Use of observational data: model evaluation

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Outline:

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

Evaluations

Why:

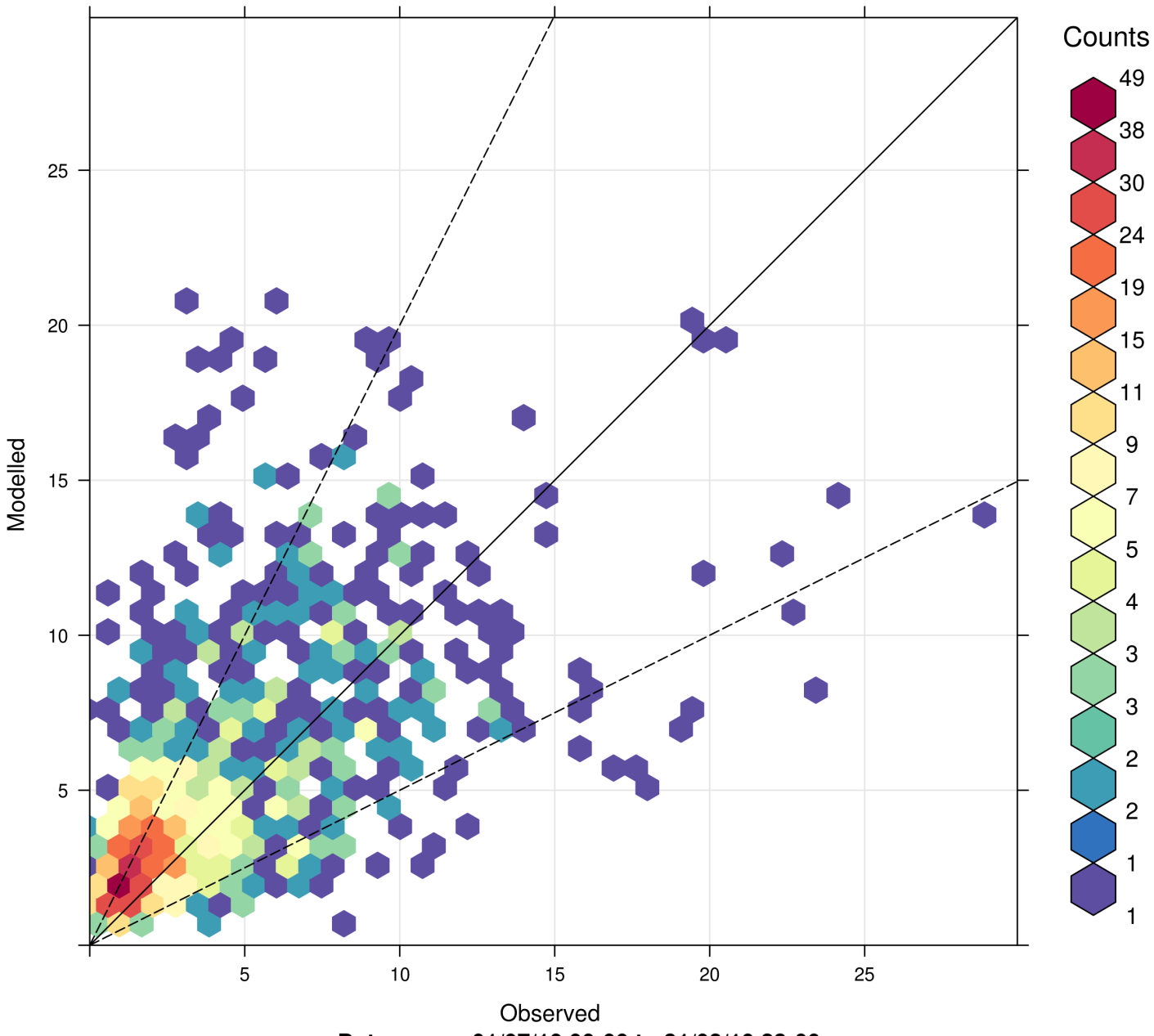
- How good/bad model is?
- When and where model is good/bad?
- How to improve model results?
- Which model is better/worse?

Observations:

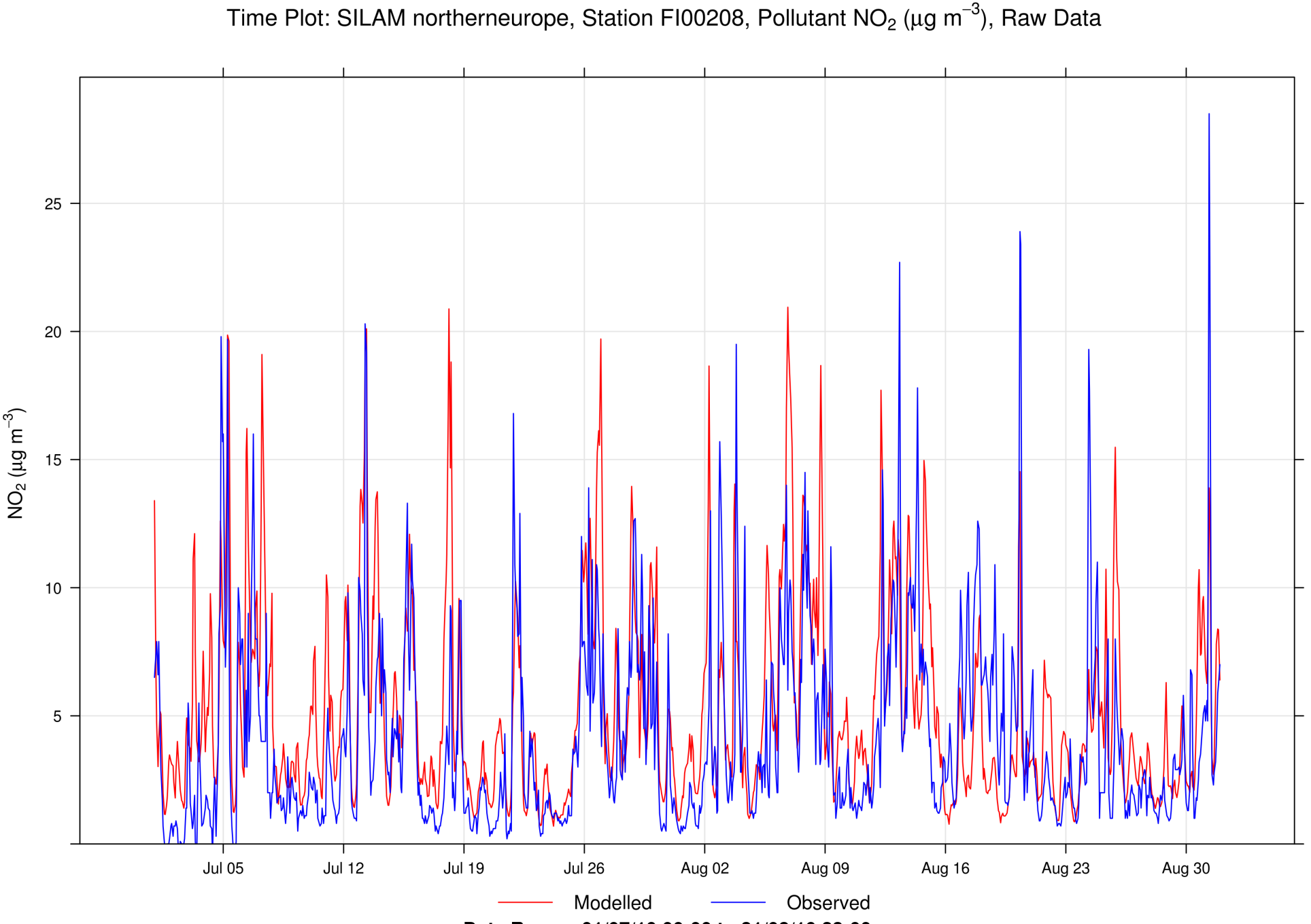
- Ground stations
- Satellite data
- Observational campaigns
- Other sources of “Ground truth”

Scatter plots: NO2

Frequency Scatter Plot: SILAM northerneurope, Station FI00208, Pollutant NO_2 ($\mu g\ m^{-3}$), Raw Data, No Filtering

