



Experience from the Partnership with China on Space Data (PANDA) Project

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Outline

- **Introduction**

- Objective
- Roadmap

- **Learn from PANDA**

- Boundary and Initial Conditions
- Emissions (Natural, Anthropogenic)
- Representation of PBL Processes
- Input Data Change

- **Experience**

- Cooperation Dissemination
- Capacity Building
- Challenges



Objective of the PANDA Project

- *To establish a team of European and Chinese scientists who will jointly use space observations and in-situ data as well as advanced numerical models to monitor, analyse and forecast global and regional air quality.*
- PANDA disseminated methodologies, tools and data to a variety of users.





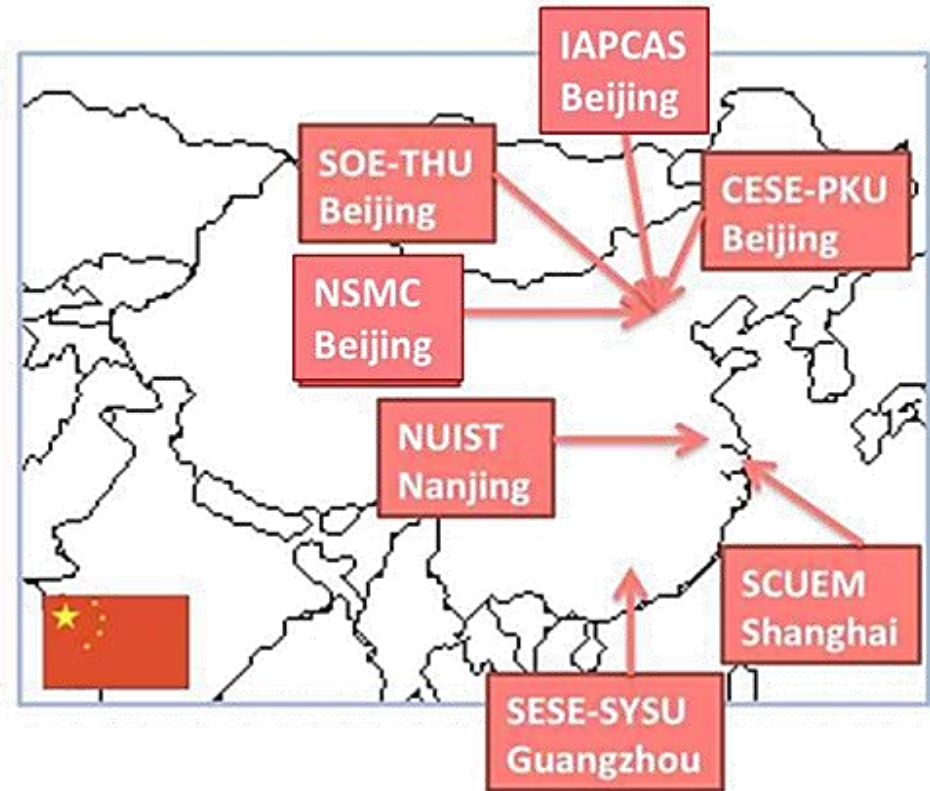
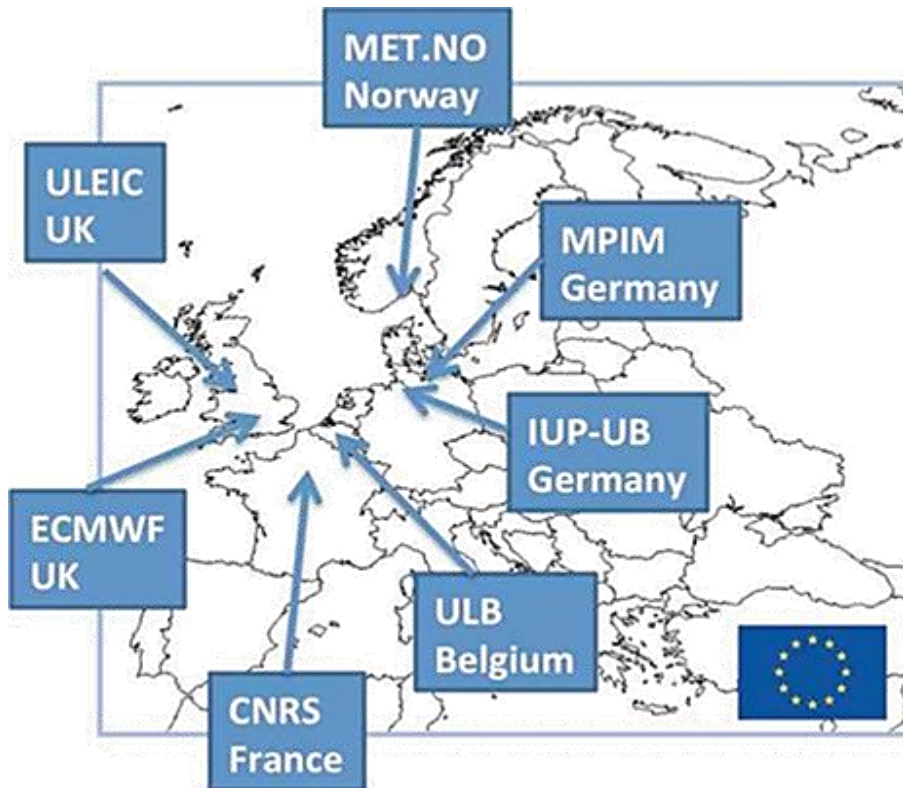
The PANDA Project

