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Monitoring, forecasting and communicating air quality in cities

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A3

CORILA

AIR PARIF

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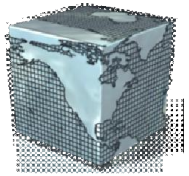
bavAIRia
Europe's heart of aerospace and navigation

- Mandate Bavarian Ministry of Economy
- About 260 members
- Aviation, space, space applications
- Official Copernicus Office Bavaria
- > 60 events/year
- 12+ people

Monitoring, modelling & communicating air quality

High spatial resolution: km x km range



High temporal resolution: hourly forecasts for 72 h

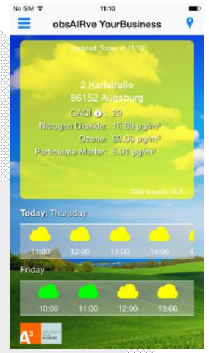
Aerosols

NO2

O3

Scalable

Provide citizens with localised data via mobile app, website



MODELLING

Ground air measurements for validation

City & ground model & satellite data

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Target group: Regions / cities -> citizens

-> EU air quality directives
strictly enforced in EU:
--> infringement procedures

-> Cities/regions violating directive: air quality plan

Effective, transparent, trust?

-> Citizens & environmental interest groups §
go to court – law suits pending

obsAIRveYourBusiness - Roadshow

- **Expert committee visiting regions meets local key players in air quality**
- **Listen, offers & advice**
- **Support for ½ day event**

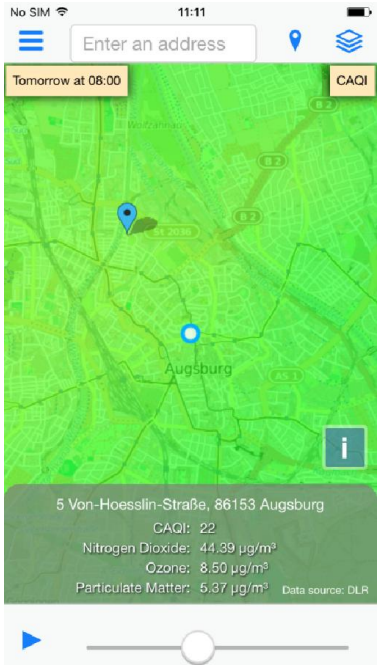
-> Two strategies Paris & Augsburg

-> Present demonstrator app

-> Needs for inputs to develop local app

-> How to communicate with public

-> Prague, Munich, Modena



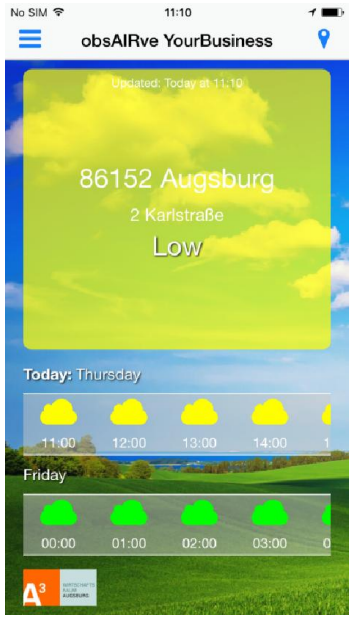
obsAIRveYourBusiness – Policy event

"About air quality in European cities & regions"

-> Hotel Thon EU, Brussels: 16 Nov. 2015

-> Hot discussions & speakers from cities & EC

- Eurocities & Polis representatives, NGOs
- Paris, Augsburg, Berlin, Prague, Modena, Munich
- EC DG Grow: Space for societal change
  DG ENVIR: Air quality unit
- Resumée from roadshows, best practice
- Trends, outlook, current discussions



-> **www.obsAIRveYourBusiness.eu**

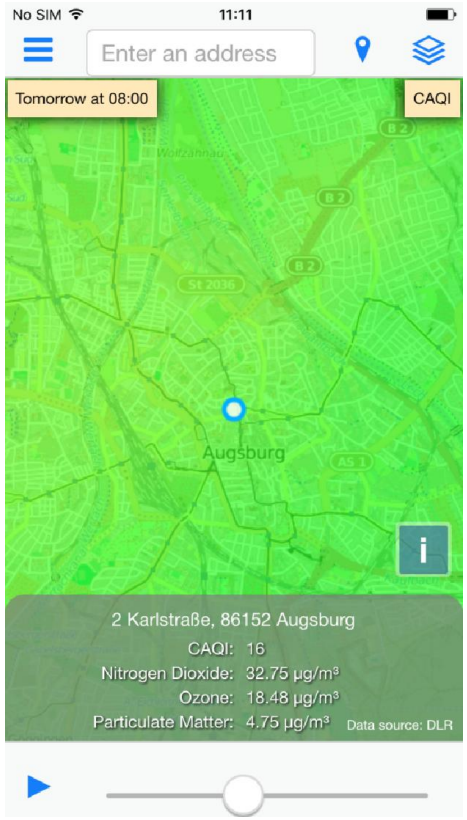
obsAIRveYourBusiness – Offers

Exploring the applicability of the obsAIRveYourBusiness solution with potential users in deeper detail

