Risk Habitat Megacity

Air Quality and Health

Speaker: ***Rainer Schmitz (UCH) & Peter Suppan (IMK-IFU/KIT)***

Involved scientists: ***Frank Baier (DLR), Ulrich Franck (UFZ), Michael Hagen (FONASA), Ricardo Muñoz (UCH), Renate Forkel (IMK-IFU/KIT), Martin Nogalski (IMK-IFU/KIT)***

Content

Air Quality
& Health

1. *Problem Analysis*
2. *Model Setups*
3. *First results*
4. *Next steps*

Problem / Risk

Air Quality & Health

Air pollution as the most significant environmental challenge, followed by congestion issues

(Survey with 500 megacity - „stakeholders“)

but

„The environment matters, but may be sacrificed for growth“

Source: Siemens, 2007

Research questions

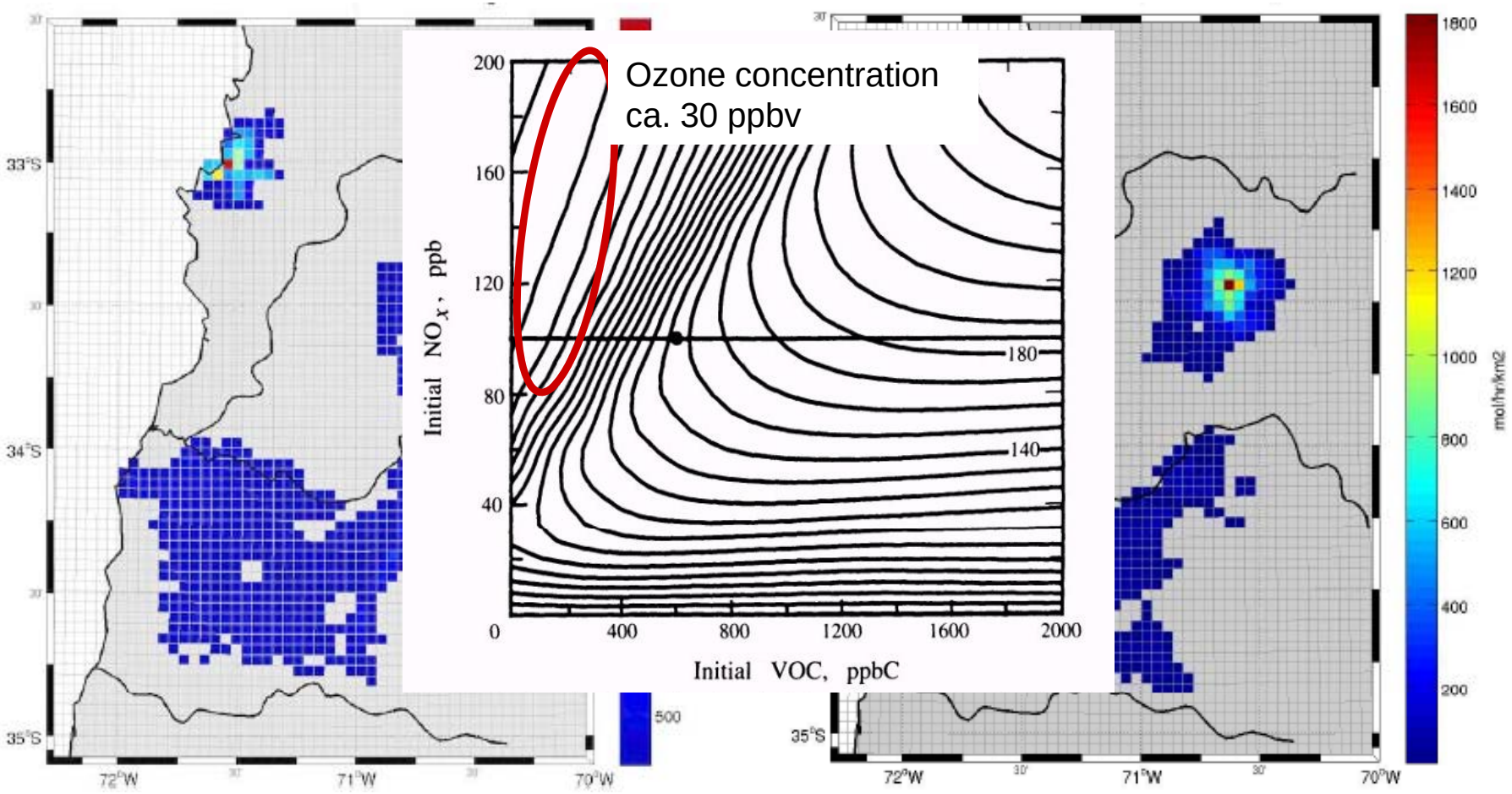
Air Quality & Health

- Do we understand the **complex links** between emissions, air quality and health impact?
- How can suitable **emission inventories** for reliable air quality assessment studies be developed? What is the part of the traffic?
- How can separate **information platforms** be linked to the development of an integrated approach to air quality assessment in megacities? How can they be used for forecasting and scenario analyses?
- Which relationship exists between specific air pollutants like PM_{10} or NO_2 and the **appearance of environment-related diseases**?

