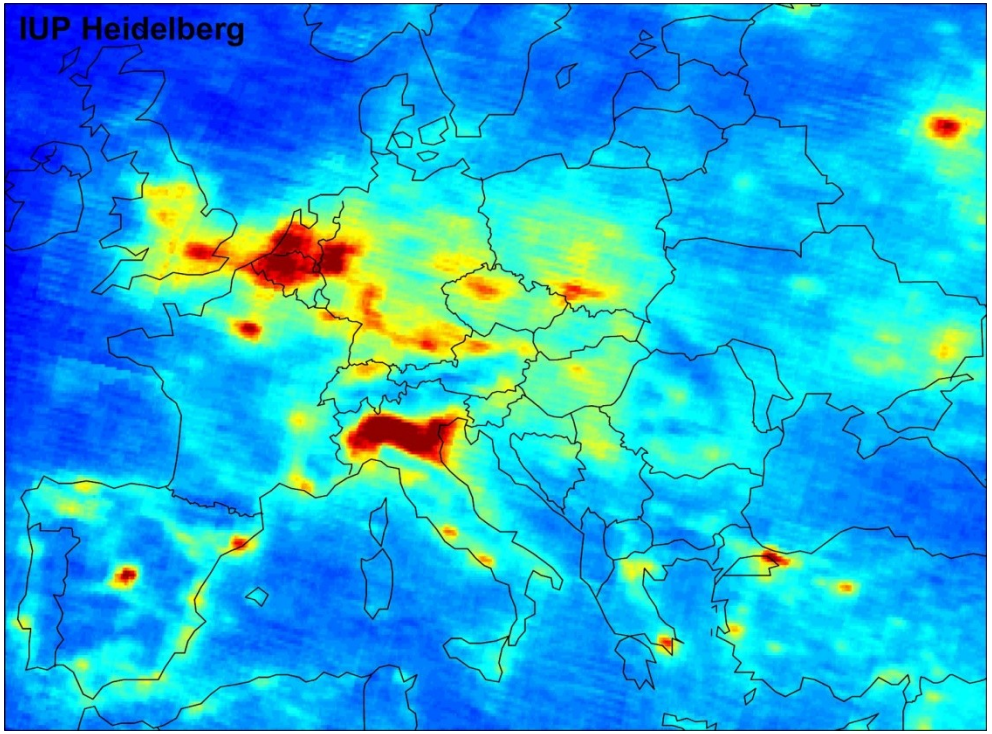
QUITSAT : integration of satellite, ground-based and mathematical modelling data

- Basic idea:
  - To merge satellite data column measurement of NO_2 and CTM simulated column, in order to provide a consistent NO_2 ground level concentration map.

- Methodology:
  - Satellite data retrieved NO_2 column
  - CTM simulated NO_2 column
  - Merging of the two dataset
  - Ground level concentration map

Methodology: Satellite data

- **SCIAMACHY** (***SC****anning* ***I****maging* ***A****bsorption spectro****M****eter for* ***A****tmospheric* ***C****artograp****HY****)* is a passive remote sensing spectrometer observing backscattered, reflected, transmitted or emitted radiation from the atmosphere and Earth's surface
- the instrument flies on board **ENVISAT** which was launched on 1 March 2002.