- Option 1: Data scouting, evaluating available information & data ; Prelim. analysis, data integration in model
- Option 2: Back-End Developmt. / Data Import / Web
- Option 3: App / Front end System Development
- Option 4: Maintenance service
- Option 5: Consultancy modeling implement & adaptation
- Option 6: Integration into existing services

obsAIRveYourBusiness - Status APPs

-> Paris APP have been removed,
Augsburg APP is about to be updated



obsAIRveYourBusiness - more about technical details

hand over to

Frank Baier

German Aerospace Center

German Remote Sensing Data Center, Atmosphere

Oberpfaffenhofen/Munich

European
Space Solutions

02 June, 2016,
The Hague

obsAIRveYourBusiness

Technical aspects & Lessons learned

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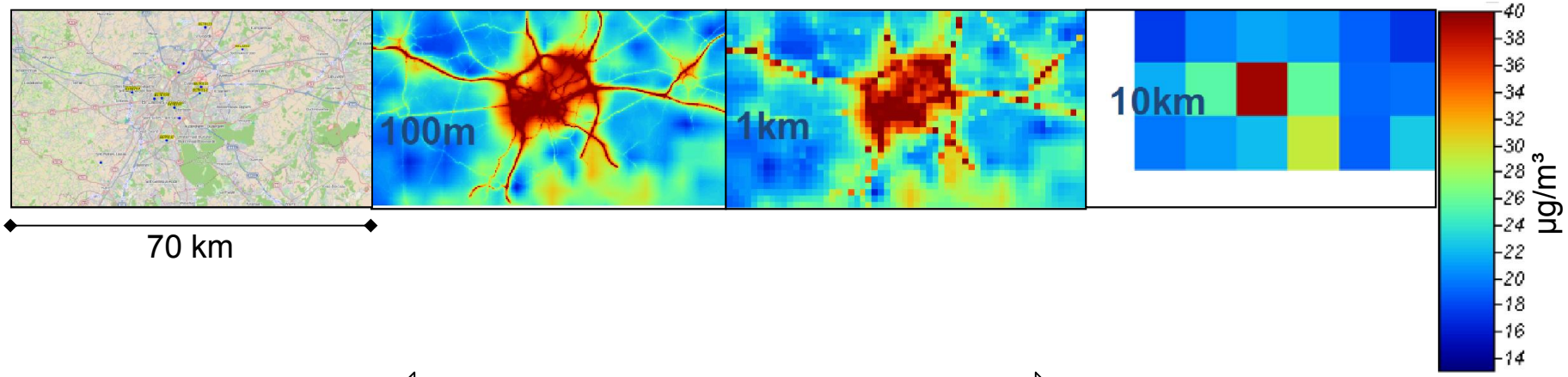
Frank Baier