Key problems - Emissions

Air Quality & Health

Official Emission Inventory



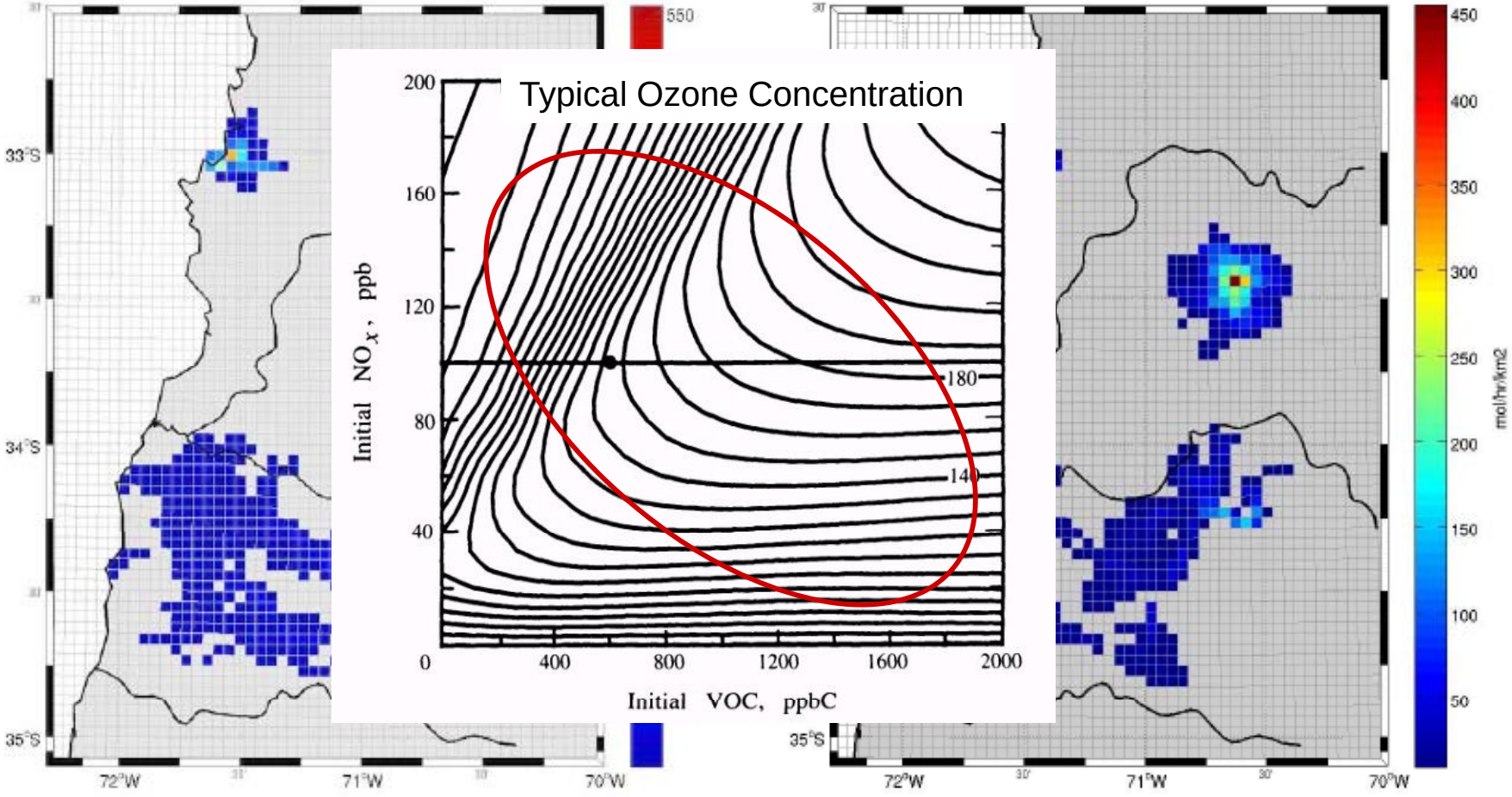
NOx

VOCs

Key problems - Emissions

Air Quality & Health

Adapted Emission Inventory

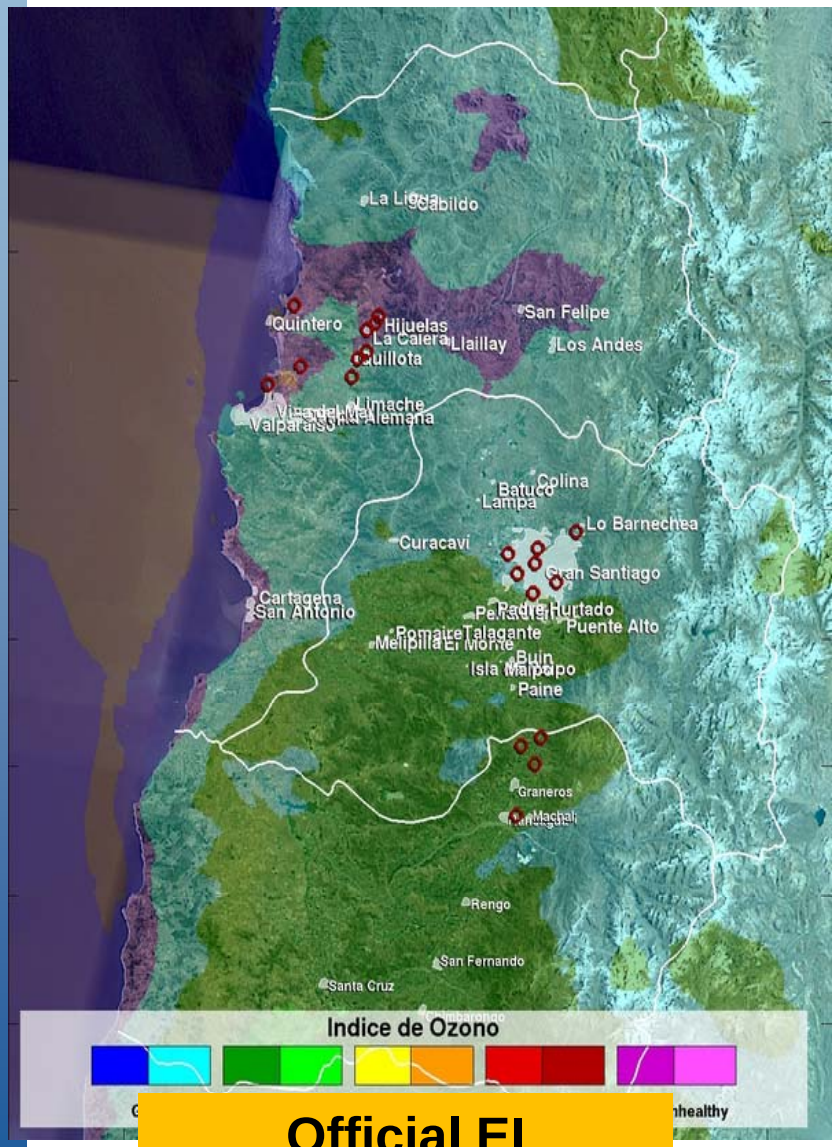


NOx

VOCs

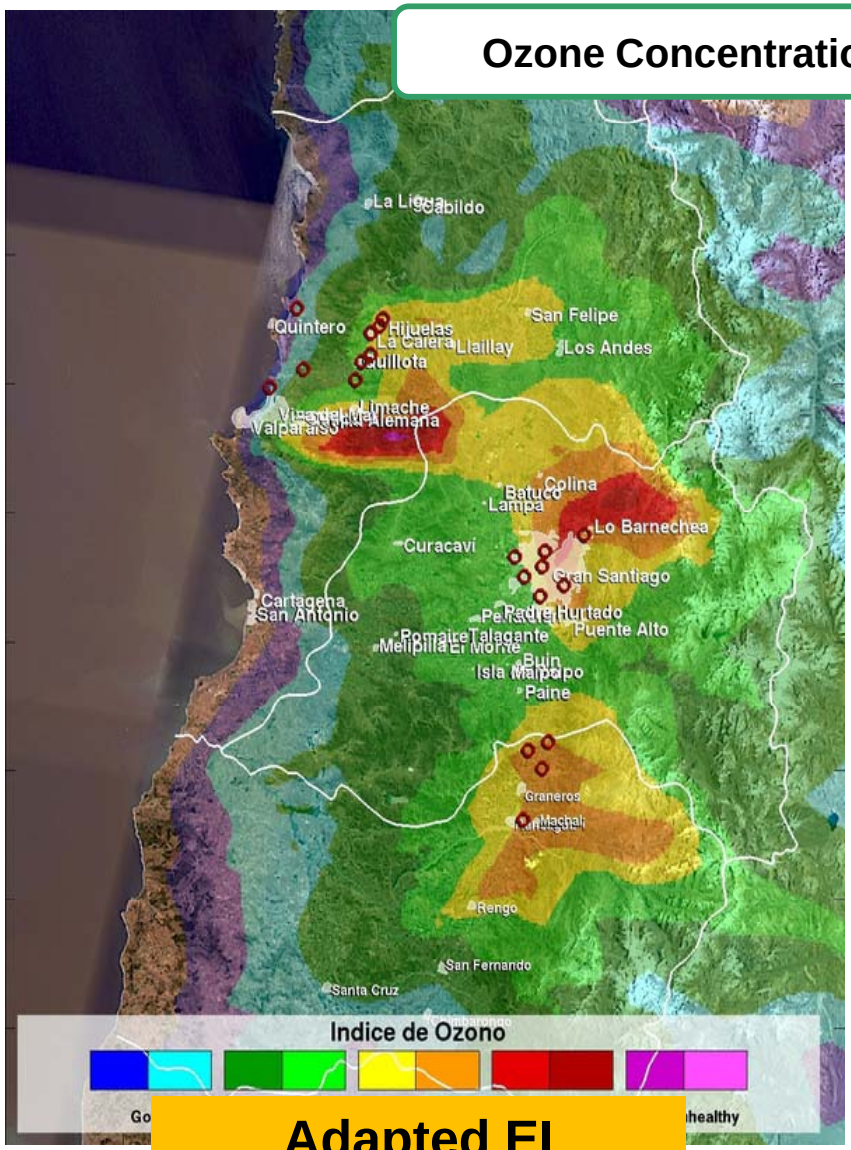
Key problems / Risks – Air Quality

Air Quality & Health



Official EI

Ozone Concentration



Adapted EI

Model Applications - Traffic Emissions