Coordinator: Guy Brasseur

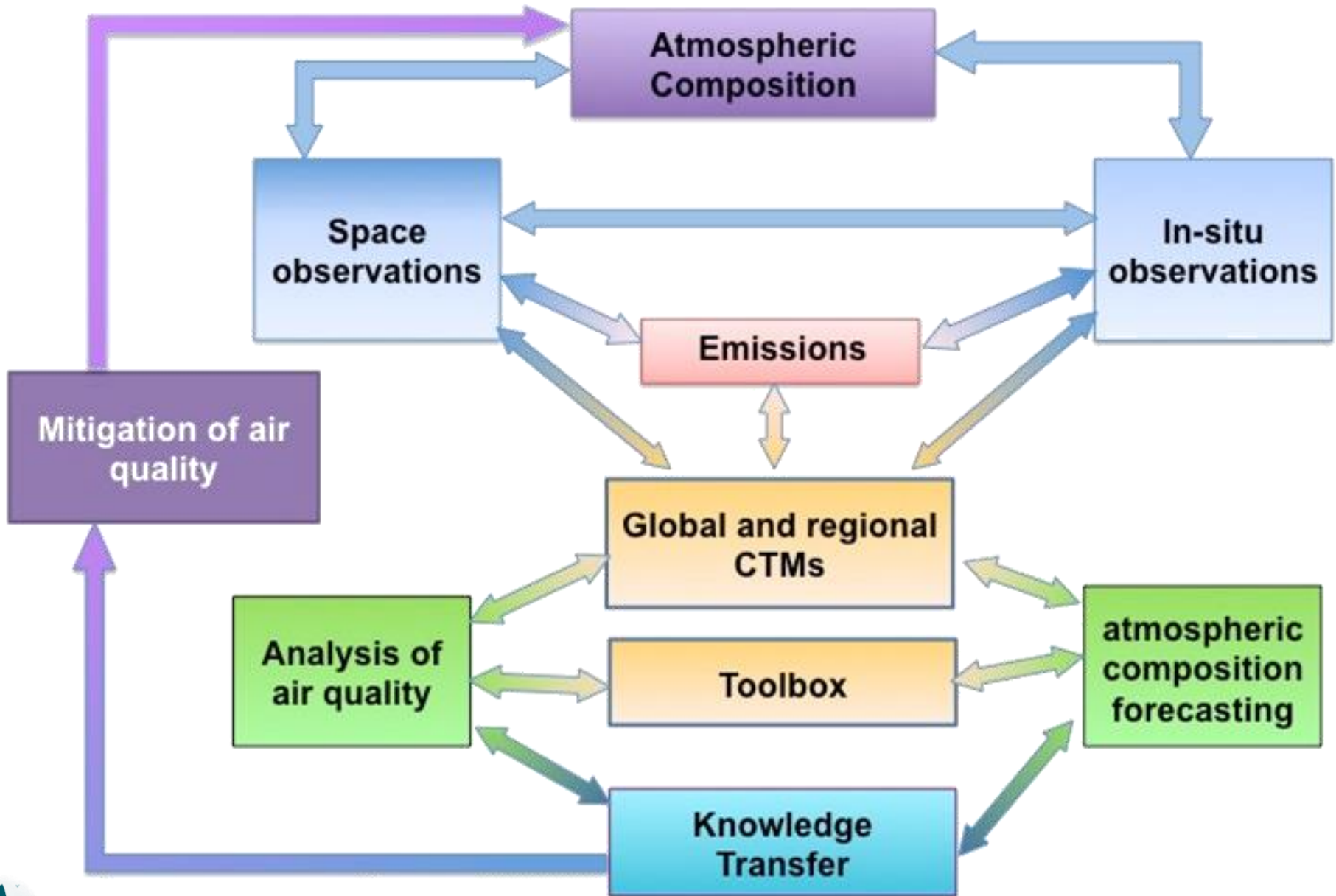
Deputy Coordinator: Prof. Xuemei Wang

Period: Jan 2014 - Dec. 2016

Budget: 2 Millions Euros



PANDA Roadmap



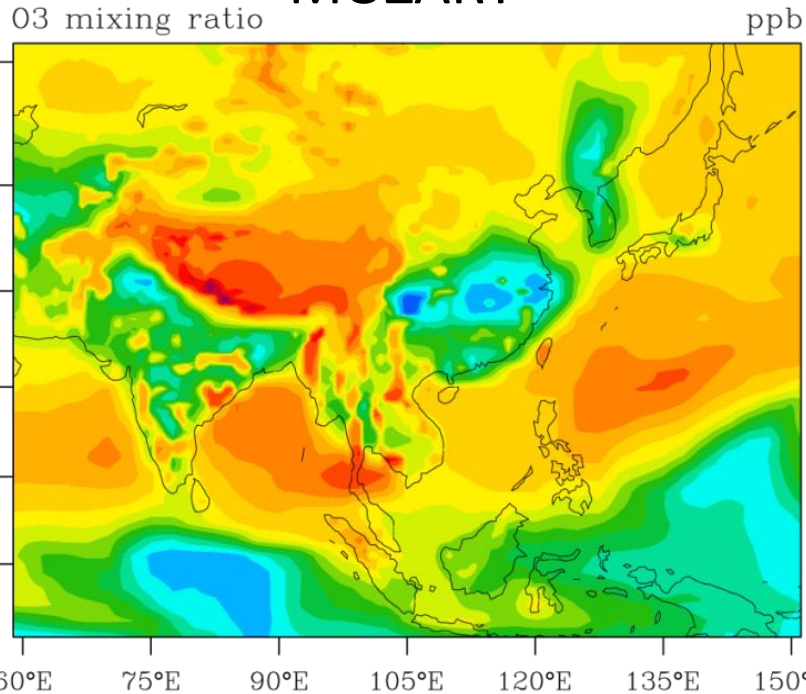
Learn from PANDA project

- Boundary and Initial Conditions
- Emissions (Natural, Anthropogenic)
- Representation of PBL Processes
- Input Data Change

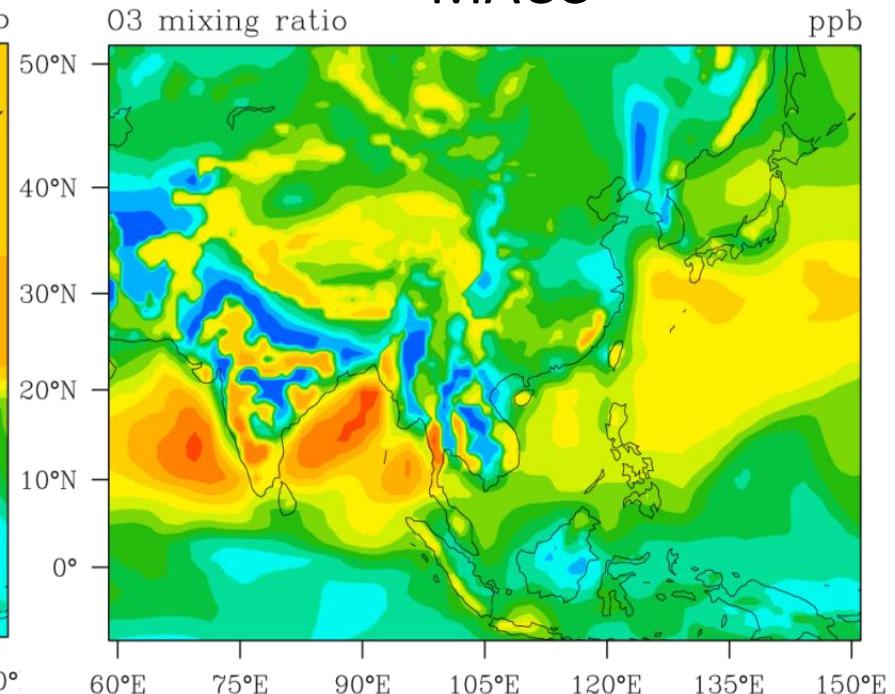


Initial and Boundary Conditions

MOZART

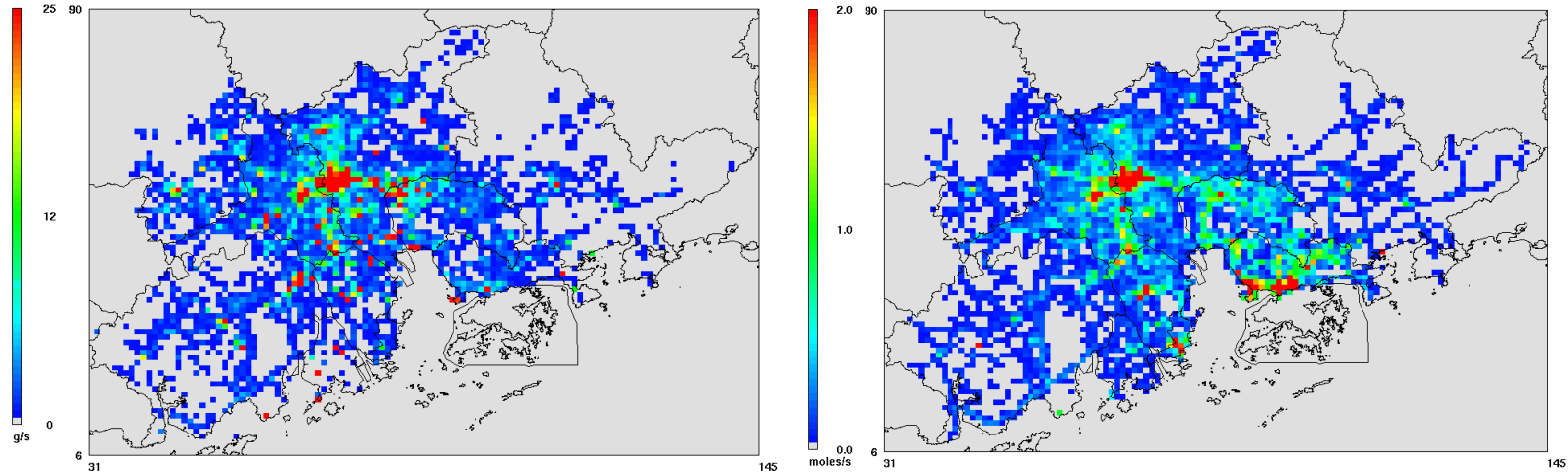


MACC



Monthly mean surface O₃ concentrations for January 2010 simulated by WRF-Chem using MOZART (left) and MACC (right) initial and boundary conditions.