Necessity of observing air pollutants at urban scales

Brussels NO_2 at different spatial resolutions

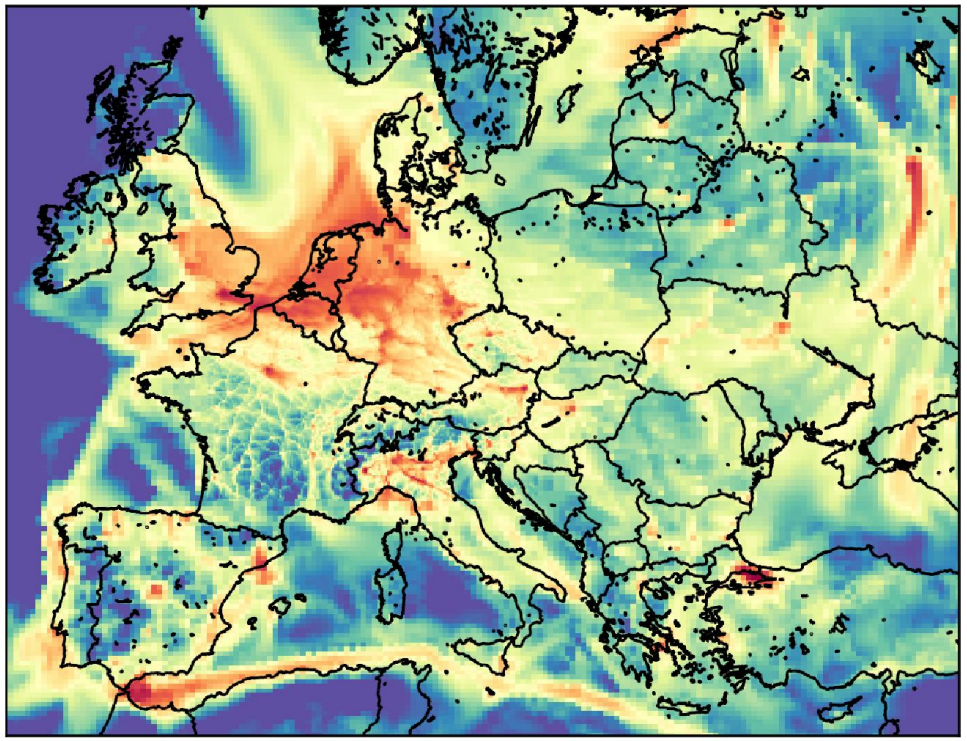


Ground monitoring by ~13 stations •

Current observational gap

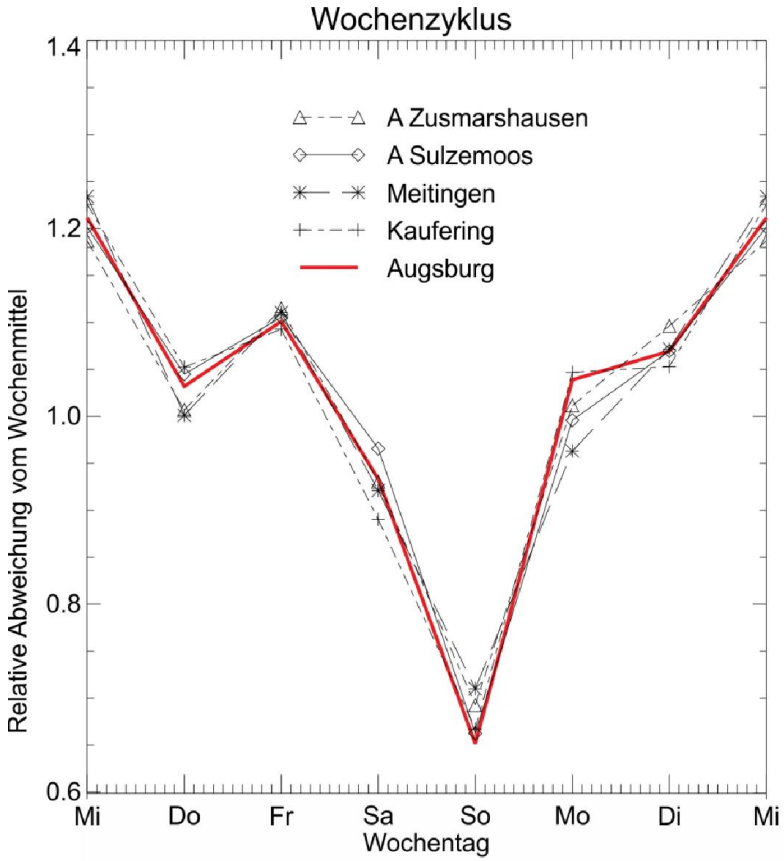
Upcoming Satellites (Sentinels from 2016)

Air pollution at European scales



NO2 surface concentration forecast (7.10.2015 at 17 UTC)