Air Quality & Health

In close cooperation with FoA **Transportation**

ESTRAUS
- total vehicle flow
- street network

Emission factors
- experimental results

Vehicular disaggregation
- fleet composition

Temporal disaggregation
- Driving profiles

Annual Emissions

Hourly Emissions

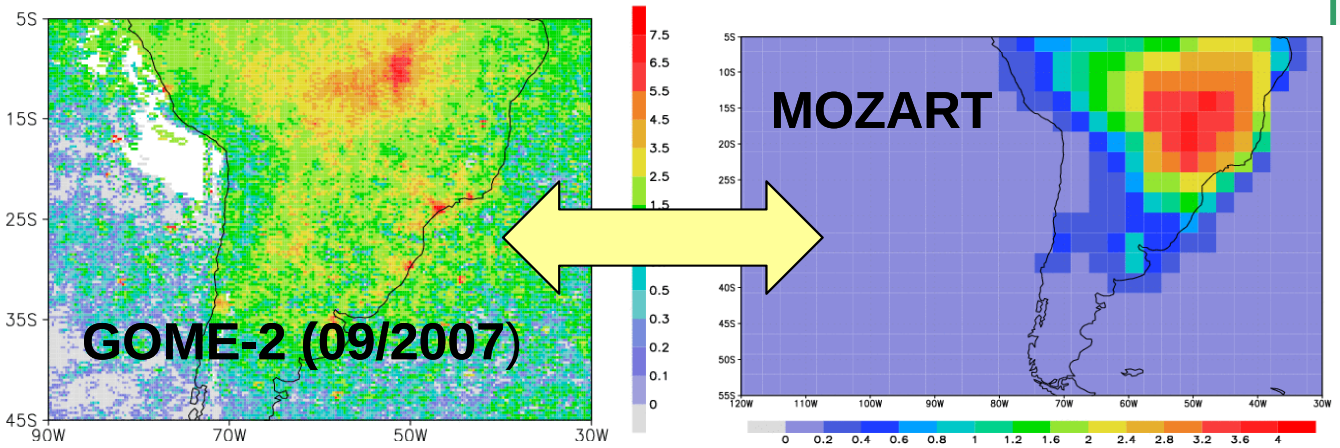
Methodology of traffic emission modeling as a basic requirement for assessing the scenarios

