# Use of observational data: model evaluation

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Outline:

- Evaluation of AQ models
- Simple comparisons
- Slightly more advanced comparisons: ABL





### **Evaluations**



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Why:

- How good/bad model is?
- When and where model is good/bad?
- How to improve model results?
- Which model is better/worse?

Observations:

- Ground stations
- Satellite data
- Observational campaigns
- Other sources of "Ground truth"



## Scatter plots: NO2

Frequency Scatter Plot: SILAM northerneurope, Station FI00208, Pollutant NO<sub>2</sub> (µg m<sup>-3</sup>), Raw Data, No Filtering





### Timeseries: NO2





### Scatter plots: CO

Frequency Scatter Plot: SILAM northerneurope, Station EE0009R, Pollutant CO ( $\mu$ g m<sup>-3</sup>), Raw Data, No Filtering





### Timeseries: CO





### Scatter plots: SO2

Frequency Scatter Plot: SILAM northerneurope, Station Fl00208, Pollutant SO<sub>2</sub> (µg m<sup>-3</sup>), Raw Data, No Filtering





### Timeseries: SO2





### Simple comparisons



- Simple statistics:
  - Gives some average numbers
  - Good for scoring
  - Does not tell "when" and "why"
- Scatter plots:
  - Many data points
  - Not very informative
- Time series plots:
  - Individual stations
  - Few data points
  - Can give a hint on reasons of deviations



### More advanced comparisons

Time Plot: SILAM northerneurope, Station EE0009R, Pollutant CO (µg m<sup>-3</sup>), Raw Data



### ABL scheme evaluation

Old ABL scheme (dry parcel):

- Poorly agrees with measurements
- Produces very shallow ABLs in nighttime
- Is known to overestimate concentrations in night-time

New ABL scheme (bulk Richardson):

- Better agrees to observations
- Produces deeper ABL in night-time

Does it improve the model?





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Example: NO from suburban background stations

- Not directly affected by local sources
- Near-ground emissions



Austria



### **Belgium**

hour

BELGIUM suburban\_background (18 stations) Pollutant:NO (µg m<sup>-3</sup>), 2010 12 18 23 12 12 18 23 6 18 23 Monday Tuesday Wednesday Thursday Friday Saturday Sunday 30 NO (μg m<sup>-3</sup>) 25 20 15 10 5 0 6 12 18 23 0 6 12 18 23 0 6 12 18 23 0 6 12 18 23 hour Observed Old ABL New ABL 14 20 20 12 NO (μg m<sup>-3</sup>) NO (µg m<sup>-3</sup>) NO (μg m<sup>-3</sup>) 15 10 15 8 10 -10 6 5 -5 4 9 0 12 18 Ň Mon 23 F М s 0 D Tue Wed Thu Fri Sat Sun J Δ м

month

wookday

Bulgaria



### BULGARIA suburban\_background (9 stations) Pollutant:NO (µg m<sup>-3</sup>), 2010

wookday

## Cech Republic

CZECH REPUBLIC suburban\_background (14 stations) Pollutant:NO (µg m<sup>-3</sup>), 2010



### Germany



month

wookday

Spain

20 15 NO (µg m<sup>-3</sup>) 10

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14

12

10 NO (μg m<sup>-3</sup>)

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4

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hour

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NO (μg m<sup>-3</sup>) 6 -4 -12 18 23 J F М м A



18 23 Italy

ITALY suburban\_background (67 stations) Pollutant:NO ( $\mu g m^{-3}$ ), 2010 12 18 23 12 23 12 18 23 6 18 Monday Tuesday Wednesday Thursday Friday Saturday Sunday 30 25 NO (μg m<sup>-3</sup>) 20 15 10 5 0 6 12 18 23 0 6 12 18 23 0 6 12 18 23 0 6 12 18 23 hour Observed Old ABL New ABL 15 20 30 -NO (μg m<sup>-3</sup>) NO (μg m<sup>-3</sup>) NO (μg m<sup>-3</sup>) 15 20 10 10 10 -5 0 12 18 N Mon Sun 23 s 0 D Tue Fri Sat м Δ м Wed Thu

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hour

### Netherlands

NETHERLANDS suburban\_background (4 stations) Pollutant:NO (µg m<sup>-3</sup>), 2010



### Portugal

PORTUGAL suburban\_background (7 stations) Pollutant:NO (µg m<sup>-3</sup>), 2010 12 18 23 12 12 18 23 6 18 23 Monday Tuesday Wednesday Thursday Friday Saturday Sunday 15 NO (μg m<sup>-3</sup>) 10 5 23 0 6 12 18 23 0 6 12 18 0 6 12 18 23 0 6 12 18 23 hour Observed Old ABL New ABL 8 12 12 7 10 10 NO (μg m<sup>-3</sup>) NO (μg m<sup>-3</sup>) NO (μg m<sup>-3</sup>) 8 6 6 5 4 4 4 -0 12 18 23 Ň F s 0 D Mon Wed Fri Sat Sun J м Δ м Tue Thu hour wookday month

### ABL exercise summary



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ABL exercise:

- New ABL is better
- Need to correct emissions country by country...



LMATIETEEN LAITOS Meteorologiska institutet Innish meteorological institute

### Final remarks

### Issues with comparisons

Observed quantities differ from modelled

- Credibility of observations
- Supplementary information
- Amount of data
  e.g. 10<sup>5</sup> hours/year x 10<sup>3</sup> stations
- Way of comparison and metrics
- Attribution of discrepancies