Anthropogenic Emission Inventories

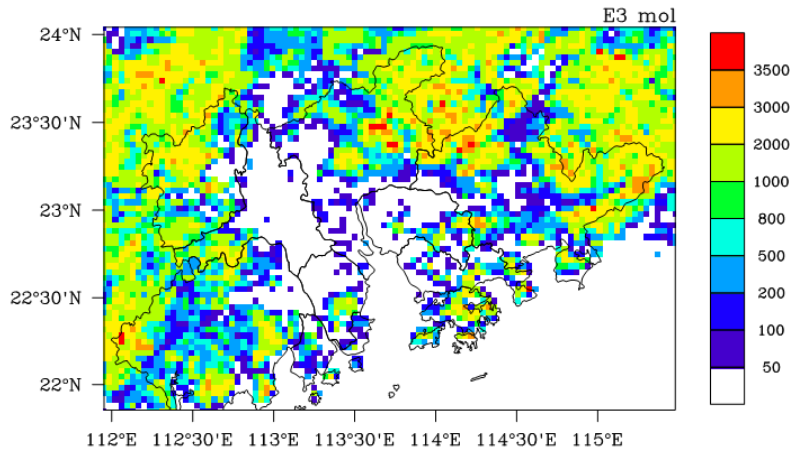


PRD dynamic EI examples (left : PM_{10} ; right : VOC)

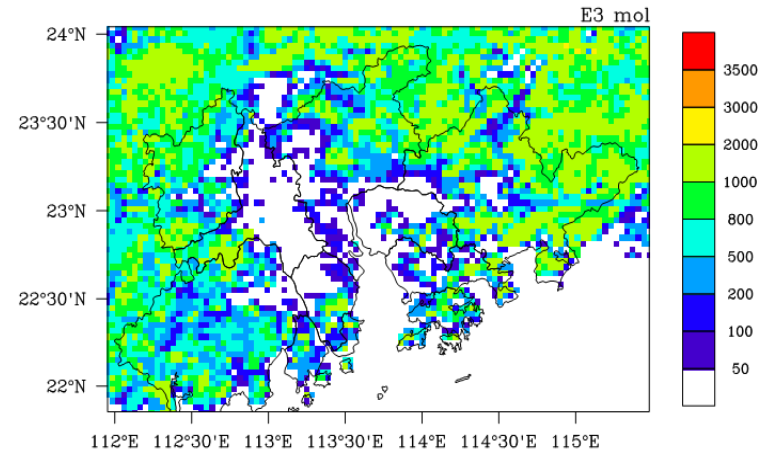
- **EI gridding** : EI + SMOKE model + meteorological field
- **Local IE** : Power plants, industry source, on road mobile source, non-road mobile source, dust source, VOCs product-source, biogenic and others (Zheng et al, 2009)
- **Background IE** : From David Streets (INTEX-B Asia EI, 2006)

BVOCs Emissions in PRD

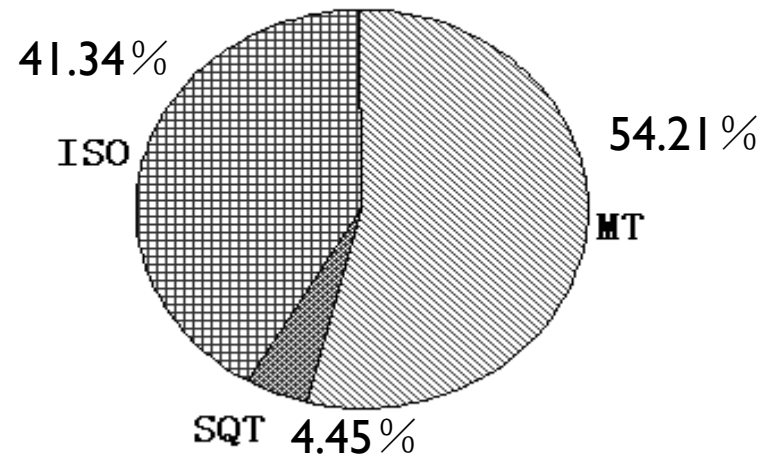
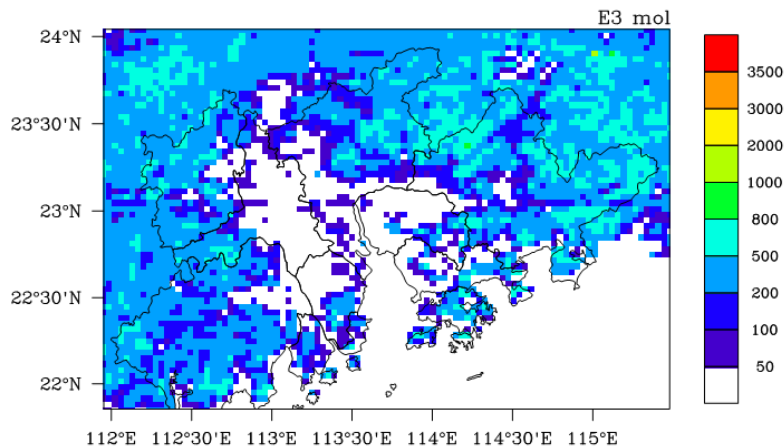
Total Isoprene Emission