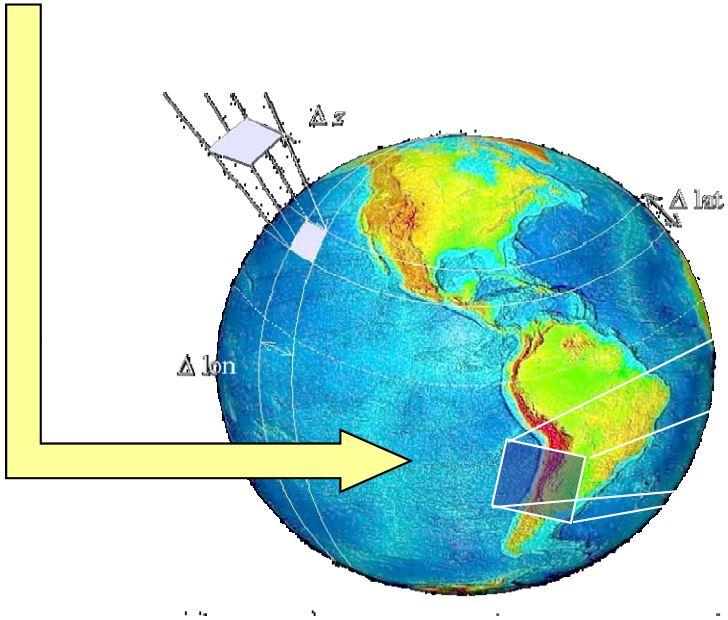
$$E_{ijk}[g] = TF_j[veh/h] * L_j[km] * VD_{jk} * TF_{jk} * EF[g/km]_{ik}$$

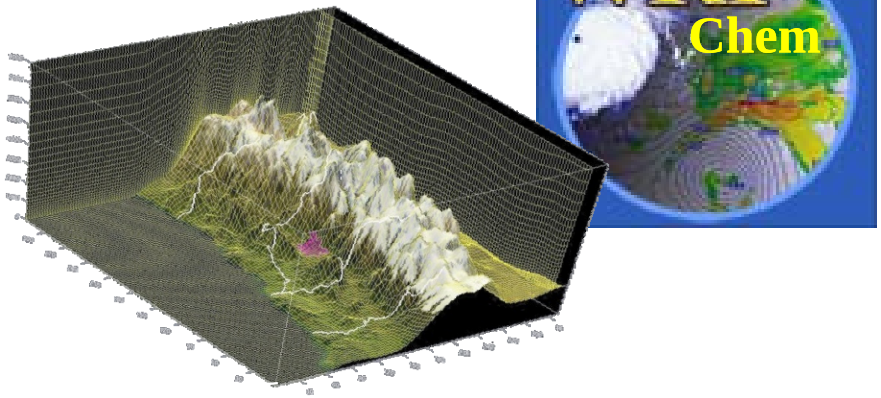
Model Applications – Mesoscale

Air Quality & Health

Comparison of different sources of satellite data show sufficient accuracy as input for regional modeling







Model box

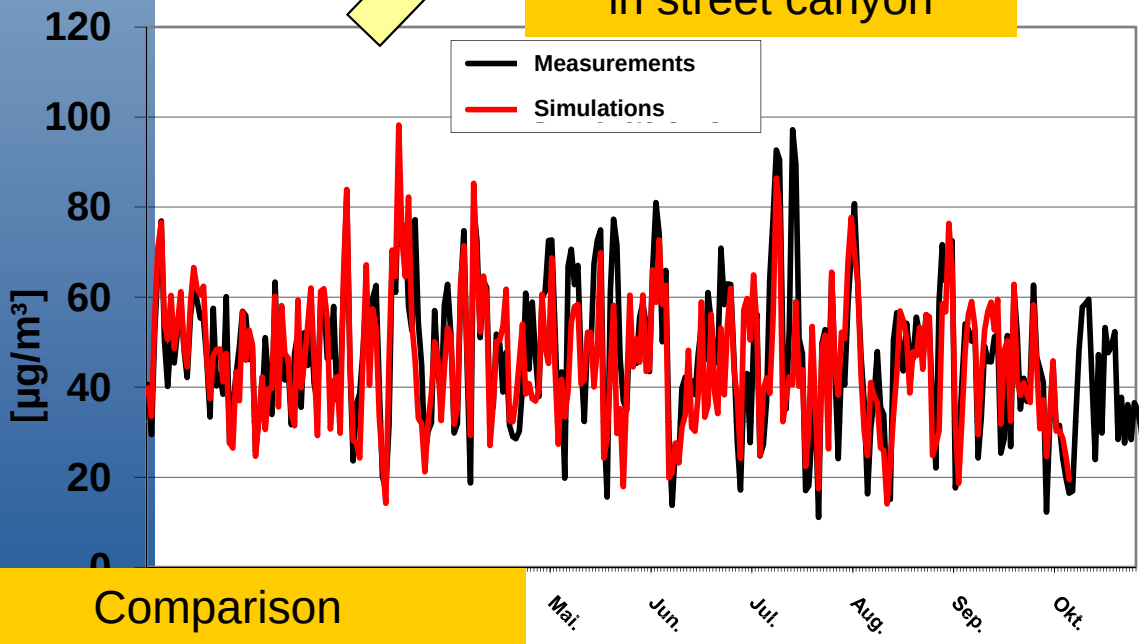
Model Applications – Microscale

Air Quality & Health

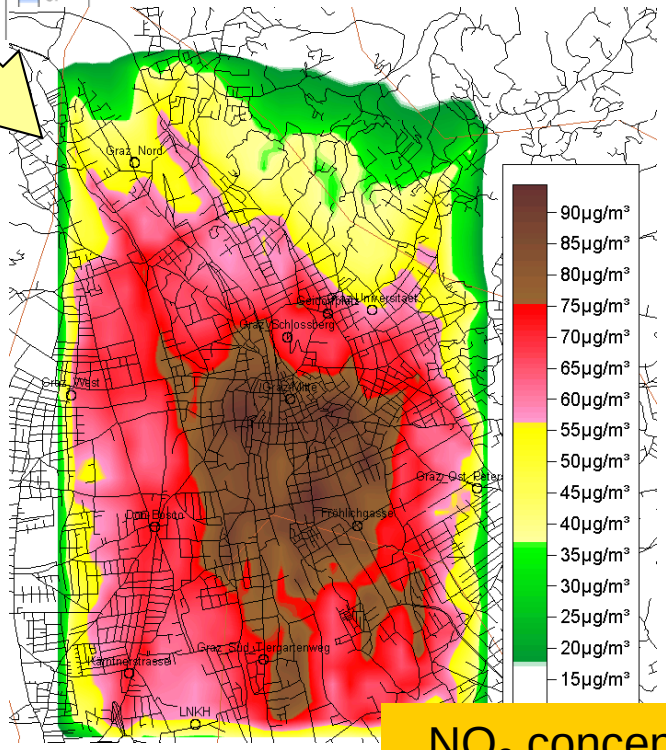
Coupling WRF-GRAL:
spec. humidity
pot. temperature
uvw-wind directions
geostrophic wind
non-hydrostatical pressure