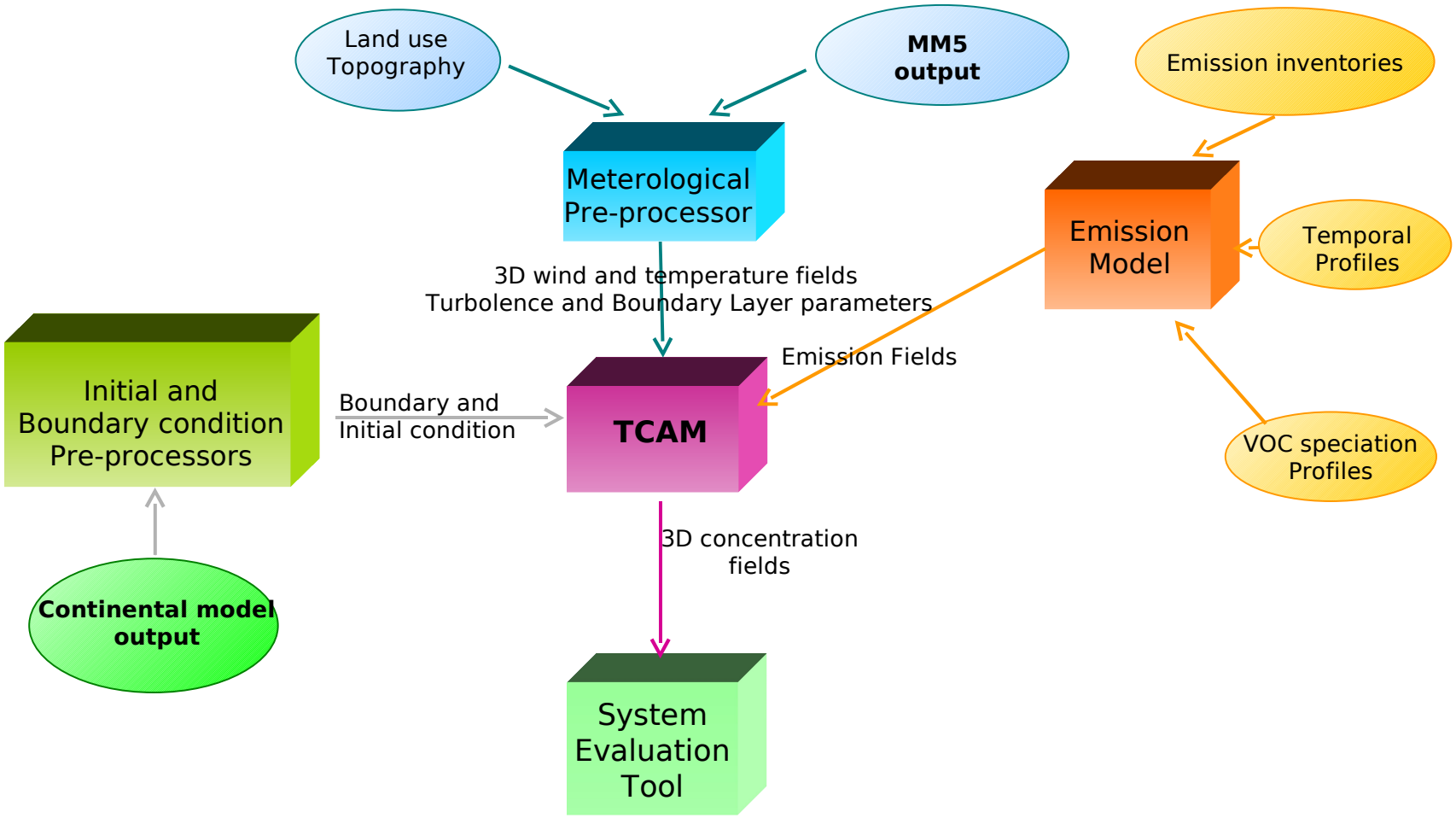


Methodology: Satellite data

- **SCIAMACHY** retrieved **NO2** column:
  - Nadir observation of NO_2 slant column using DOAS (Differential Optical Absorption Spectroscopy) technique
  - Stratospheric contribution is removed using clean air values

- Features of **SCIAMACHY** data:
  - 30x60 km^2
  - Overpass time at 10:30 local time
  - Limitation due to cloud presence in the instrumental field of view