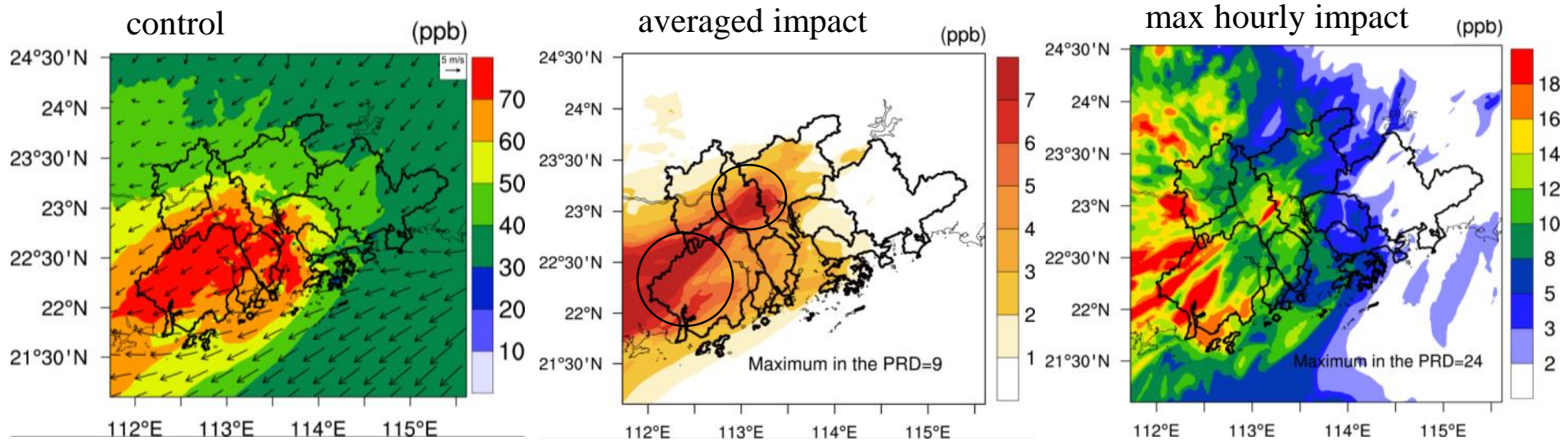
Total Terpene Emission



Total OVOC Emission

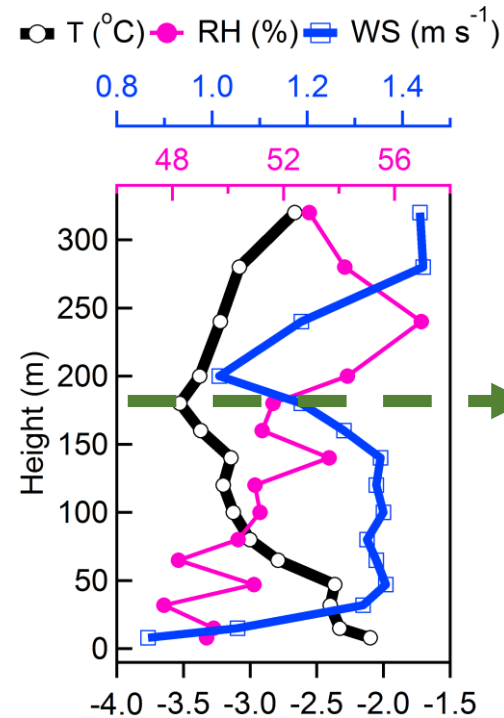
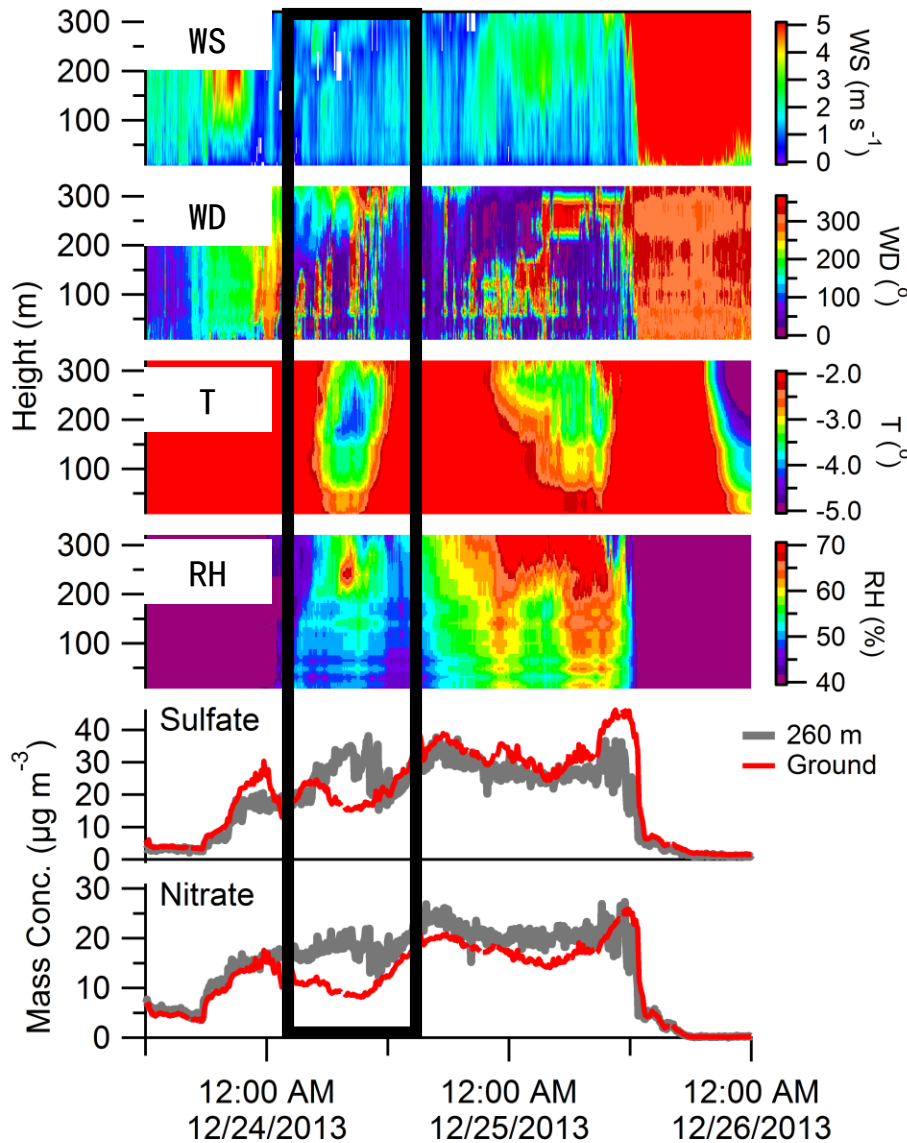


Impacts of BVOCs Emissions on Surface Ozone



- The surface ozone in **the urban area** and in **the downwind area** were most sensitive to the BVOCs emissions in November
- The max hourly impacts **varies between 10 and 24 ppb** in the urban area and the downwind area
- The impacts change **by a factor of 1.5** if the emission factors change by a factor of 3