NO_2 concentrations in street canyon

- Coupling of micro-meso scale implemented
- Handover of relevant meteorological parameters from the meso (WRF) to the micro scale (GRAL) have been tested
- Simple ozone chemistry implemented and validated (GRALchem / Graz)



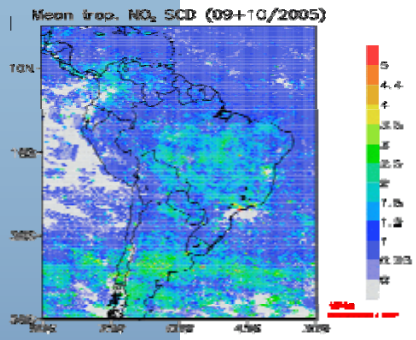
Comparison Simulation / Measurements



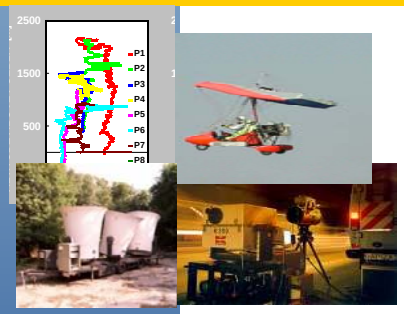
NO_2 concentrations in the urban area

Integration of platforms / Chain of risks

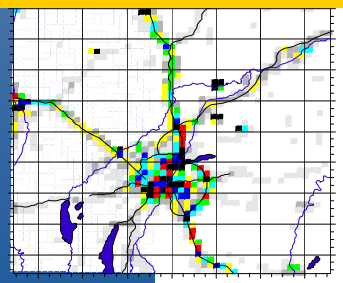
Satellite Data

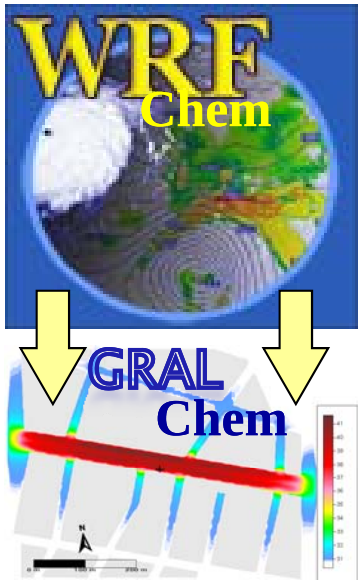


Measurement Data



Emission Data





Air Quality

Scenarios

Indicators

Mortality

.....

.....