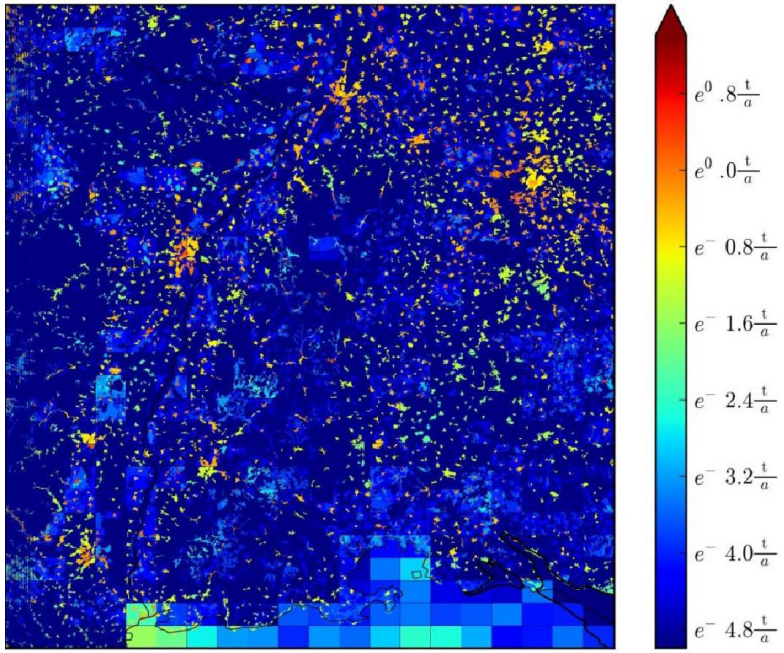
Models: prospect for satellite data



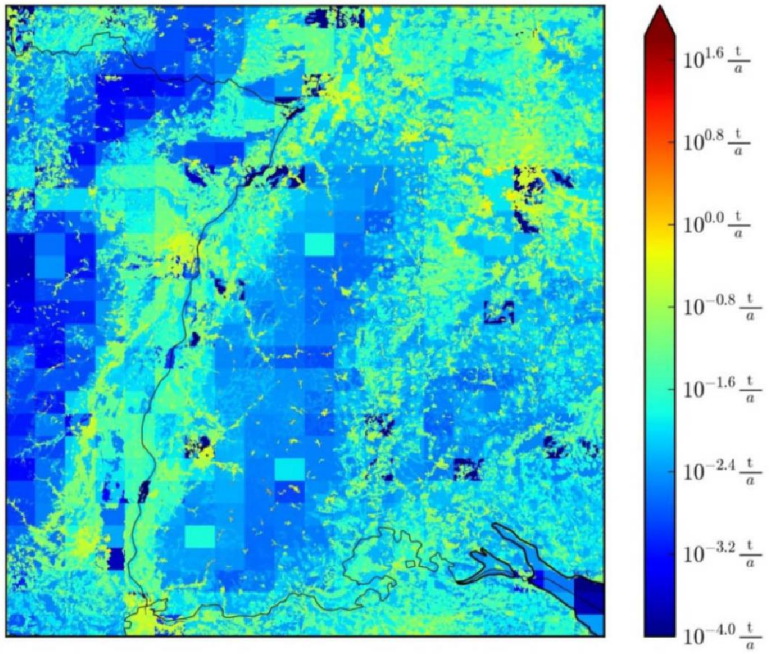
City	Sensor	Period	Relative Trend [%/year]
Paris	SCIAMACHY	2002-2012	-3.4
Augsburg	SCIAMACHY	2002-2012	-1.9
Munich	SCIAMACHY	2002-2012	-0.5

Note strong diurnal and weekly cycles!

Future challenge: Satellite based dis-aggregation of emission data



BF area emissions from population density



BF area emissions from land coverage

OYB approach

- providing area-wide Air Quality instead of monitored point data
- Location based (GNSS) service
- Link to Copernicus
- Test nowcast and forecast capability
- Integration of real-world emission data (station and satellite)
- Proof of concept by two different modelling solutions for Paris and the Augsburg region

OYB pilot cities

- ***Paris***
  - *Strong expertise in air quality (~50 people) and historical awareness of the situation (Airparif was founded in 1979)*
  - *Operates its own models*
  - *"Data-rich" city with near-real-time traffic information, large observation networks etc.*
- ***Augsburg***
  - *Smaller city (~300,000 people)*
  - *Far less data available and protocols for NRT data transfer not established.*
  - *Need to build things from scratch*

OYB: Two cities – two approaches

Air Quality Monitoring for Paris Île de France

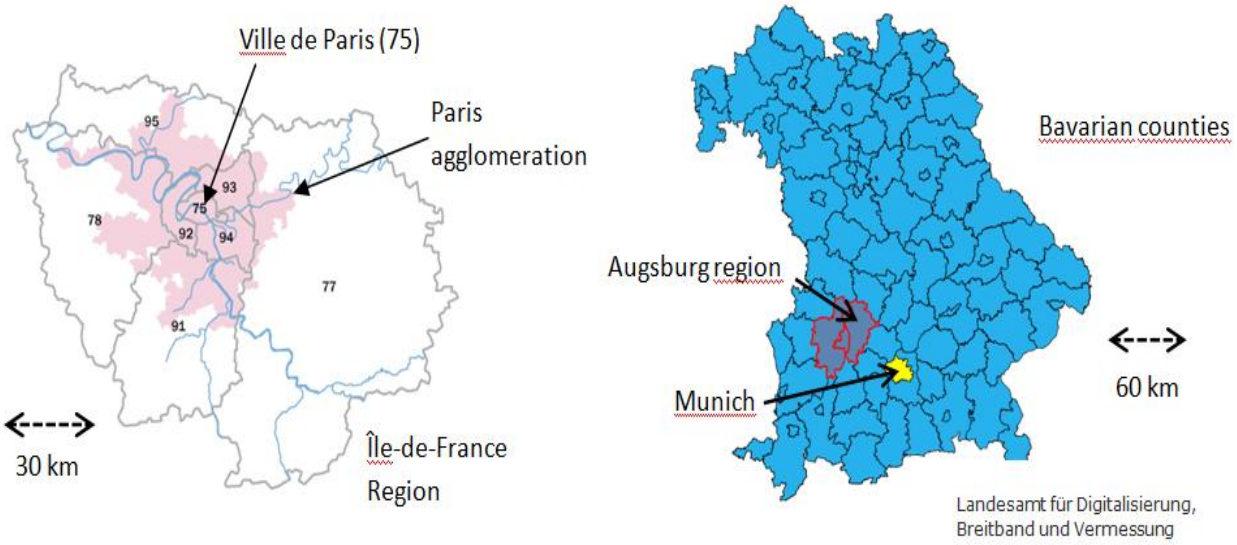
- **Focus on near-real time impact of traffic emissions**
- **Traffic counting, fleet analysis, COPERT emission factors.**
- **Nesting of dispersion model ADMS-Urban into background forecast (Pre'AIR / Chimere)**