Boundary Layer (PBL) Structure

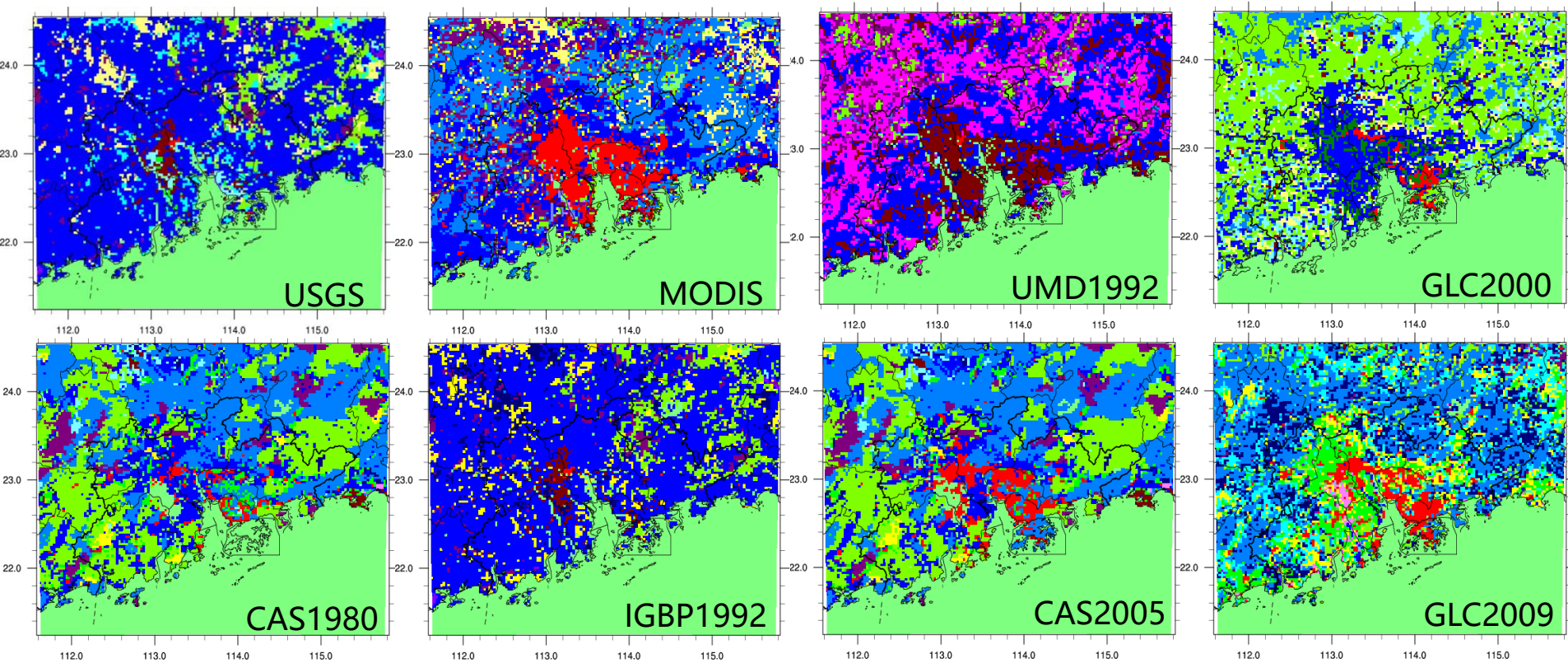


180m

- Inversion Layer
- Low Wind Speed
- High RH

The change of boundary layer structure

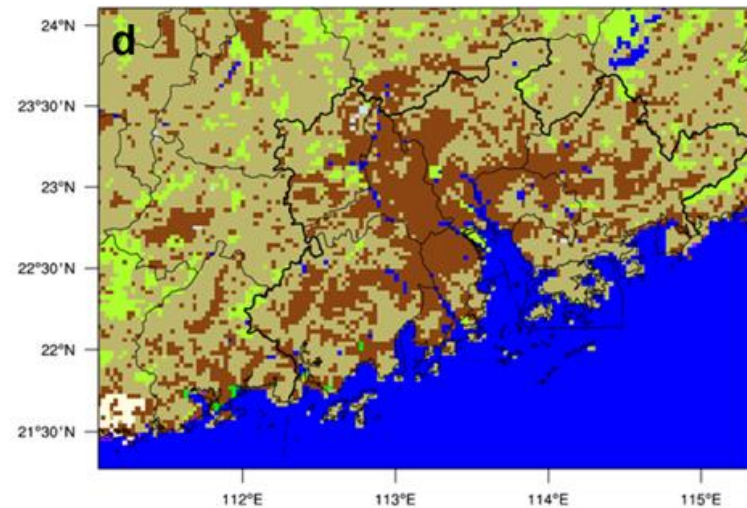
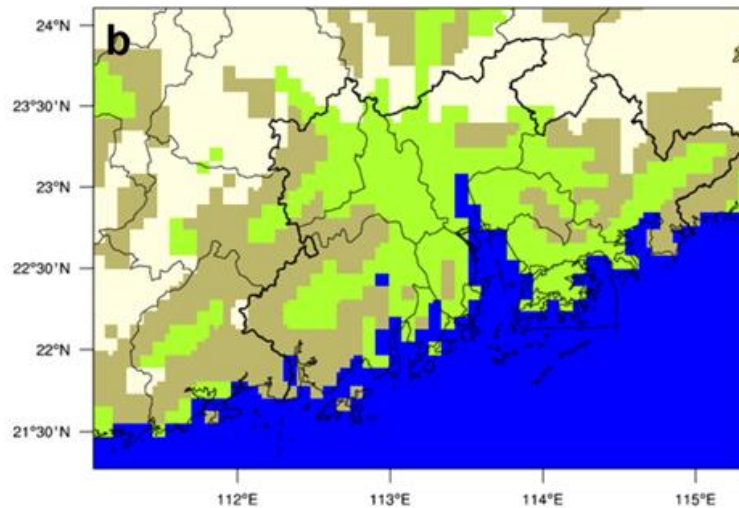
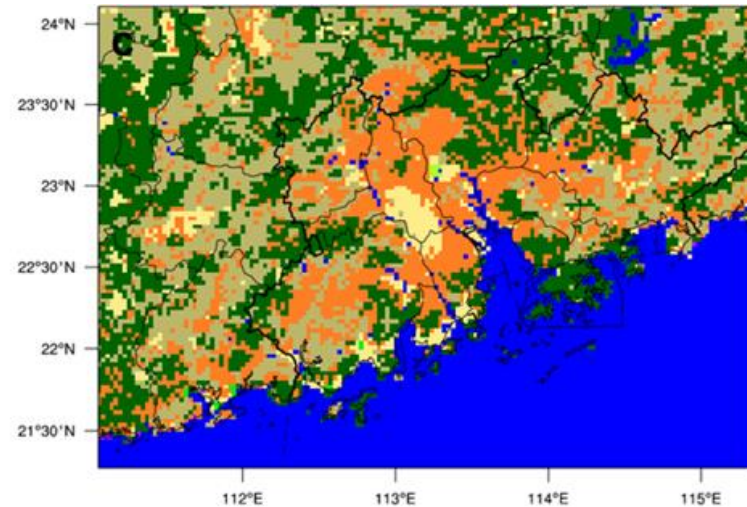
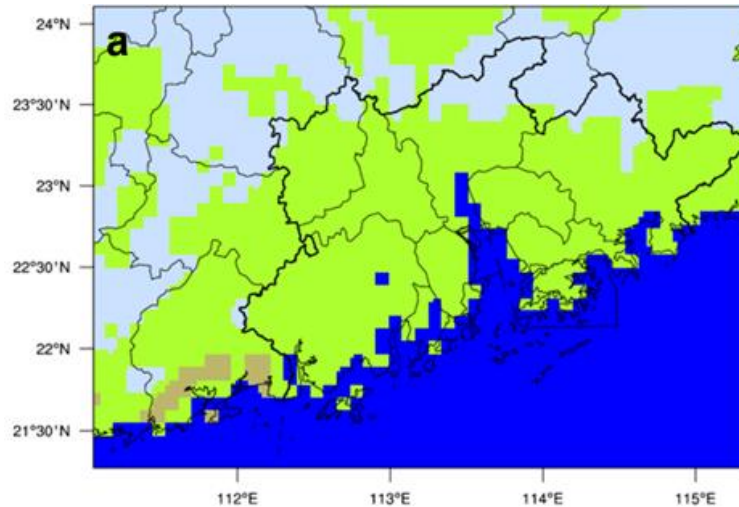
Land Use Input Data Change



- | | | | |
|------------------------------|-----------------------------|-------------------------|------------------------------|
| 1 Urban and Built-Up | 7 Grassland | 13 Evergreen Broadleaf | 19 Barren/Sparsely Vegetated |
| 2 Dryland Cropland&Pasture | 8 Shrubland | 14 Evergreen Needleleaf | 20 Herbaceous Tundra |
| 3 Irrigated Cropland&Pasture | 9 Mixed Shrubland/Grassland | 15 Mixed Forest | 21 Wooded Tundra |
| 4 Mixed Cropland and Pasture | 10 Savanna | 16 Water Bodies | 22 Mixed Tundra |
| 5 Cropland/Grassland Mosaic | 11 Deciduous Broadleaf | 17 Herbaceous Wetland | 23 Bare Ground Tundra |
| 6 Cropland/Woodland Mosaic | 12 Deciduous Needleleaf | 18 Wooded Wetland | 24 Snow or Ice |