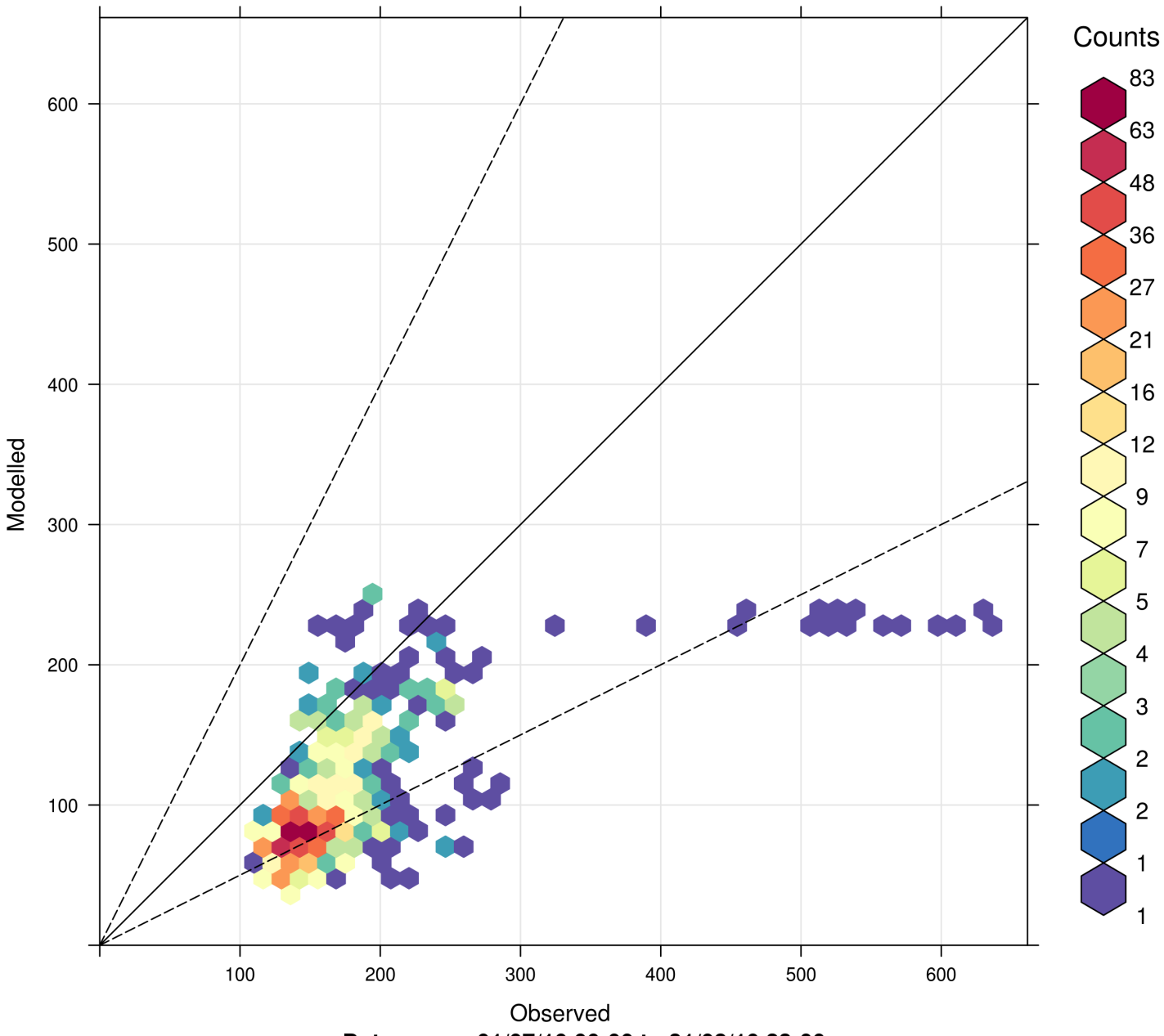


Timeseries: NO2

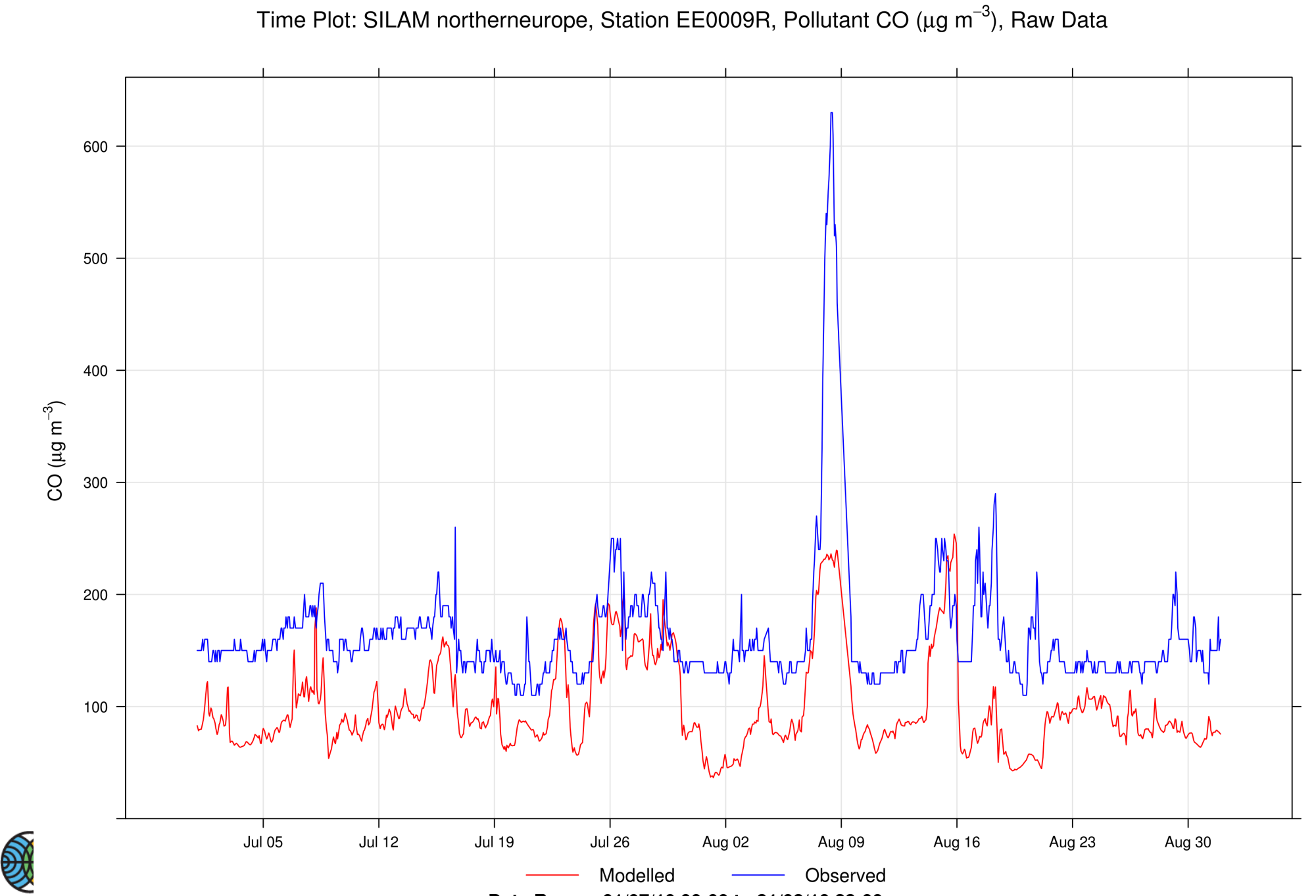


Scatter plots: CO

