FMI-ENFUSER
Blending regional model forecasts with measurements & recent results

11.2.2015
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Outline

• A glimpse at the ENFURER workbench and Client API

• A macro scale example, fusing modelled data and measurements over Southern Finland

• Recent model comparison results (urban fine scale)
  • Future improvements based on these results

Reminder: FMI-ENFUSER is model to assess air quality with high resolution. It is based on both Land-Use-Regression and Dispersion modelling. Besides measurements, ENFUSER can use other modelled AQ data as input since it utilizes data fusion algorithms.
Changes in ENFUSER Service

- Live hourly AQ observations extraction (100+ stations in Finland)
- WP5: Hourly AQ observations extraction (900+ stations in China)
- Performance boost
  - More AQ products to query. Latest Air quality results (for selected locations) delivered instantly
ENFUSER Client

Currently, fused output can be accessed with...

GUI client (uses the API)

Java API library (built for MMEA)

Send request => upload files to shared folder
ENFUSER workbench

ENFUSER Clients communicate with this monster over a cloud service.
Regional example

How regional models contribute to the fusion when measured data is available?

NO2, 2015-02-02T12 (Data available from 40+ stations and from SILAM model)

Weather data available from HIRLAM model

This is the expected standard deviation.

This is the relative weight [%] assigned to SILAM model. No stations nearby => SILAM gets higher weight since it's available everywhere in the area.
Regional example - wind
HIRLAM weather data extracted from FMI open data access

Wind speed [m/s]  Wind direction [deg]
Performance evaluation (1/3)

ENFUSER was calibrated with 2011 data from another region. Then, ENFUSER predicted hourly concentration of NO2 in 38 locations near Helsinki in 2010. Predicted seasonal averages were compared against measured averages.
Performance evaluation (2/3)

A draft paper to compare different modelling techniques with ENFUSER

Root mean squared error for estimated seasonal NO2 concentrations

- Built to estimate hourly concentration in HMA based on Dispersion modelling
- Built to estimate seasonal averages based on Land-Use-Regression
- Built to estimate hourly concentration in Finland, based on Dispersion and LUR modelling with fusion
Performance evaluation (3/3)

- Estimation of hourly PM2.5, PM10, NO2 at selected urban measurement site (Leppävaara, one of the sites used in the study)

Soon the EnfuserClient will provide time series such as these
What to learn from evaluation?

Highest relative prediction errors can be explained by Land Use data resolution limitations (25m x 25m).

Especially the detection of **urban street canyons** is difficult as it is.

**Next step:** use widely available high-res maps
- Building blocks
- Most of the usable land use types can be assessed from these maps
- **Legal issues, how to get?**
Conclusions

• Within the last 12 months in MMEA, ENFUSER model has been transformed into an operational model.
  • The client API still remains to be integrated in the MMEA platform!

• According to model comparison, the technique to combine LUR- and dispersion modelling certainly seems promising.
  • Fusion of modelled AQ data with measurements seems to work fine

• CORINE land use data has become a bottle-neck
  • Perhaps too coarse a resolution to estimate urban AQ
  • Google/Here(Nokia) to the rescue?