OYB: Two cities – two approaches

Air Quality Monitoring for Augsburg-Munich Area

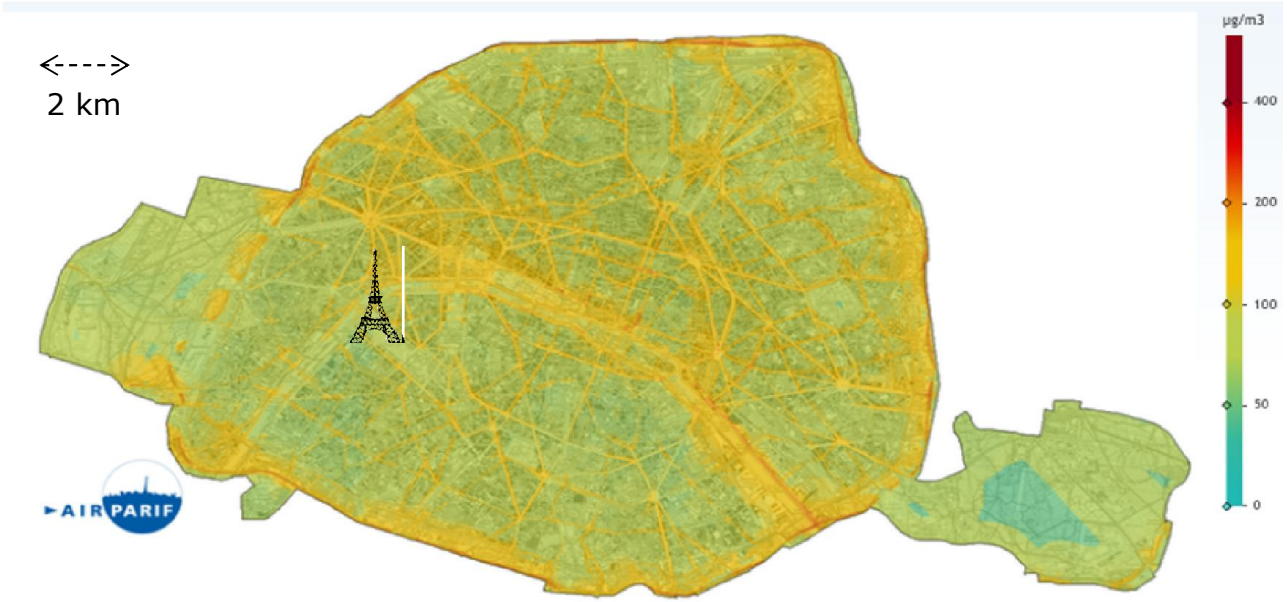
- **Focus on three-day forecast of regional pollution**
- **Emission factors from historic traffic counting**
- **Nesting of Polyphemus models from European down to regional scale**
- **OGC based web-map service for easy web-access**