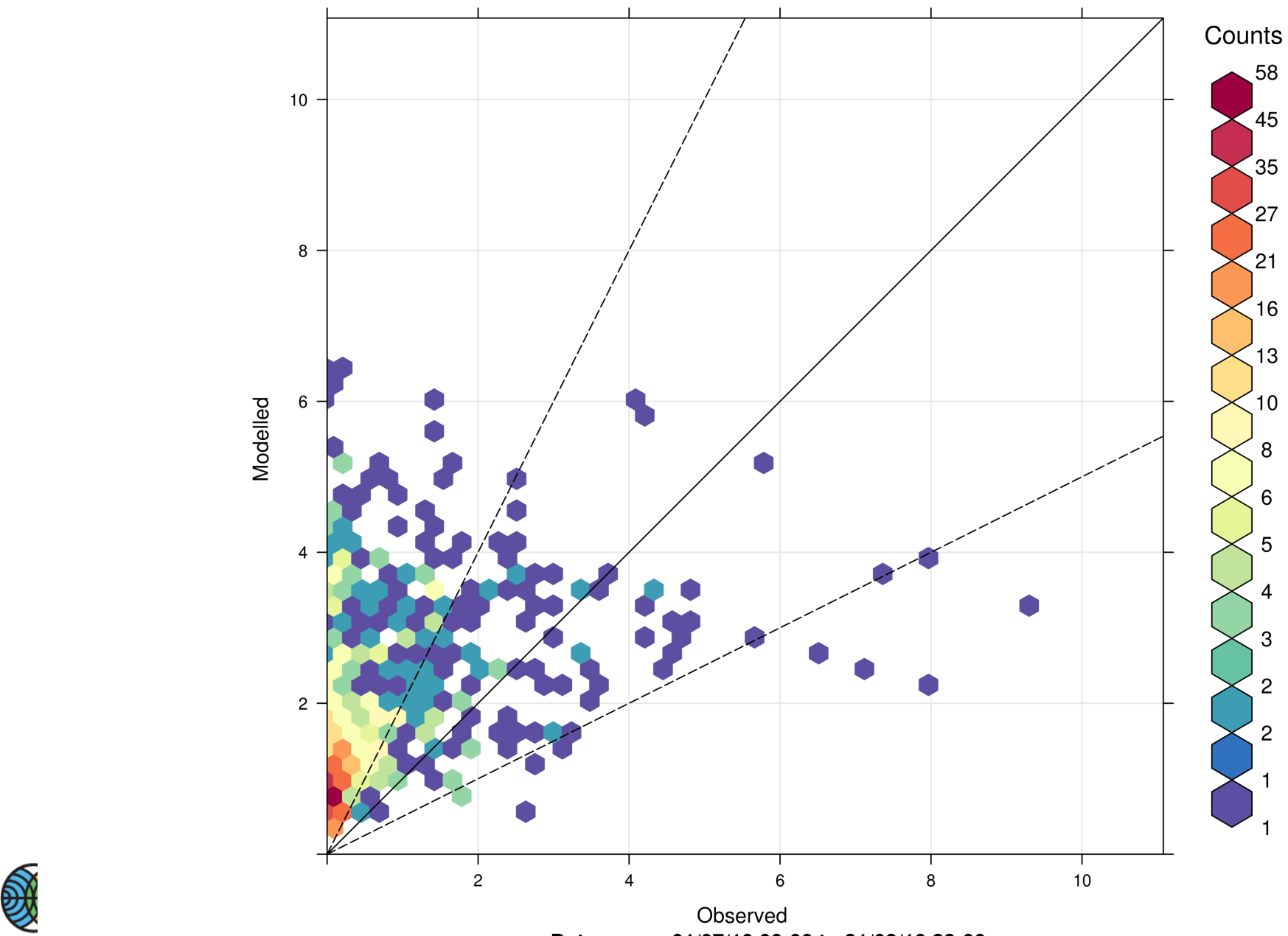
Frequency Scatter Plot: SILAM northerneurope, Station EE0009R, Pollutant CO (µg m^{-3}), Raw Data, No Filtering