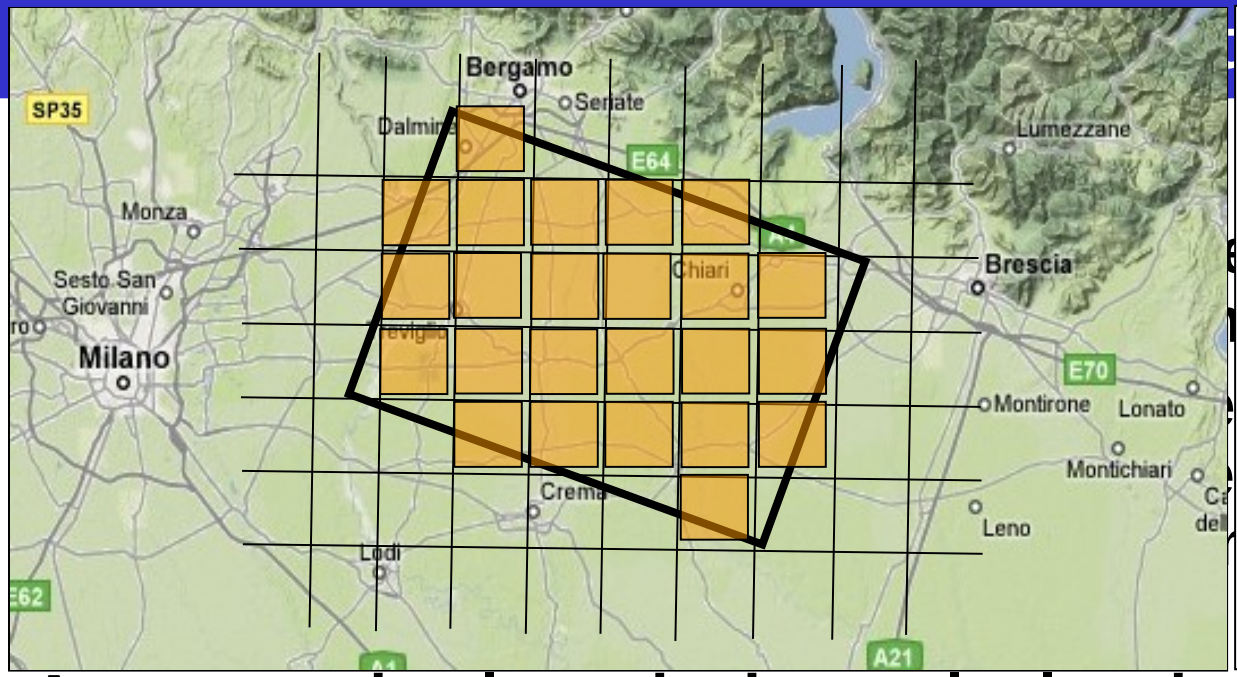
Methodology: GAMES simulation system



Methodology: GAMES simulation system

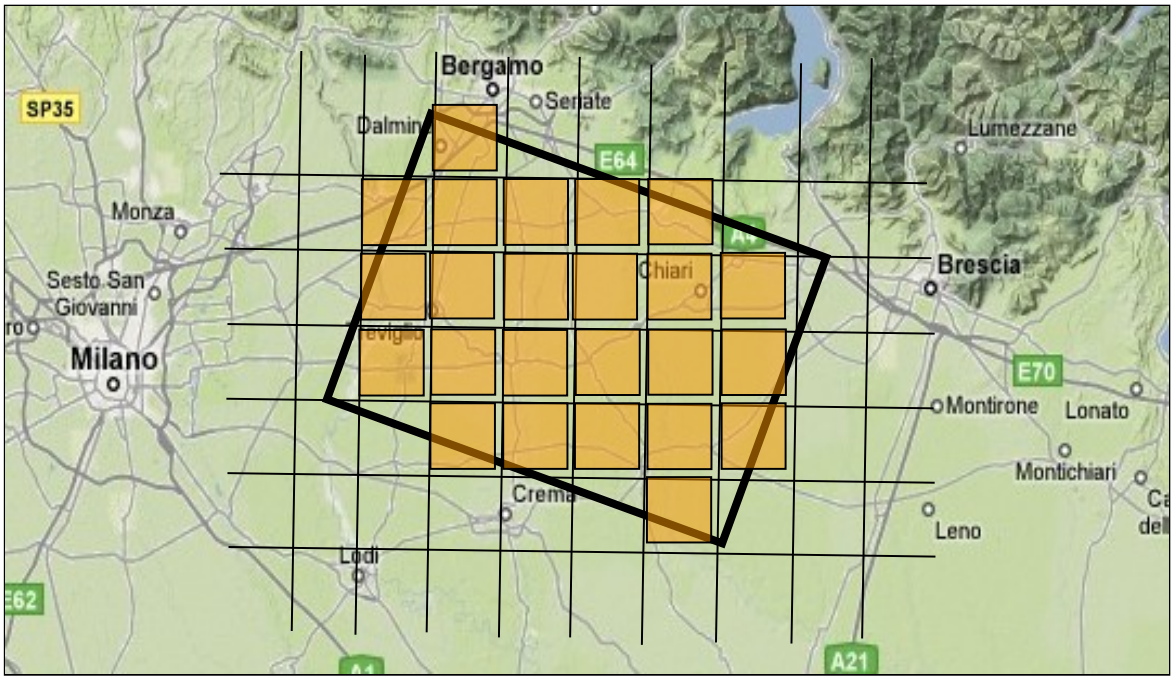
- **GAMES** simulation features:
  - Domain: the Po Valley (640 x 480 km)
  - Spatial resolution of 10 x 10 km (64 x 48 cells)
  - Emission model: CTN-ACE Italian modelling intercomparison project