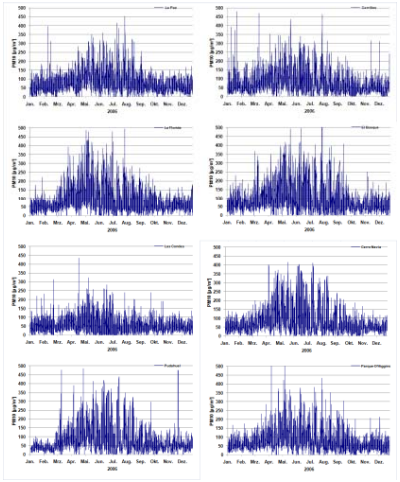
Subclinical Effects

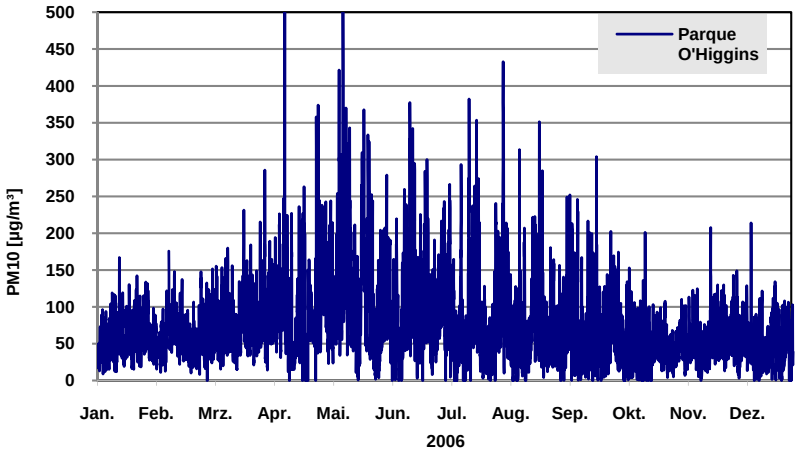
Health Impact

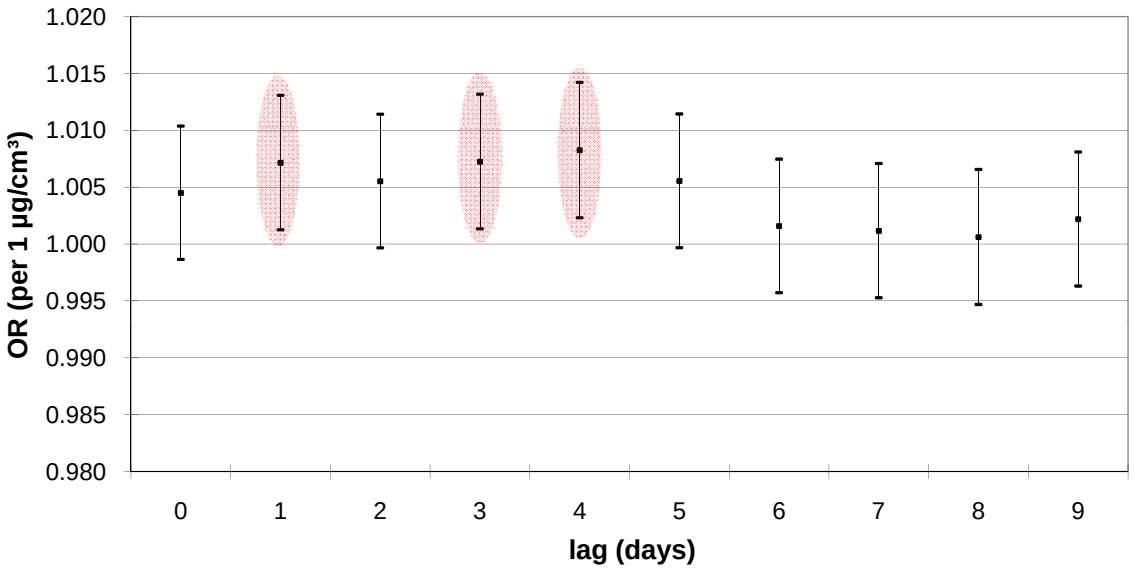
Stakeholder

Health Impact – First results

Air Quality & Health



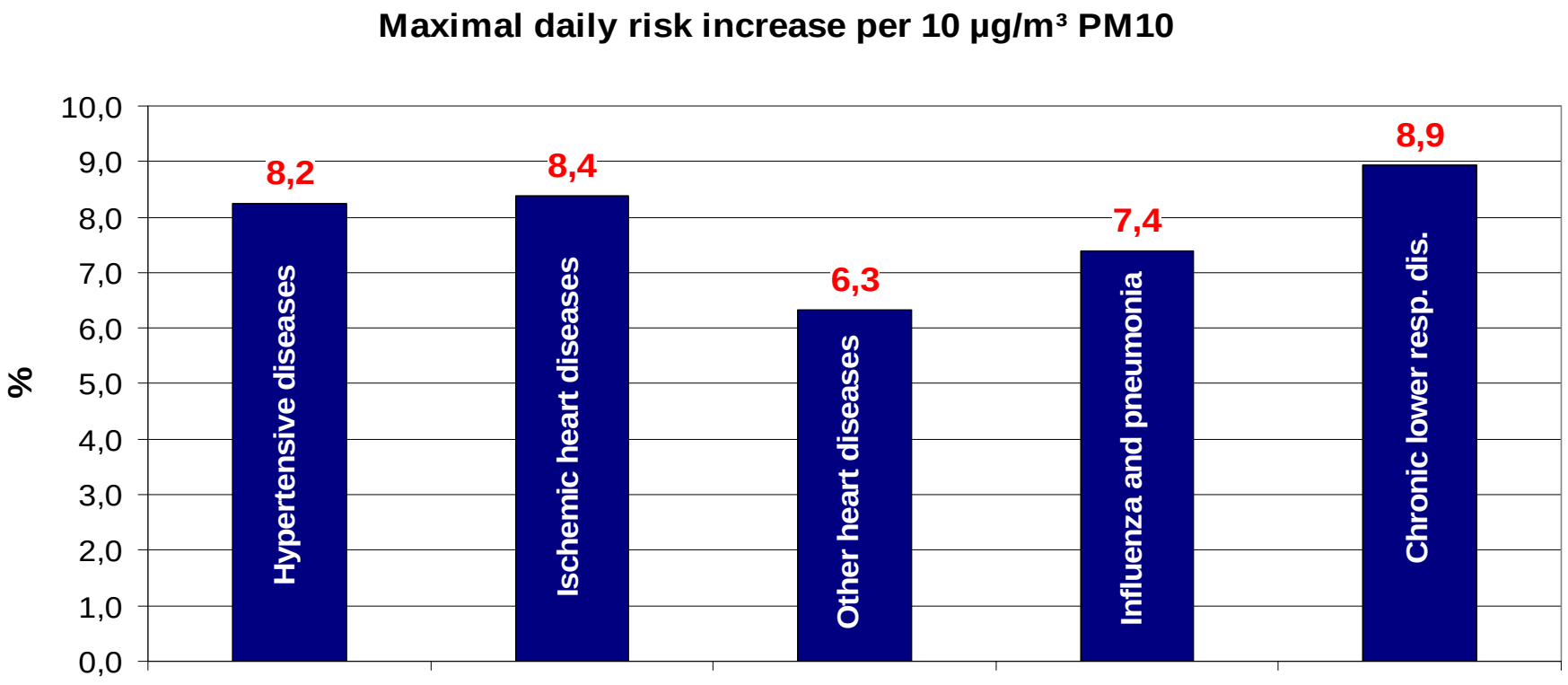




Mortality data of Santiago de Chile of 2006

Time series analysis for selected air pollutants (PM_{10}) for 2006

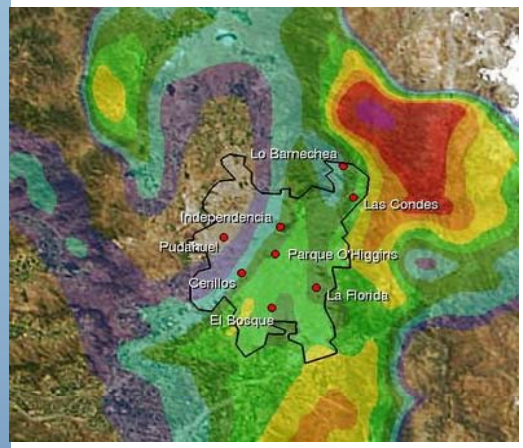
Health Impact – First results