Timeseries: CO



Scatter plots: SO2



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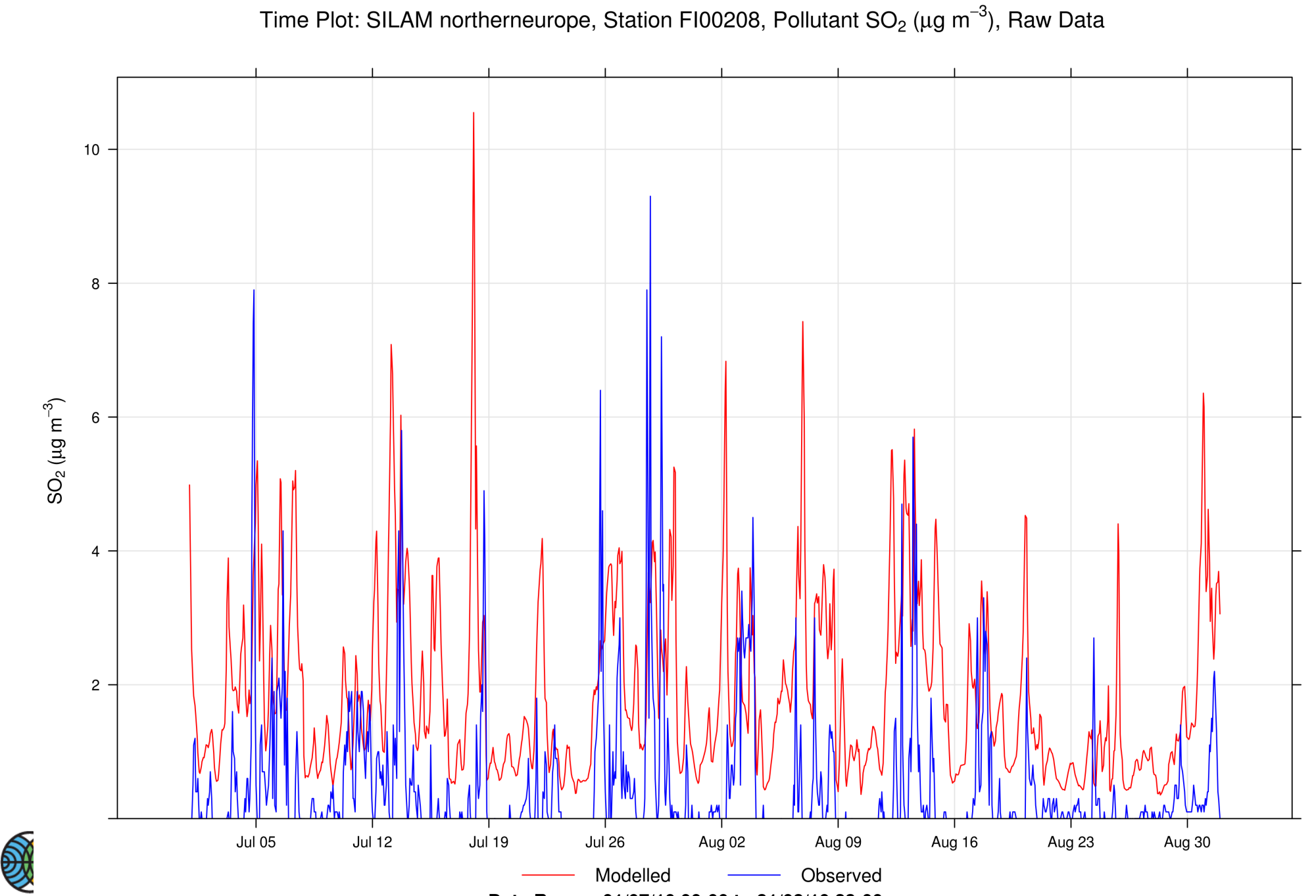
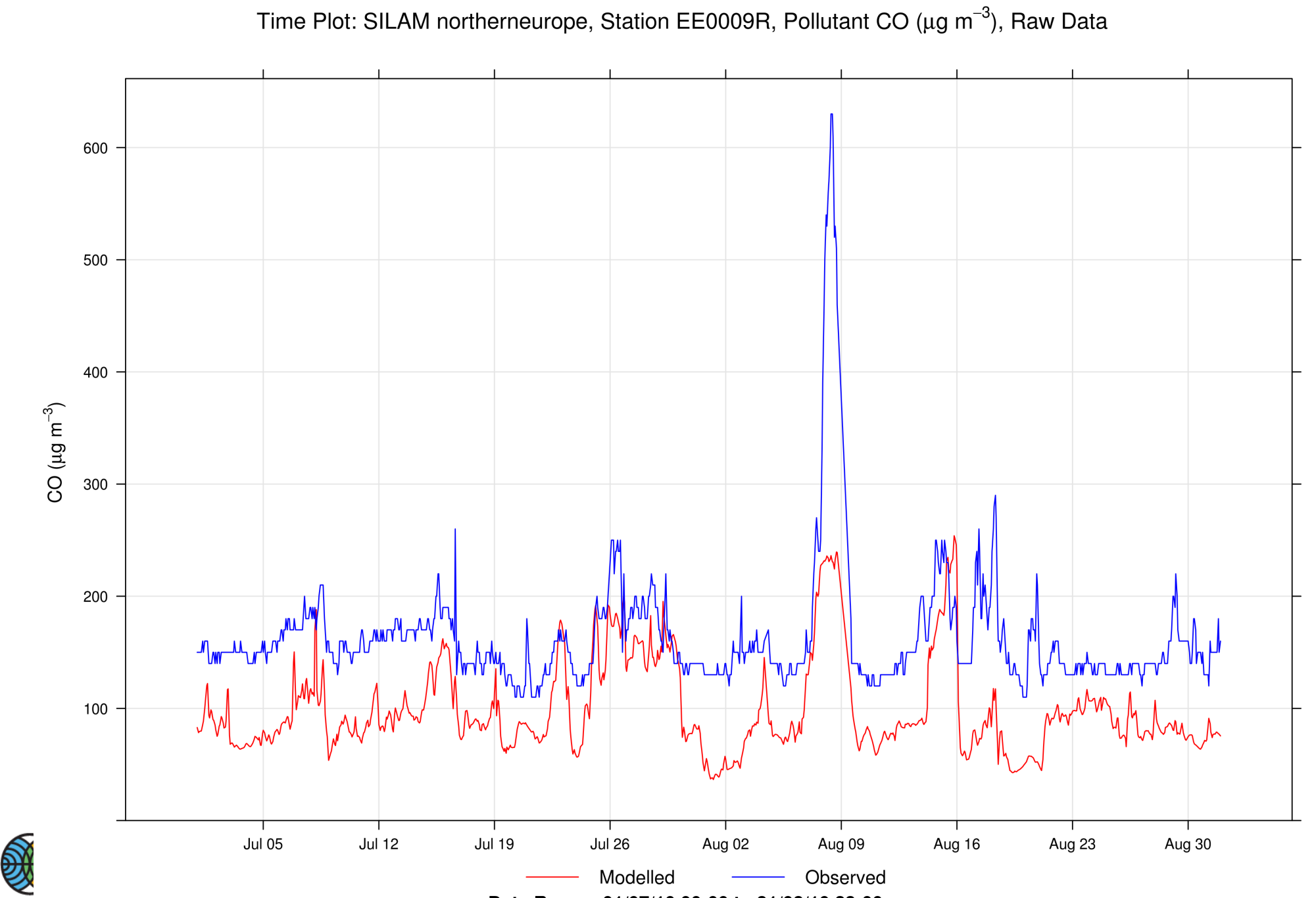


Simple comparisons

- 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



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

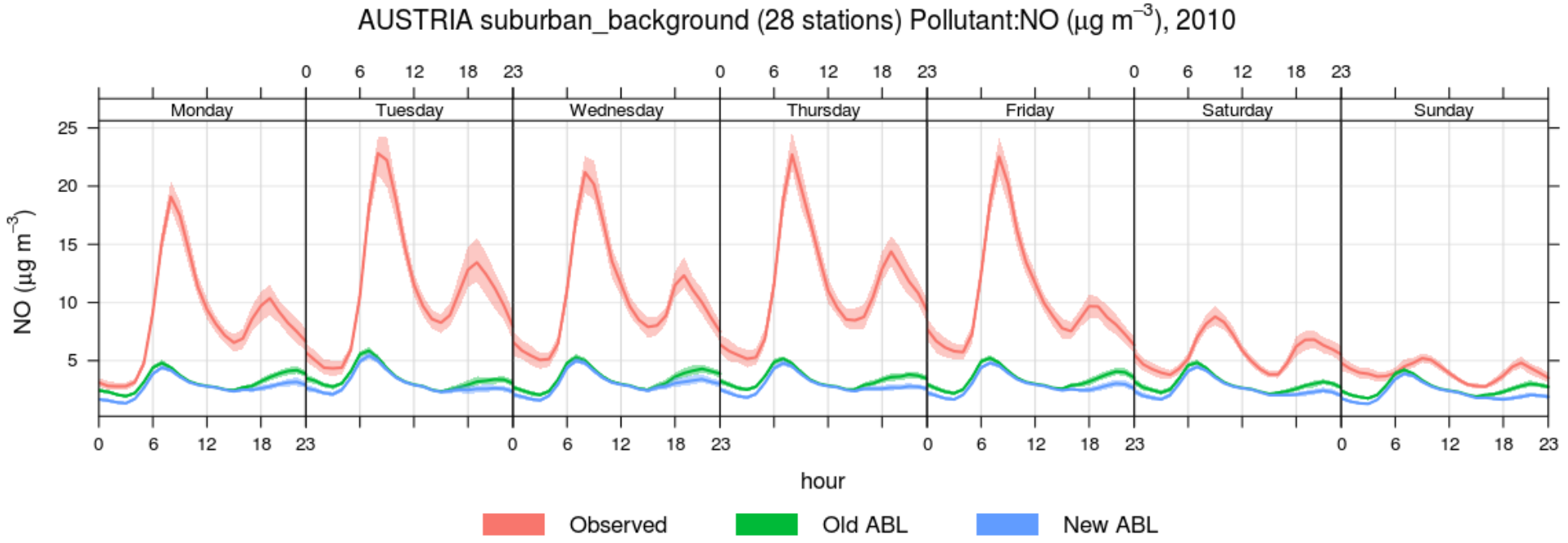
Does it improve the model?