  - Meteorological model: MM5

- Merging with **SCIAMACHY**:
  - only concentrations at satellite passing hours have been used.

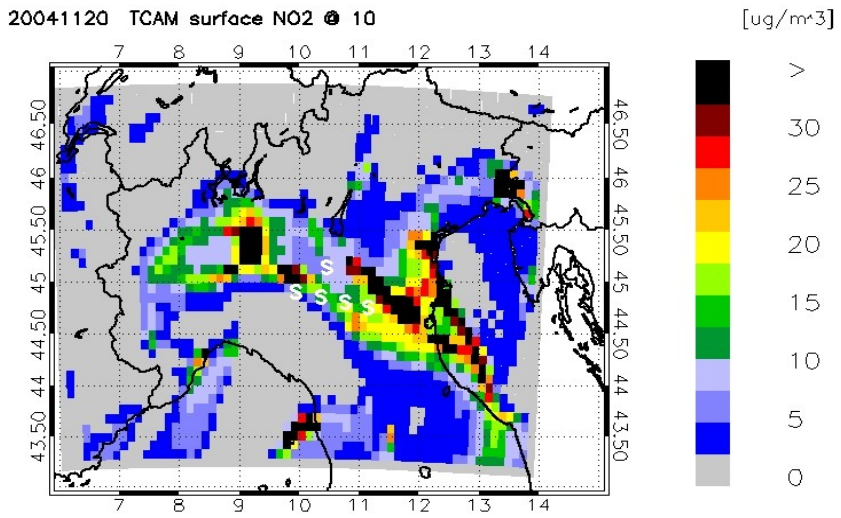


- **A corrected column is then calculated as a weighted average between satellite and model columns.**
- **The NO2 profile is properly scaled.**
- **The ground level concentration map is the final output.**