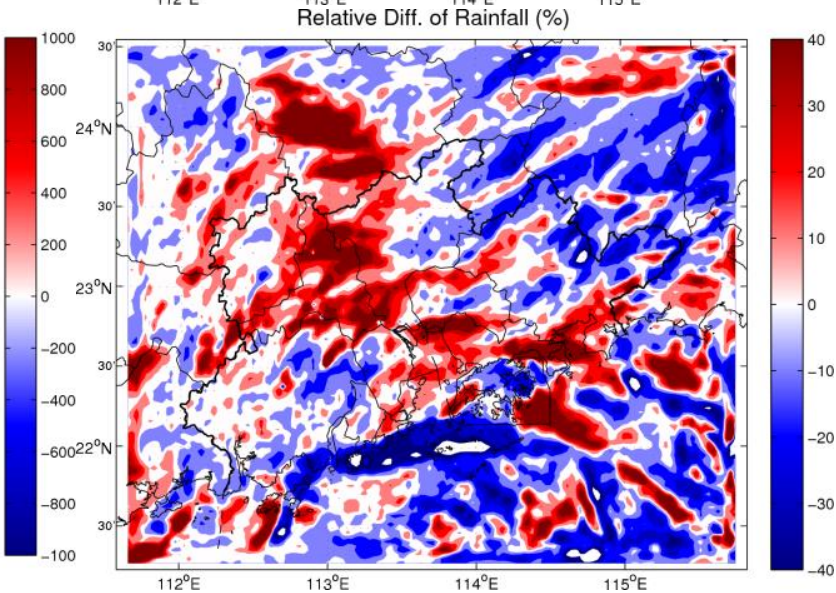
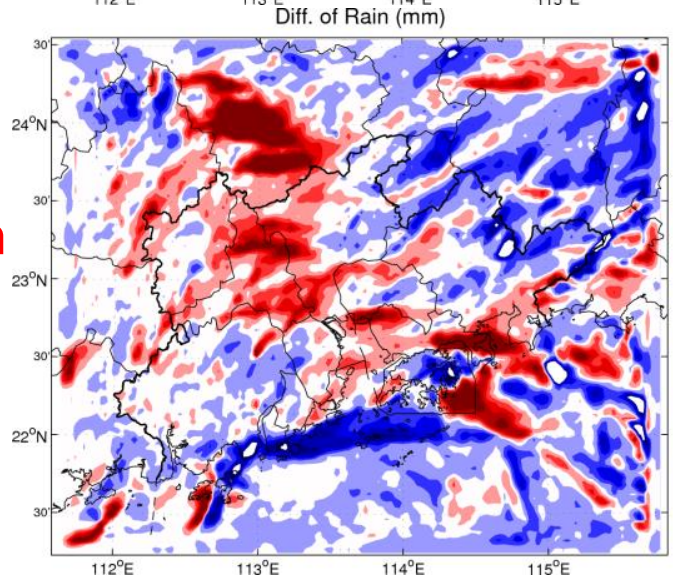
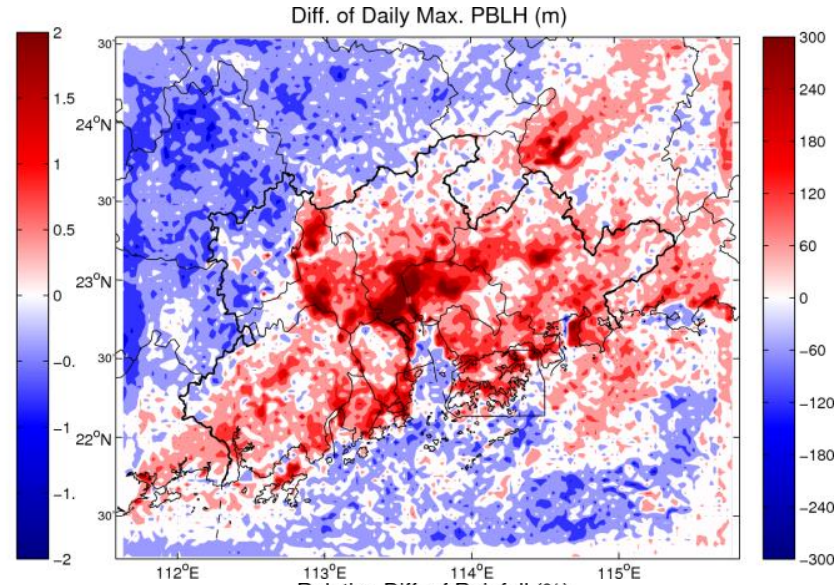
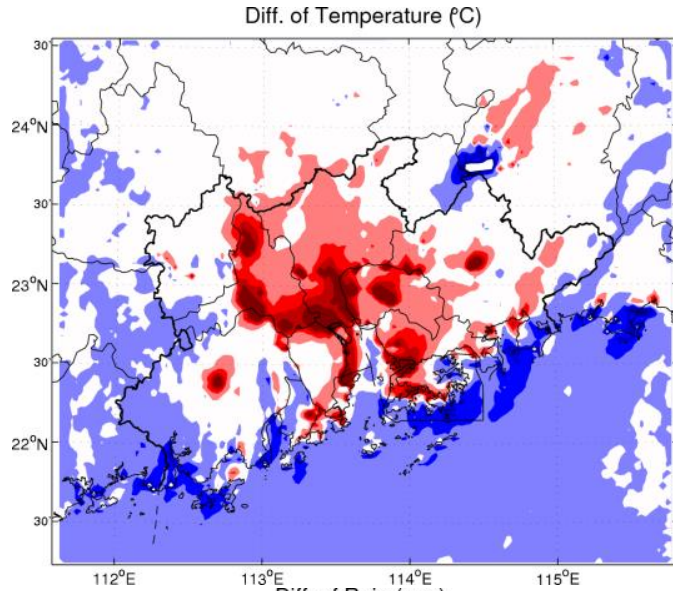


Soil Input Data change



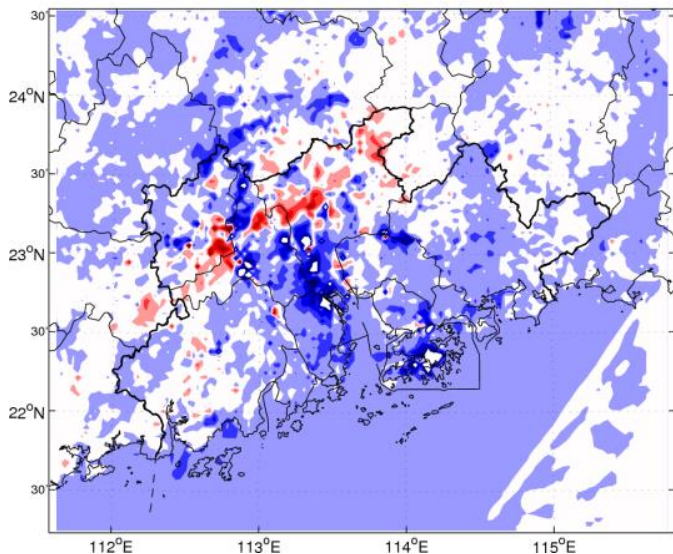
- | | | | |
|--------------|-------------------|---------------|---------------------|
| 1 Sand | 5 Silt | 9 Clay Loam | 13 Organic Material |
| 2 Loamy Sand | 6 Loam | 10 Sandy Clay | 14 Water |
| 3 Sandy Loam | 7 Sandy Clay Loam | 11 Silty Clay | 15 Bedrock |
| 4 Silt Loam | 8 Silty Clay Loam | 12 Clay | 16 Other |

Effect of Land Use Data Change



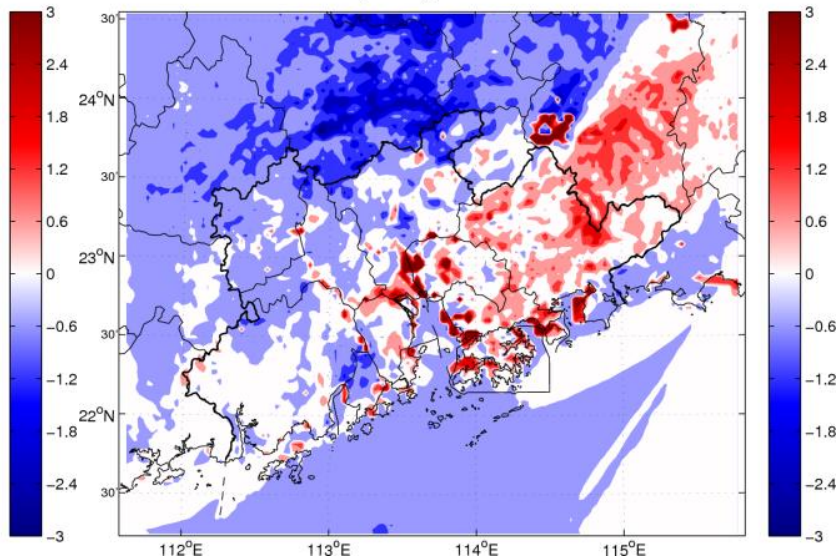
Effect to N Dry Deposition

Diff. of $F_d(\text{NH}_3)$ ($\text{Kg ha}^{-1} \text{yr}^{-1}$)