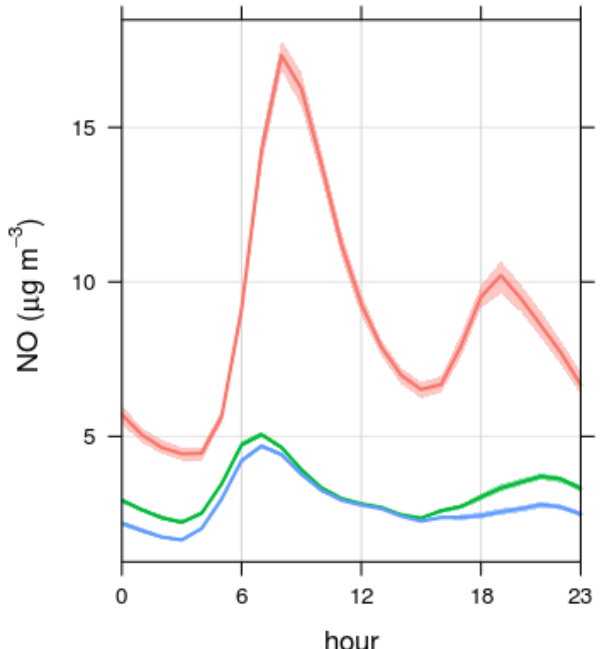
ABL evaluation

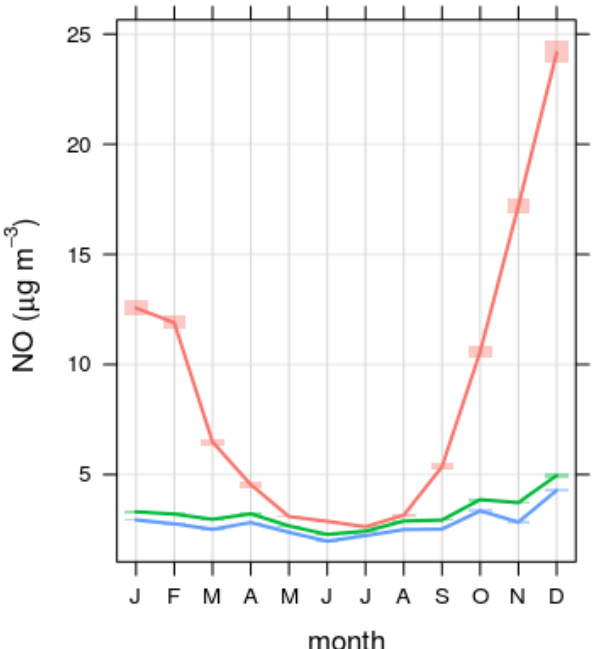
Example: NO from suburban background stations

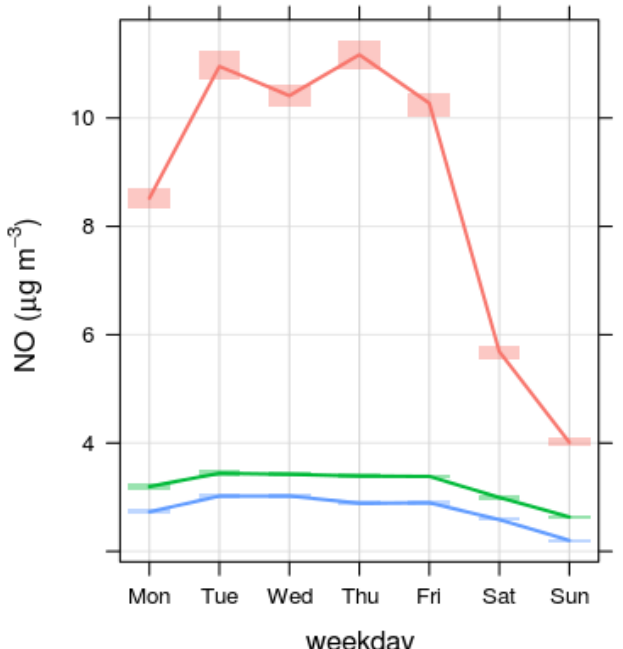
- Not directly affected by local sources
- Near-ground emissions