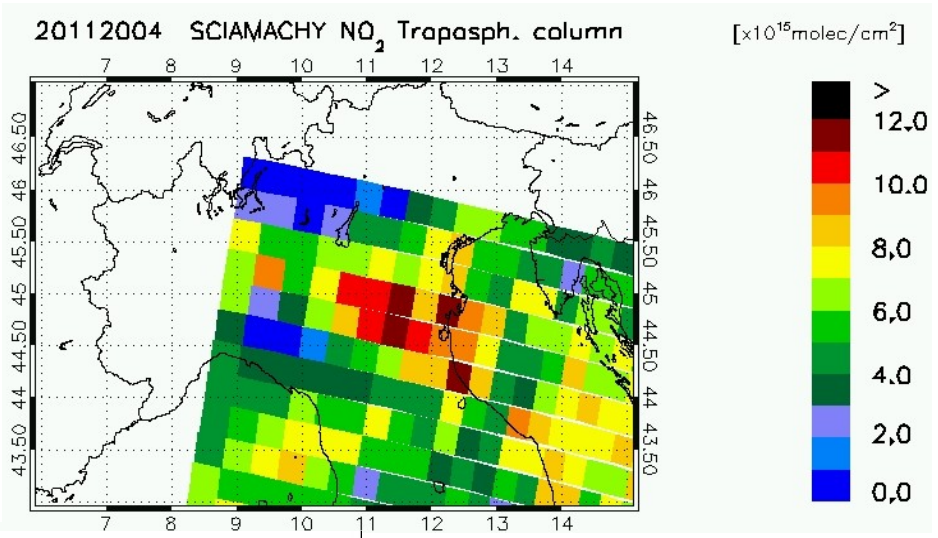
Methodology: merging the two data



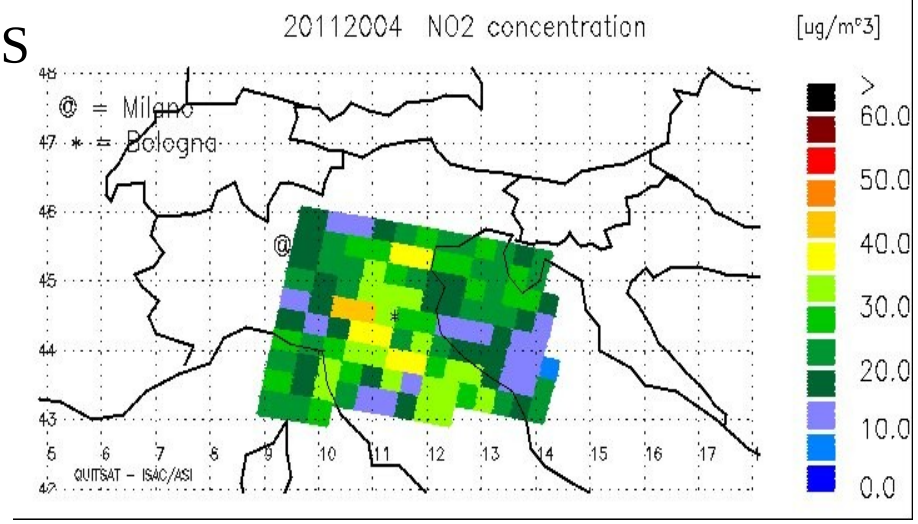
Case study application: 20th november 2004