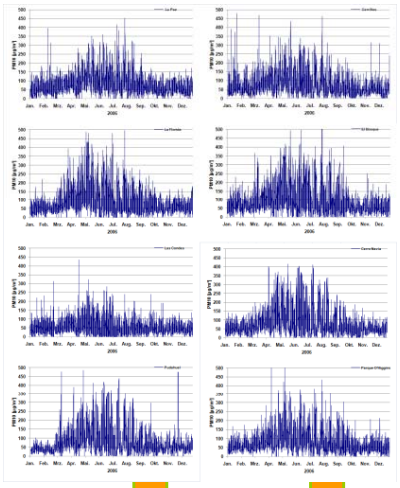


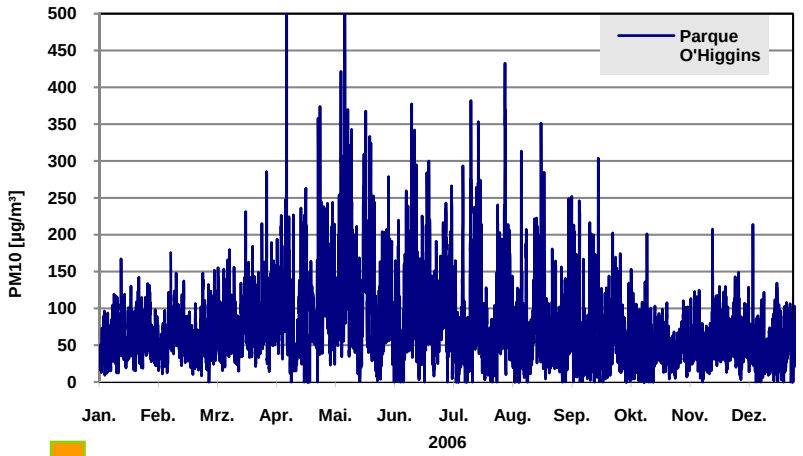
Health impact assessment

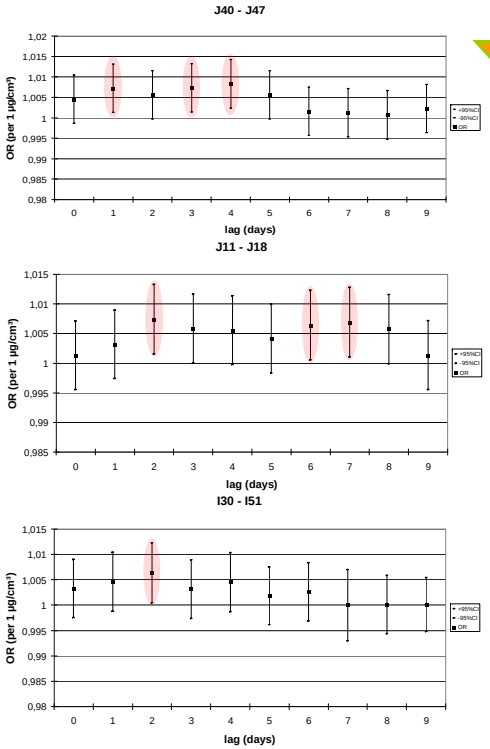
Next steps - Health Impact

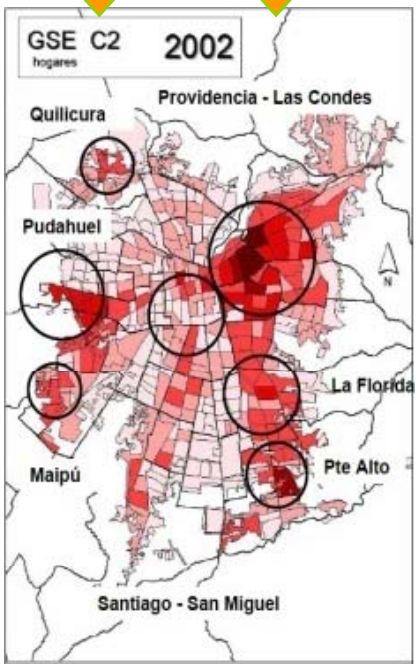
Air Quality & Health











- Mortality data of Santiago de Chile of 2006
  - Time series analysis for selected air pollutants (PM_{10}, NO_2) for 2006
  - Analysis of Comunas for selected air pollutants (PM_{10}, NO_2) for 2006