OYB: Paris & Augsburg pilot areas



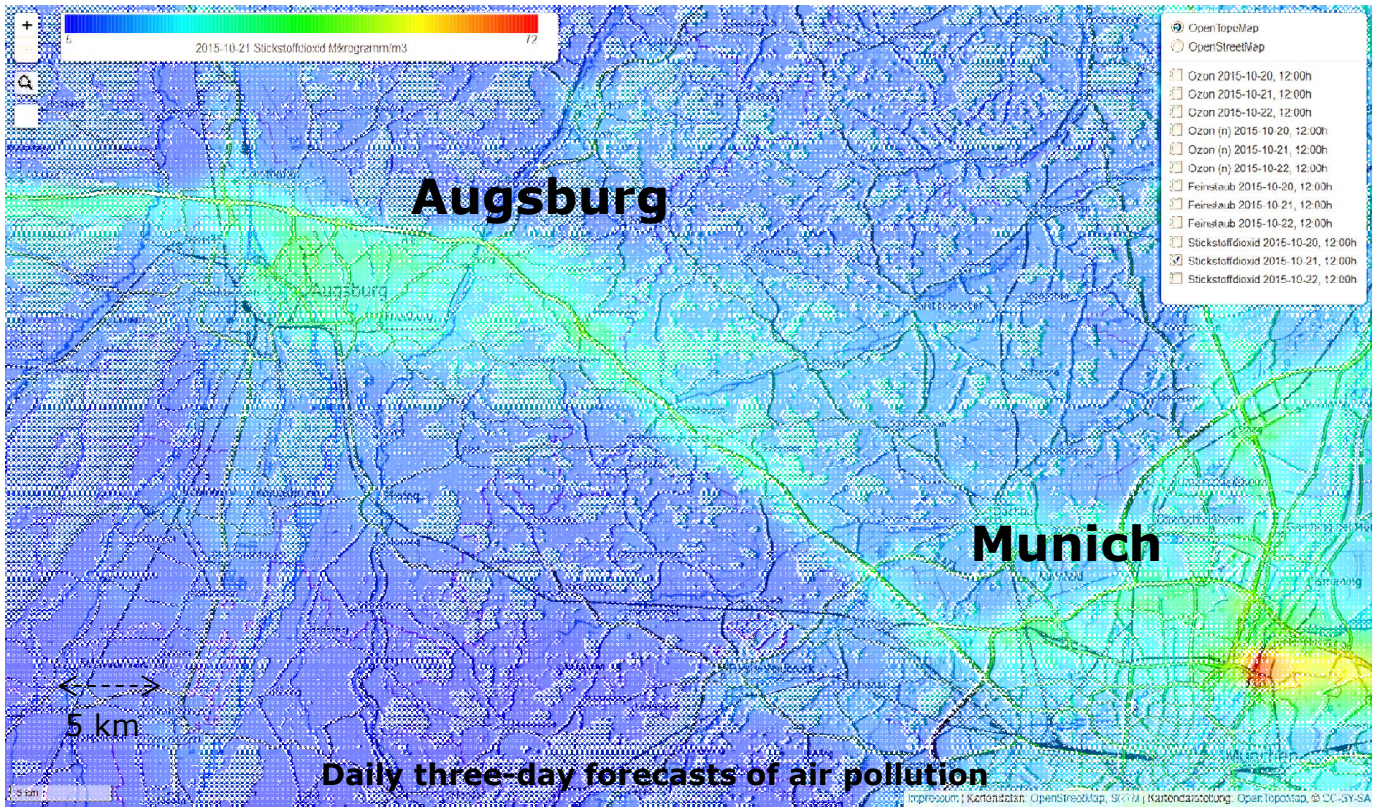
Maps for controlled pollutants: NO2, O3, PM10