GAMES

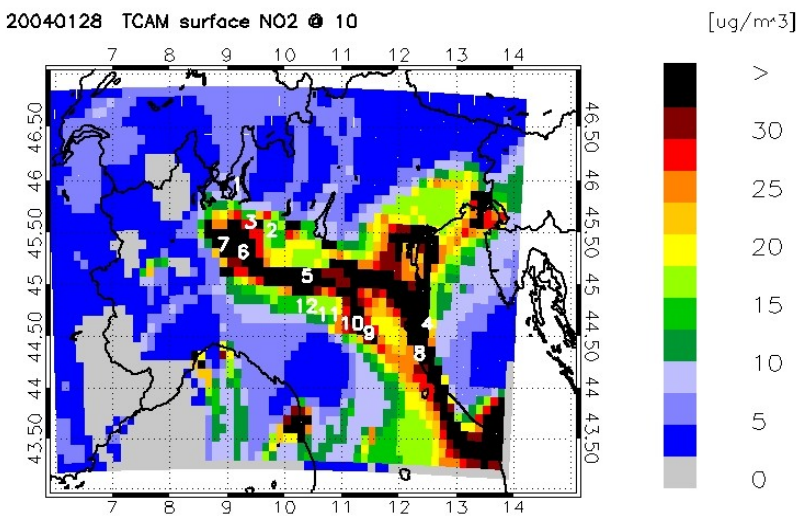


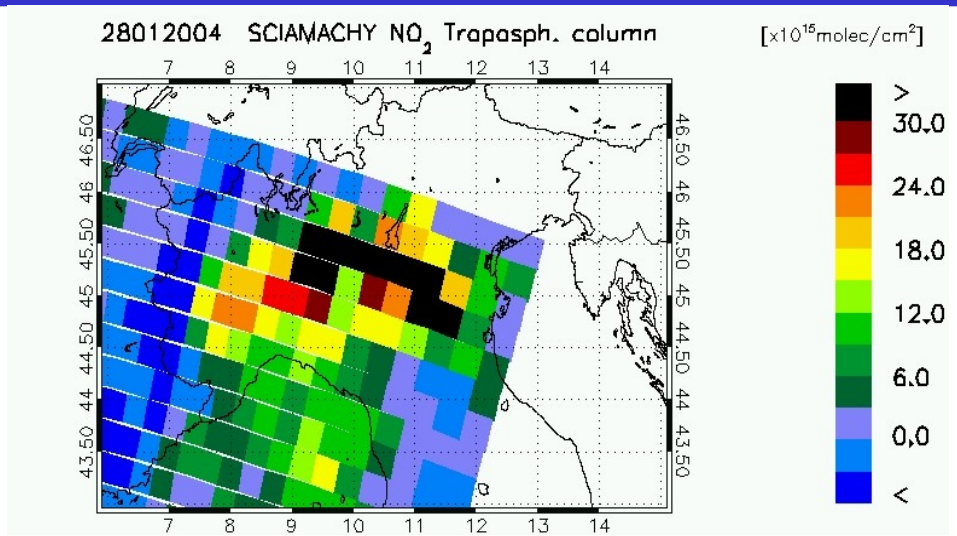
SCIAMACHY



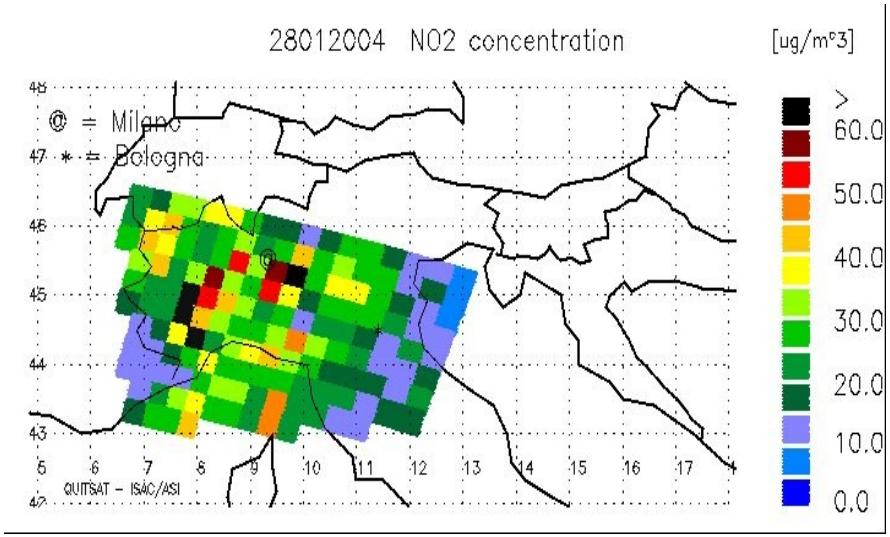
Ground level map

Case study application: 28th january 2004





GAMES



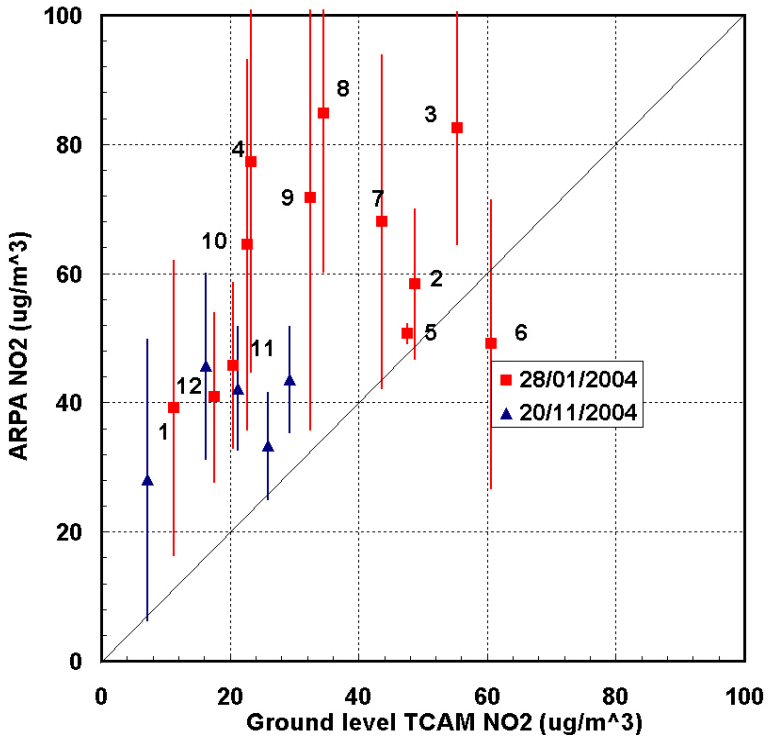
SCIAMACHY

Ground level map

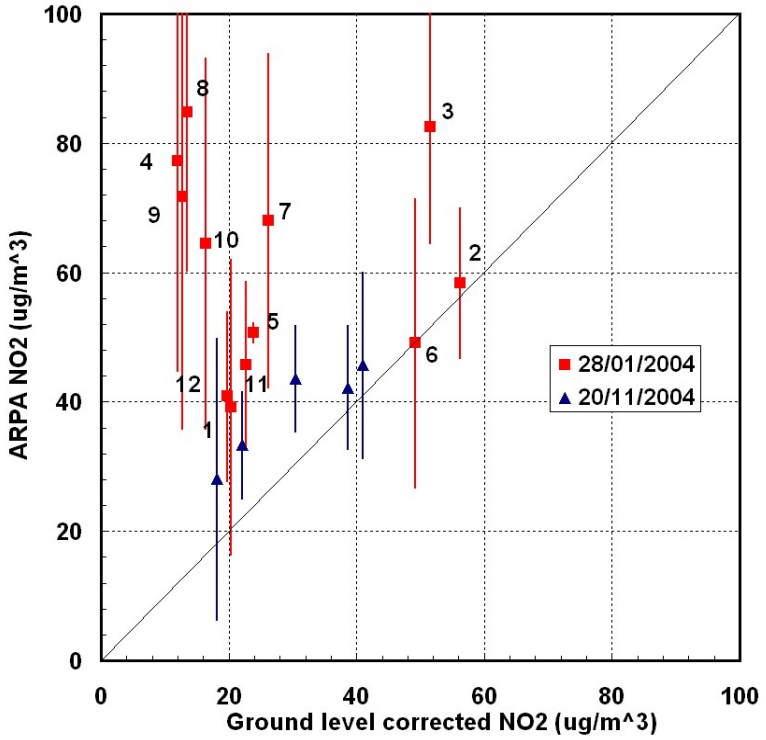
Carlo Gavazzi Space SpA

Validation of results

- Comparison with ARPA ground measurements:



GAMES ground level NO2



Final ground level NO2

Conclusions

- A method for merging SCIAMACHY with GAMES:
  - fast (suitable to be used for NRT monitoring);
  - giving good results in terms of validation of the ground level NO2 concentrations;
  - perspective use with sensors (like OMI) overcoming the spatial scale limitations of SCIAMACHY

- Considering the high maintenance costs of ground instrumentations, this synergy seems a promising way to follow for air quality monitoring.

Thanks to…

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