Austria

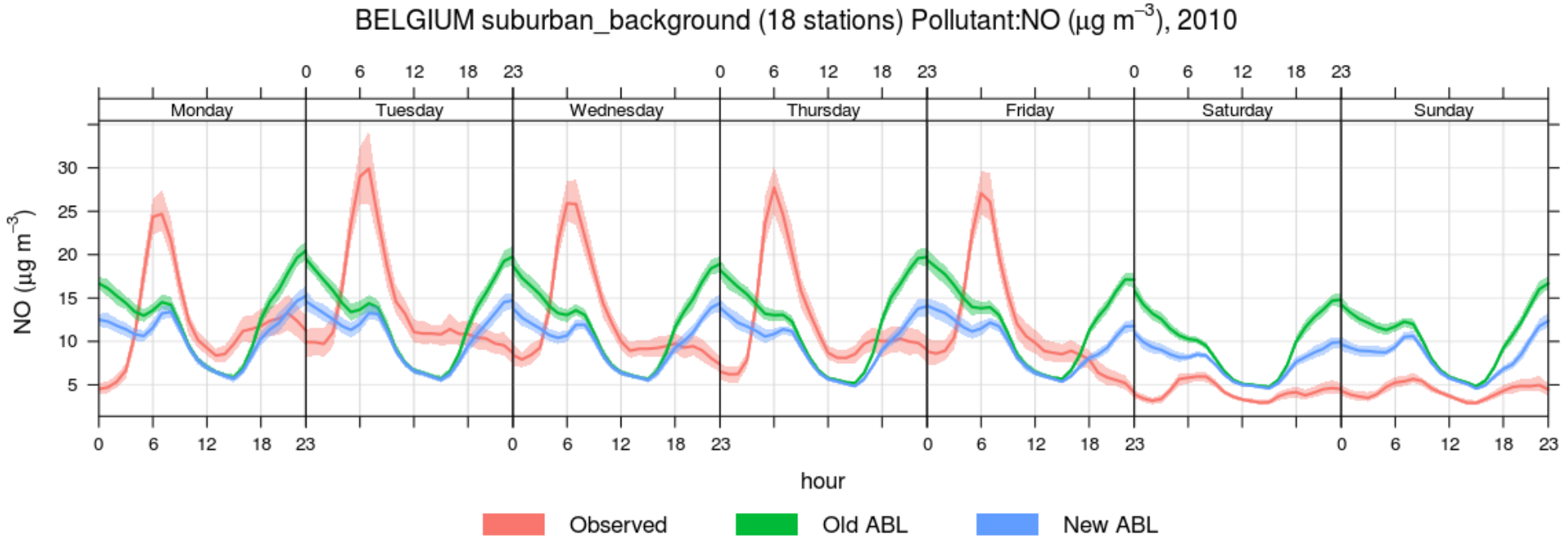

AUSTRIA suburban_background (28 stations) Pollutant:NO (µg m^{-3}), 2010
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
NO (µg m^{-3})
hour
Observed
Old ABL
New ABL