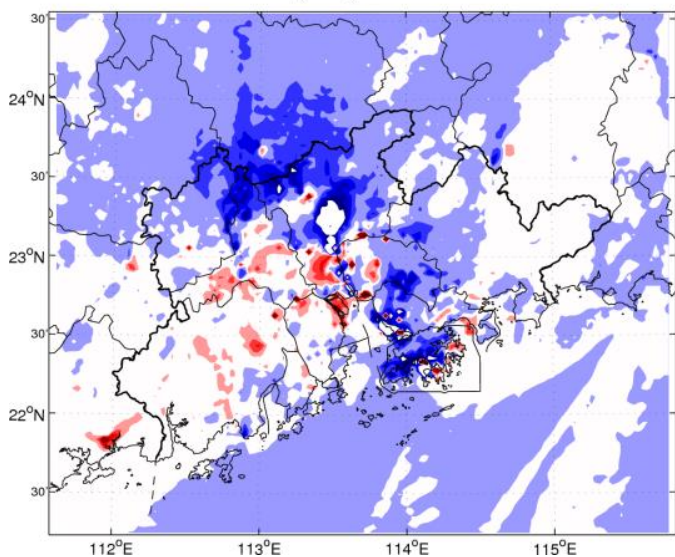
-1.1%

Diff. of $F_d(\text{HNO}_3)$ ($\text{Kg ha}^{-1} \text{yr}^{-1}$)



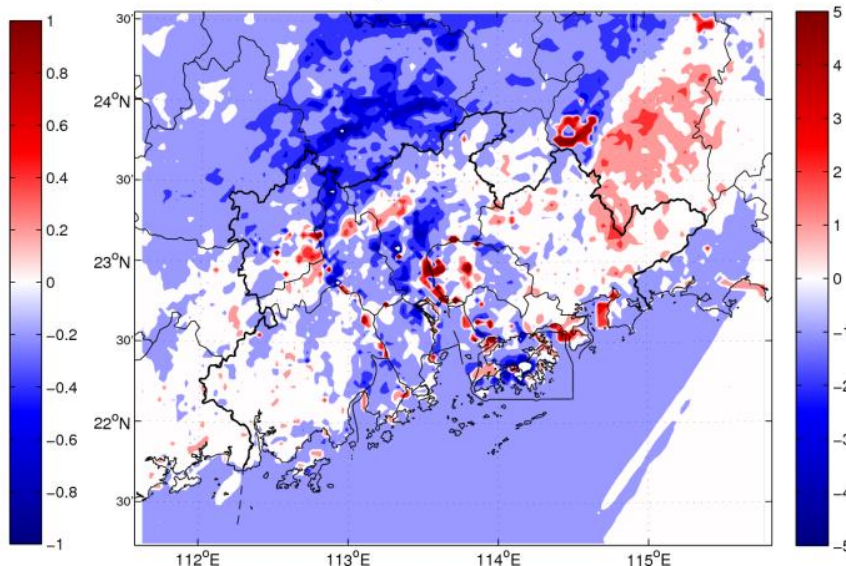
4.5%

Diff. of $F_d(\text{NO}_2)$ ($\text{Kg ha}^{-1} \text{yr}^{-1}$)



-1.7%

Diff. of $F_d(\text{Total N})$ ($\text{Kg ha}^{-1} \text{yr}^{-1}$)



1.2%

Capacity Building

- Service
 - Website
 - Toolbox
- Education
 - Workshop
 - Summer School

www.marcopolo-panda.eu



Due to the strong economic growth in China in the past decade, air pollution has become a serious issue in many parts of the country. For this reason up-to-date regional air pollution information and means for emission control of the main pollutants are becoming more and more important. Within the [EU FP7 programme](#) two collaborative research projects have started in which [Chinese and European partners](#) co-operate to study the air quality in China by using space observations. These two projects, **MarcoPolo** and **Panda**, have joint their forces and present their results on this web-portal.



MarcoPolo



In the MarcoPolo project the focus is placed on emission estimates from space and the refinement of these emission estimates by spatial downscaling and by source sector apportionment. A wide range of data is used from various satellite instruments. From these satellite data, emission estimates are made for anthropogenic and biogenic sources. With various state-of-the-art techniques, up-to-date emission inventories will be created. By combining these emission data with known information from the ground, a new emission database for MarcoPolo will be constructed. The new emission inventory is input to air quality models and is expected to improve the existing air quality modelling and forecasts considerably. We demonstrate the resulting air quality information by running models on both regional and urban scale. [Download leaflet](#)

Panda



The objective of the PANDA project is to establish a team of European and Chinese scientists who will jointly use space observations and in-situ data as well as advanced numerical models to monitor, analyse and forecast global and regional air quality. PANDA will provide to users and stakeholders knowledge, methodologies and toolboxes that will serve as a basis for global and regional air quality analysis and forecasts. It will provide science-based information that will improve air quality management by regional and local authorities. Through tutorials, workshops and [summer schools](#), users and stakeholders will be trained to use the key products and data generated by the project.



Toolbox

The MarcoPolo-Panda toolbox provides convenient access to the results of the MarcoPolo and Panda projects, in particular measurements, emission data and model results on atmospheric composition, including daily air quality forecasts for East Asia. The toolbox is still under development, but links to its different components are provided below.

[Air Quality Forecasts](#) [Model Results](#) [Model Evaluation](#) [Observations](#) [Emissions](#) [Tutorials](#)

Air quality forecasts

MarcoPolo and Panda are applying a number of air quality models to provide daily air quality forecasts for a selection of Chinese agglomerations and for the region of East Asia.

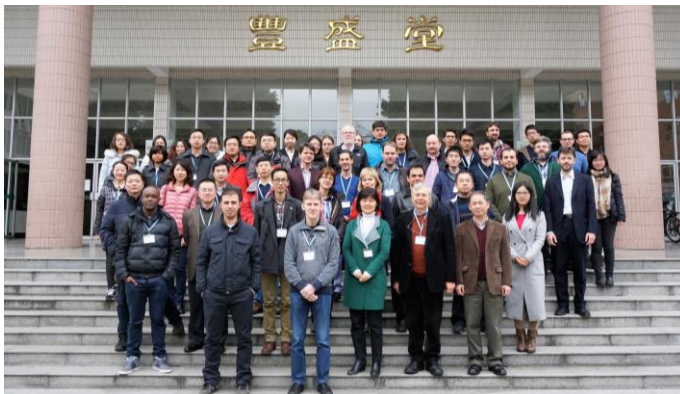
Links to the air quality forecast tool:

• [Agglomerations of China](#)

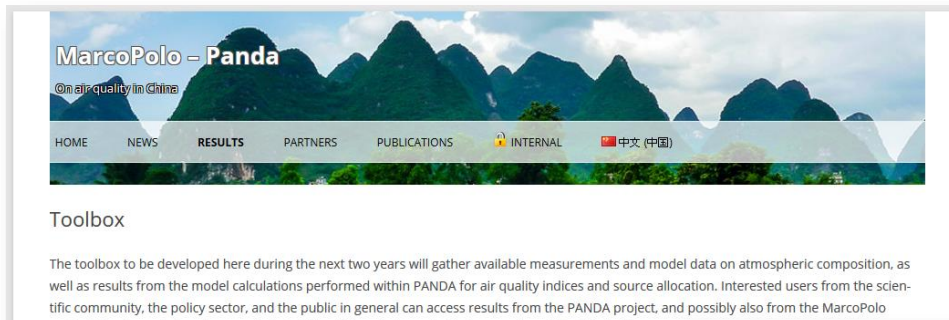
Model results

A selection of atmospheric composition models have been run for China and a larger Asian domain in the past. First results can be viewed [here](#). More regional scale modelling is being performed focusing on model evaluation and specific air pollution episodes of the past, and the result page will be continuously updated.