Next steps – Break down of scenarios

Air Quality & Health

ESTRAUS
- total vehicle flow
- street network

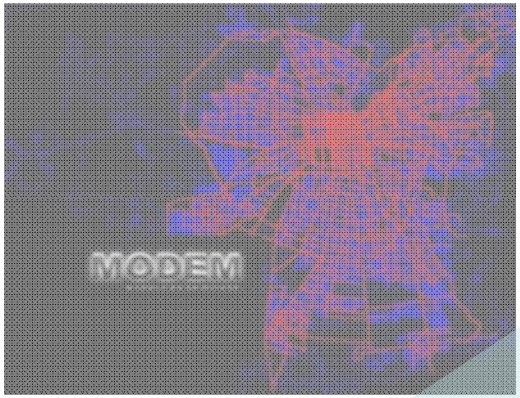
Emission factors
- experimental results

Vehicular disaggregation
- fleet composition

Temporal disaggregation
- Driving profiles

Annual Emissions

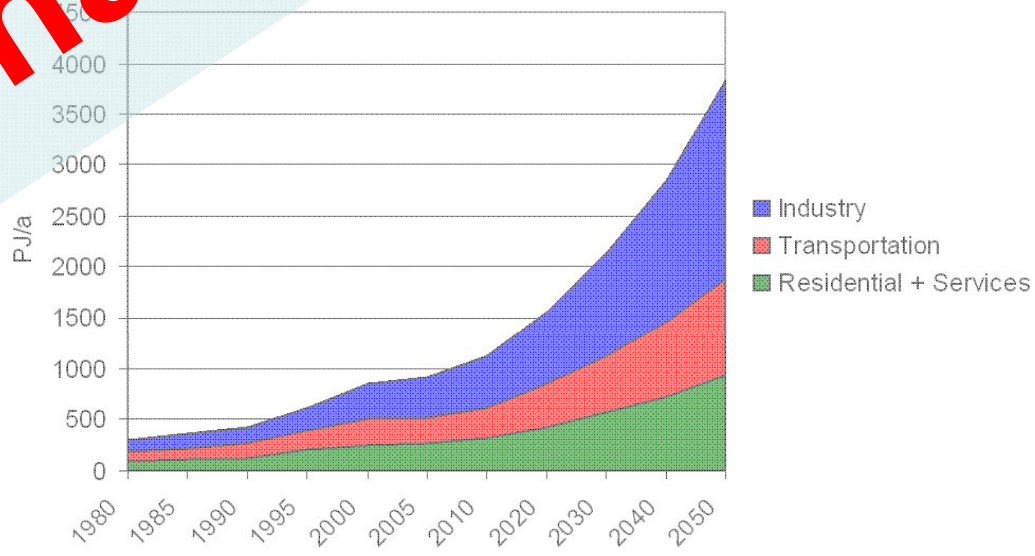
Hourly Emissions



$$E_{ijk}[g] = TF_j[veh/h] * L_j[km] * VD_{jk} * TF_{jk} * EF_{ijk}$$

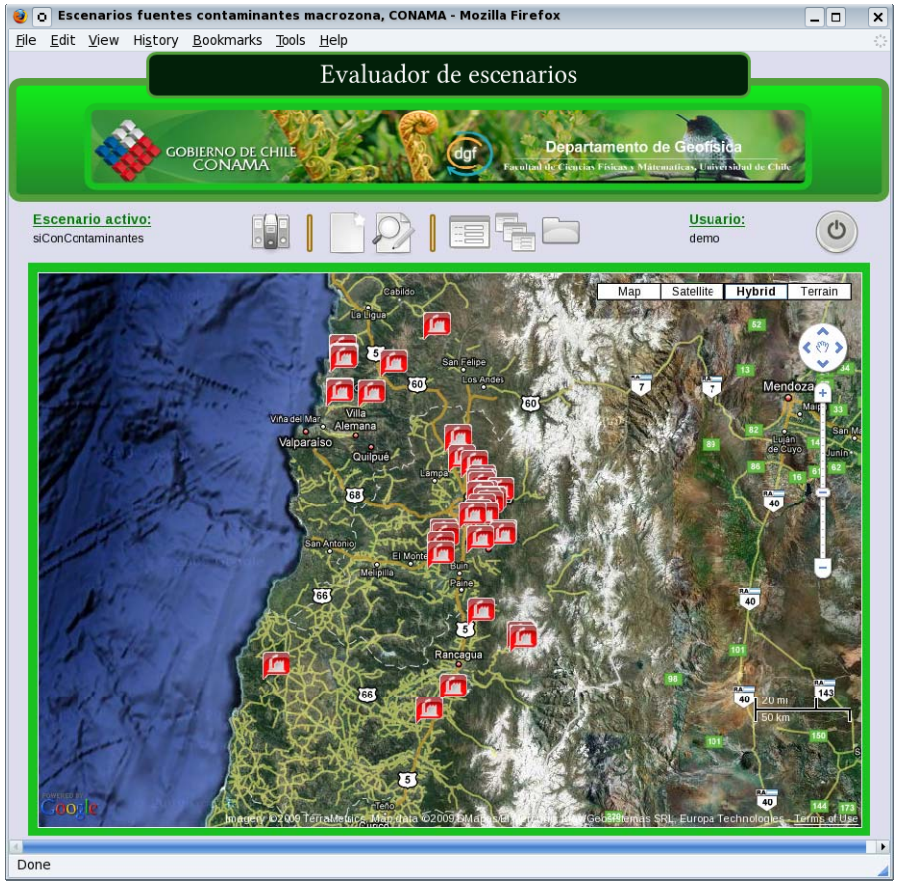
- Methodology of traffic emission modeling as a basic requirement for assessing the scenarios

Scenarios

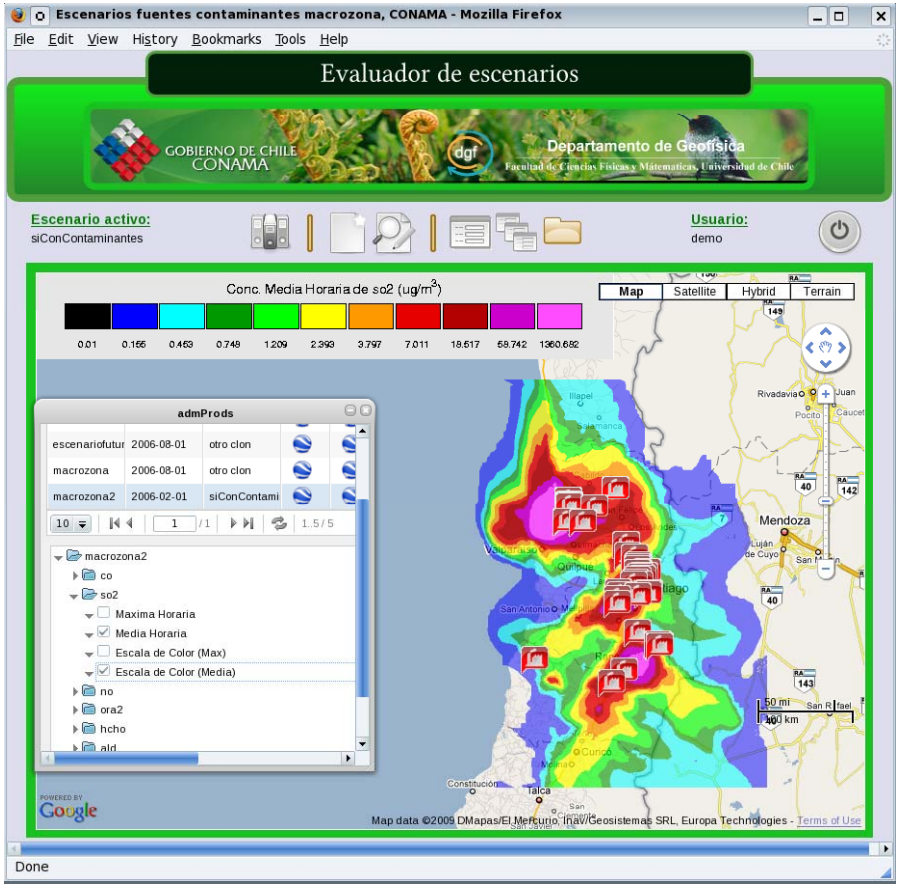


Next steps - Impact studies / Scenarios

Air Quality & Health



Emission platform



Concentrations & socio-economic impact platform

Next Steps

Air Quality

- Air quality simulations for 2006
- Developing / update of the traffic emissions inventory also for scenarios
- Developing / update of the general emission inventory also for scenarios
- Scenario simulations on the micro as well as on the meso scale

Health

- Transformation of the „inofficial“ health data into „official“data sets
- Time series analysis of mortality rates in relation to NO_2- and PM_{10}-concentrations
- Social-spatial differentiated analysis of cohort studies in relation to NO_2- and PM_{10}-concentrations
- Analysis of scenarios

Thank you for your attention