Paris city center NO2 sample result

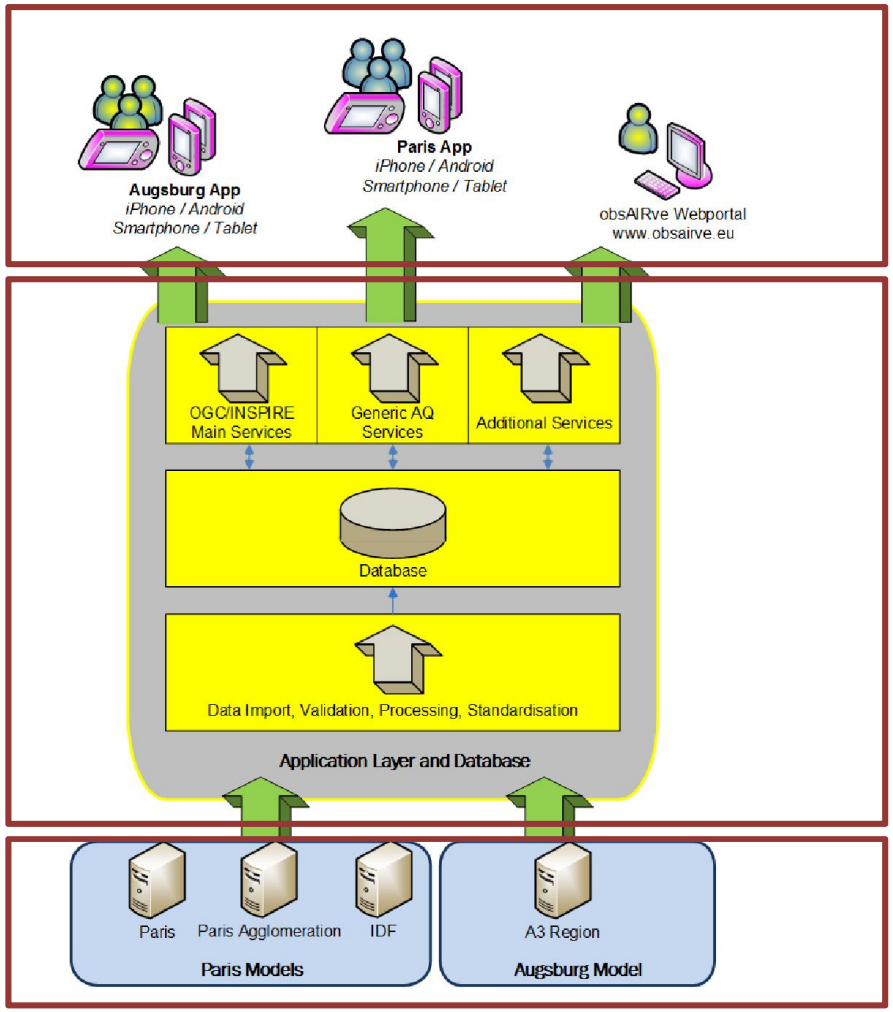


Near-real time maps with hourly updates

Augsburg-Munich NO2 sample forecast



The data challenge

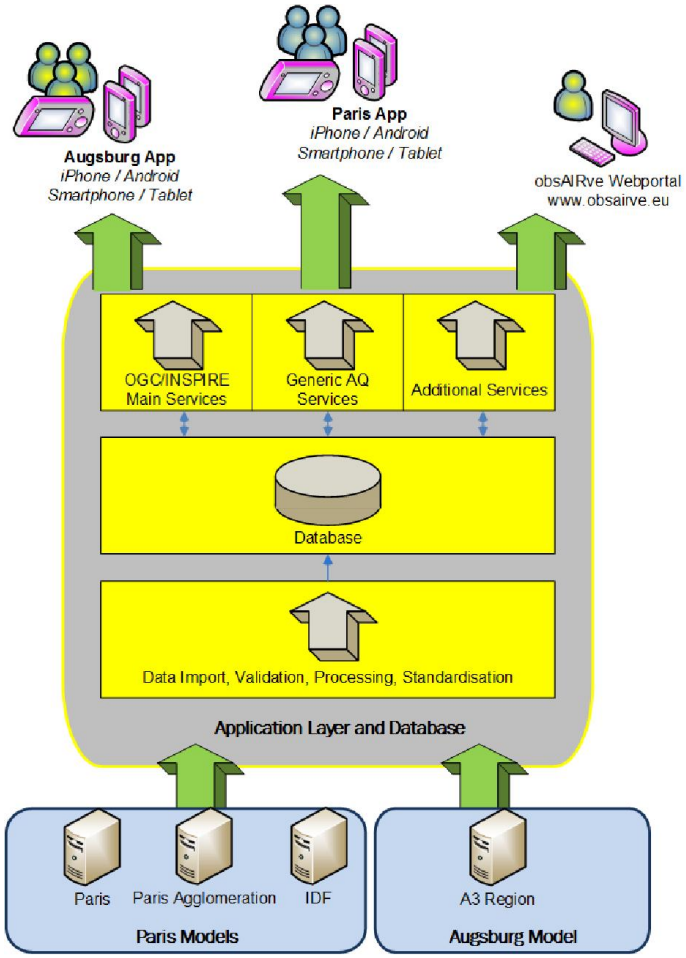


Multi-platform user applications

Data collecting and processing host

Data providers connect via WMS interface

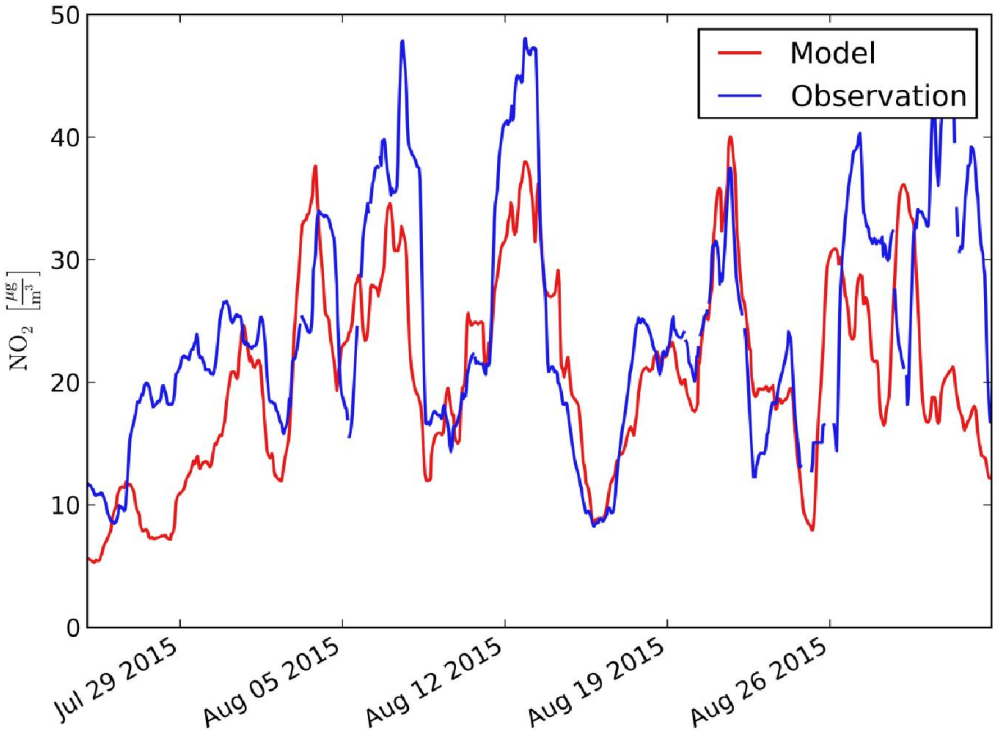
The data challenge



- **GNSS service**
- **Mobile GIS**
- **Open Web-GIS**
- **Android & IOS**
- **Multi-language**
- **Easy tailoring**

How do we test it?