Model evaluation

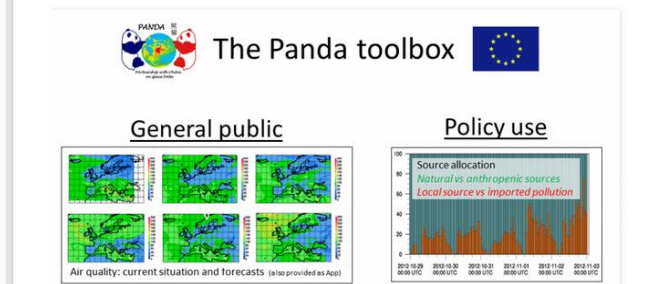


The PANDA Toolbox



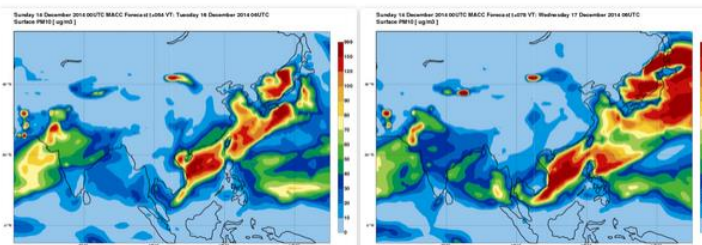
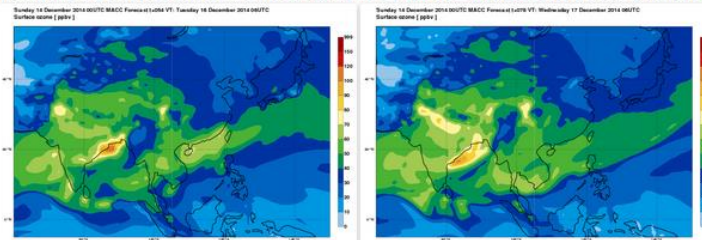
Toolbox

The toolbox to be developed here during the next two years will gather available measurements and model data on atmospheric composition, as well as results from the model calculations performed within PANDA for air quality indices and source allocation. Interested users from the scientific community, the policy sector, and the public in general can access results from the PANDA project, and possibly also from the MarcoPolo project. The figure below shows a sketch of the different elements that are envisaged for this toolbox.



Model results

The C-IFS model is run daily to provide global atmospheric composition forecasts. For the PANDA project, ozone, PM2.5 and PM10 forecasts are provided on a daily basis for China and large areas of South and Southeast Asia. In the images below, 1-day and 2-day forecasts are shown. More information and plots can be viewed on the [MACC page of C-IFS forecasts](#) for the PANDA project.



- ‘Delivered’ in December 2014 as D5.1
- To be further developed during the lifetime of PANDA!

- Currently located at <http://www.marcopolo-panda.eu/> under menu item RESULTS
- Possible collaboration between MarcoPolo and PANDA (→ the Panda-MarcoPolo toolbox?)

Education

- Summer School in Guangzhou, about 80 young scientists from 20 universities attended.



Education

Visit Guangzhou Meteorological Satellite Station



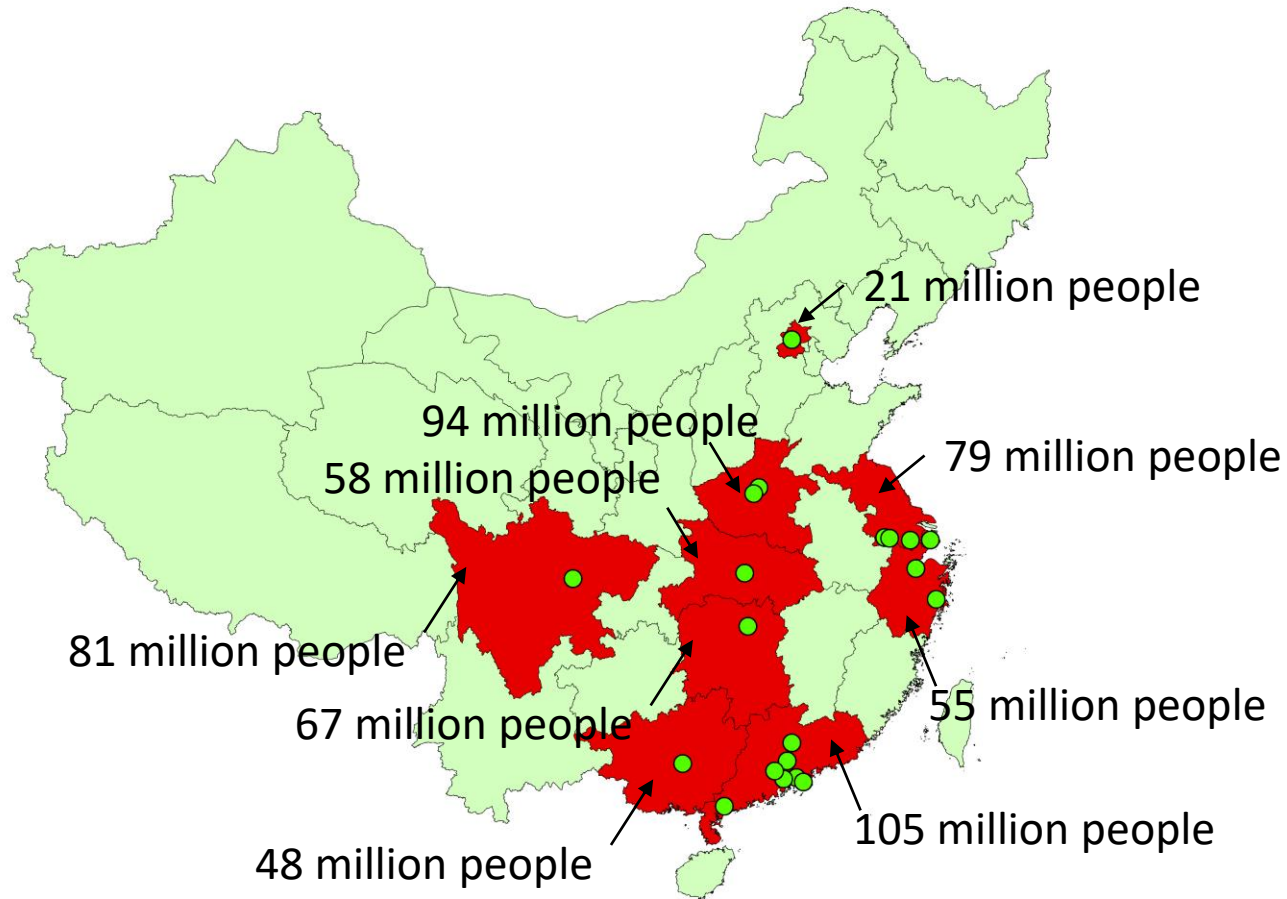
Visit Guangdong Atmospheric Supersite of China



Training Workshop To Users

Policy Makers, Government Officers, Monitoring Site Engineers...

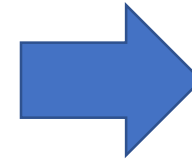
PANDA's results are used in 9 provinces and 18 cities in China,



Challenges: Lacks in air quality studies in China

Tools to obtain fast changes in

- Air pollutants distribution
- Emission inventories
- Air quality prediction



High
Resolution
Model
Results

Thank You



Thank You

