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Representativity of measurement stations for monitoring air quality in a road traffic loaded Alpine valley

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Motivation

- **Orographic limitations** for air pollution dispersion
- **Low wind speeds and mixing layer heights** between 100 and 200 m

Objectives

- Health risk assessment studies require **monitoring tools**
- **Monitoring** of emission reduction measures
- Providing **model validation data sets**

INTERREG IIIB Project ALPNAP - Monitoring and Minimisation of Traffic-Induced Noise and Air Pollution along Major Alpine Transport Routes
Duration: 01/2005 – 12/2007

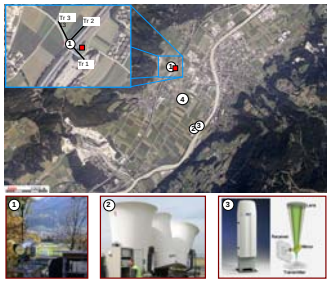
Activities

- Performing field campaign in the Inn valley between November 2005 and February 2006:
  - Investigation of temporal and spatial distribution of air pollutants
  - Study of dispersion conditions for air pollutants
  - Monitoring of mixing layer height
- Collection emission data
- Discussion of the requirements of input parameters and evaluation of numerical forecast tools, models and indices for routine application and assessments of the sensitivity of areas

Methodology

During the measurement campaign a dense network of meteorological and air pollution monitoring sites including remote sensing instruments together with in situ devices was operated.

Only those instruments are described, whose results are discussed here.

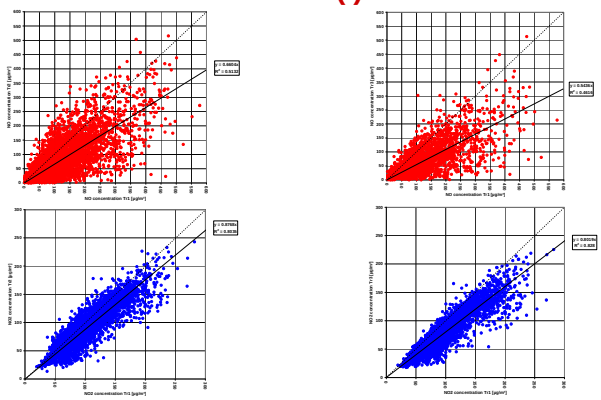


Target area Schwaz / Vomp and instrumentation.
Images of the measurement devices: (1) DOAS receiver/emitter unit, (2) SODAR, (3) ceilometer and (4) in situ instruments for NO, NO_x, CO, O_3 and PM_{10} as well as meteorological parameters.
Their location is shown on the map with a circle and the corresponding number.
The red square shows the location of the LT station Vomp Raststätte.
In the upper left corner a close up in the vicinity of the highway with DOAS and the LT station is given.
Note the river Inn and the A12 highway (closer to the northern slopes).

General

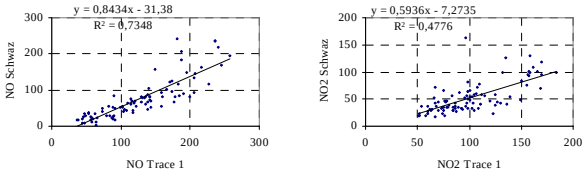
Several emission reduction measures were implemented during the last 20 years but due to increasing amounts of heavy duty vehicles and passenger cars the overall air quality in Alpine regions is even worse.
The EU air quality thresholds (European Air Quality Framework Directive 96/62/EC and its daughter directives 1999/30/EC and 2000/69/EC) of e.g. PM_{10} and/or NO_2 are too often exceeded not only in these regions.
Consequently, measures to reduce the air pollution are necessary. This requires an **optimal monitoring of the air pollutants** to register the resulting effects in air quality.

Results (I)



NO (above) and NO_2 (below) concentration measurements during the measurement campaign at the DOAS path (left) parallel to (Tr2), (right) away from (Tr3) the highway versus the DOAS path perpendicular across the highway (Tr1) with a 1 : 1 line (dotted) and a linear regression curve together with the correlation coefficient R^2.

Results (II)



Left: Daily mean NO concentrations at the station Schwaz in dependence from NO concentrations across the highway (Tr1). Right: Daily mean NO_2 concentrations at the station Schwaz in dependence from NO_2 concentrations across the highway (Tr1).

The decrease of concentrations with distance to highway is caused by **dilution** mainly. NO_2 is not only emitted but rapidly formed from NO too so that the decrease with distance from the source is much less than for NO.

The different dependencies of NO and NO_2 concentrations with distance to the source can be observed at the site Schwaz also (station 4). But the ratio is opposite i.e. NO_2 concentration are decreasing faster than the NO concentrations (with correlation coefficients similar R^2 and gradients as for the 3 DOAS paths). This difference is caused by the **fast NO_x chemistry** so that NO_2 is formed mainly near the emission source of NO_x.

Conclusions

Generally, the concentrations around the motorway are clearly **dominated by the traffic volume** and therefore are the highest at the highway.

The **site at Schwaz** is also influenced from NO emissions from the neighbourhood too which is mainly from domestic heating containing less NO_2 emissions than road traffic. This site is **representative** for the air pollution at the valley ground.

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