- Forecast versus observations at a single station (12 hour running mean)
- Forecast captures episodic distribution well

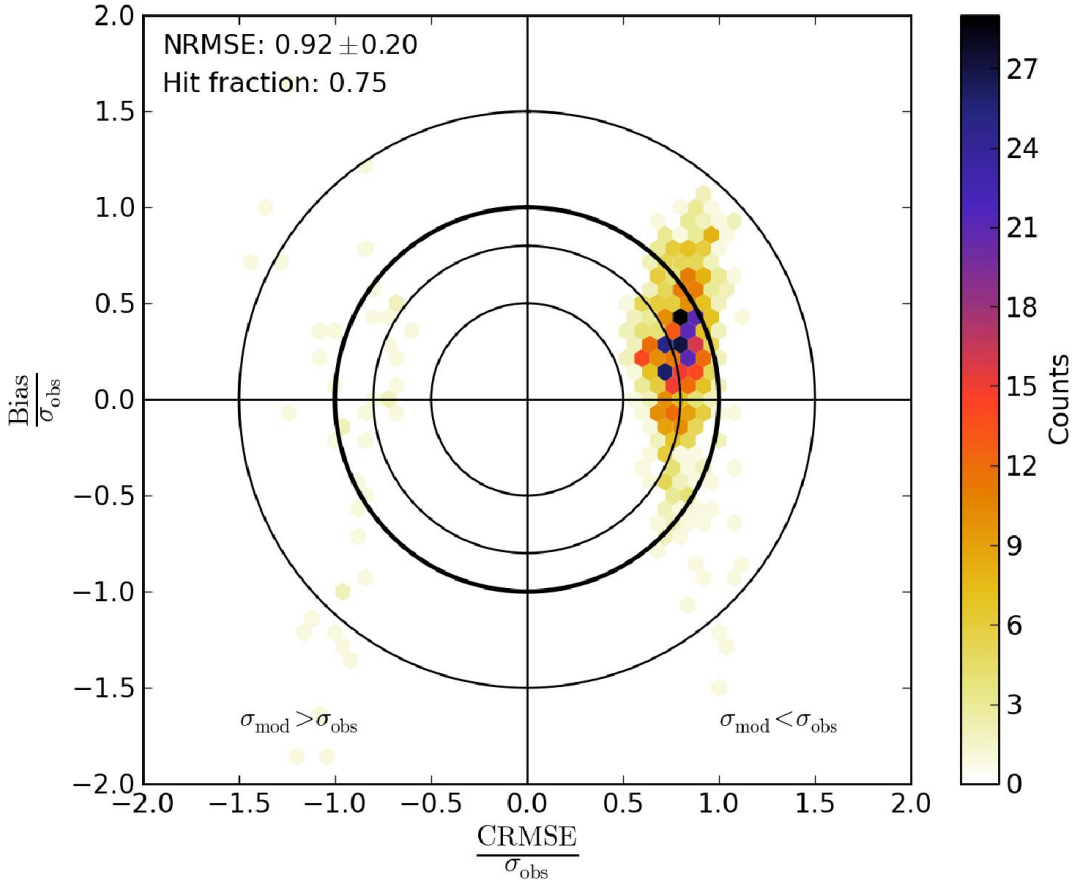


Munich station DEBY039

How do we test it?

Error statistics for historic records (e.g. 2011)

NO2: bias & rms << 1σ (obs)



Lessons learned / feedback from roadshows

- OYB concept proved for two different pilot cities
- Prague, Modena: interest in app platform, would like to use own model
- Augsburg, Munich: would like street resolution
- Paris: address different needs, e.g. experts-people (people can’t see NO2!)

Lessons learned / feedback from roadshows

- **Investments are a challenge for cities**
  - Air quality no marketable product per se
  - Cities need further support and incentives
  - Question and will of political engagement
- **Data is still a burden for the non-expert**
  - Better links to future Copernicus data needed
  - e.g., integration with INSPIRE, OGC, GISS applications
- **Communication needs more attention**
  - Better explain relevance for daily life, e.g. measurements c.t. forecast maps
  - Numbers: Translate gas/particle concentration into pollution levels (index)

The roadshows have confirmed that

- **The OYB solution can meet the requirements of cities/regions**
- **The OYB solution has the potential to be transferred to other cities**
- **The cost/efforts for take-up are much lower than if a cities develops their own solution**

Outlook Sentinels

- **Direct measurements for air Quality: e.g., S5P will allow much higher resolution (7x7 km²)**
- **Proxy measurements, e.g., of surface parameters will allow improvement of emissions**