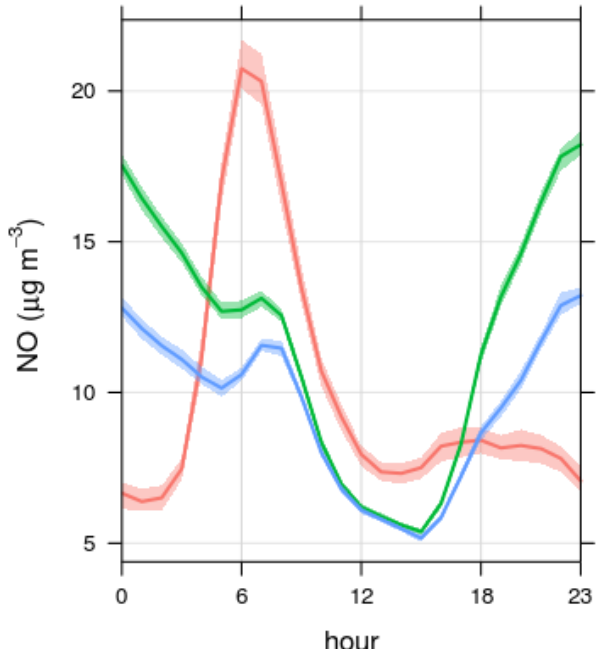

NO (µg m^{-3})
hour

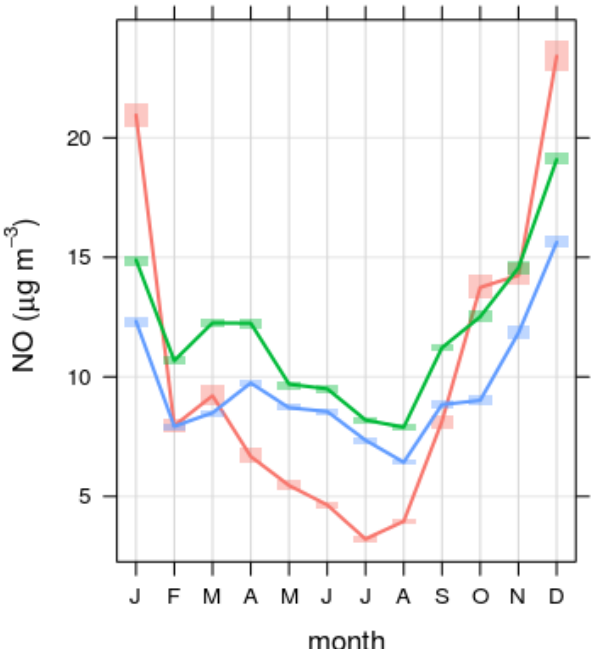

NO (µg m^{-3})
J F M A M J J A S O N D
month

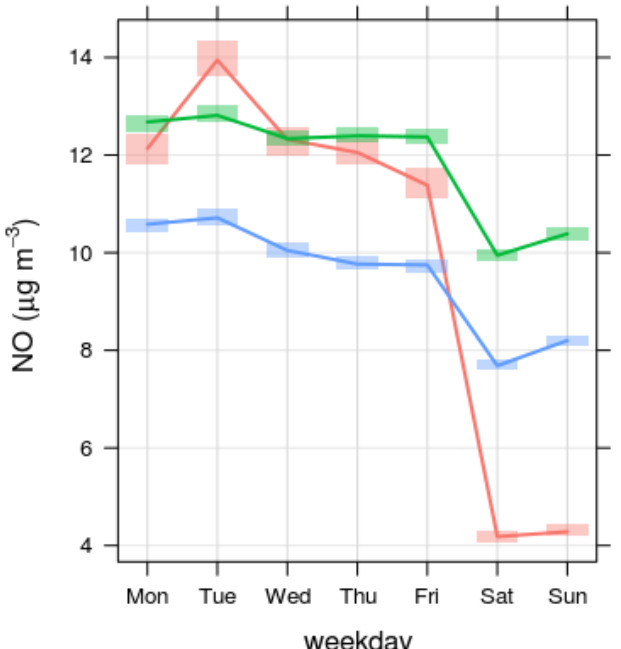

NO (µg m^{-3})
Mon Tue Wed Thu Fri Sat Sun
weekday

Belgium

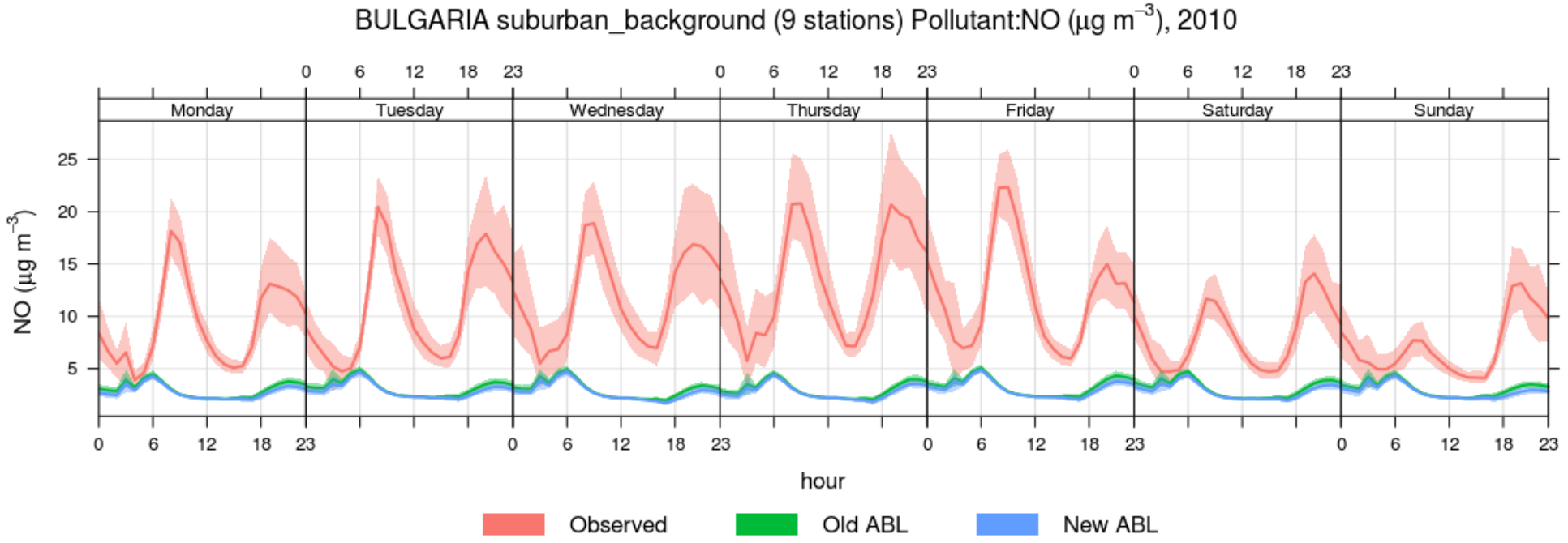

BELGIUM suburban_background (18 stations) Pollutant:NO (µg m^{-3}), 2010
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
NO (µg m^{-3})
hour
Observed
Old ABL
New ABL

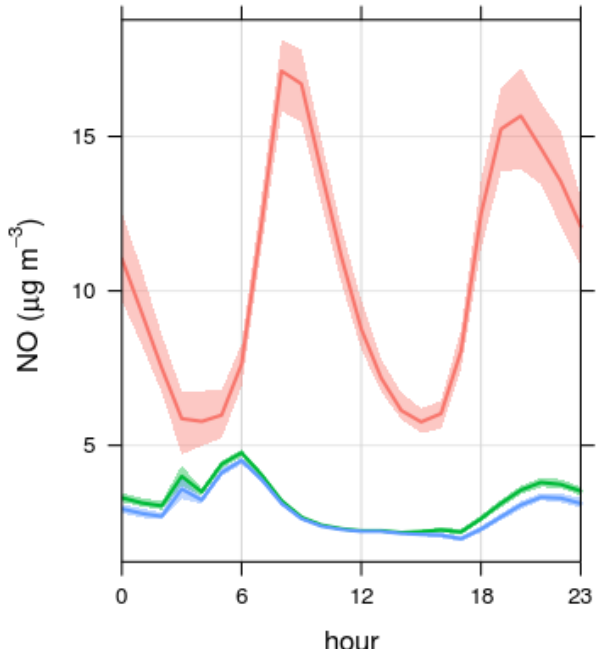

NO (µg m^{-3})
hour

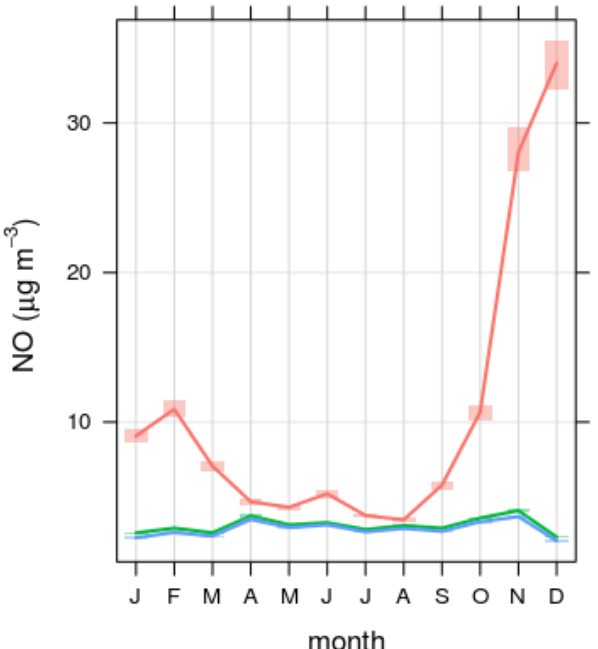

NO (µg m^{-3})
J F M A M J J A S O N D
month

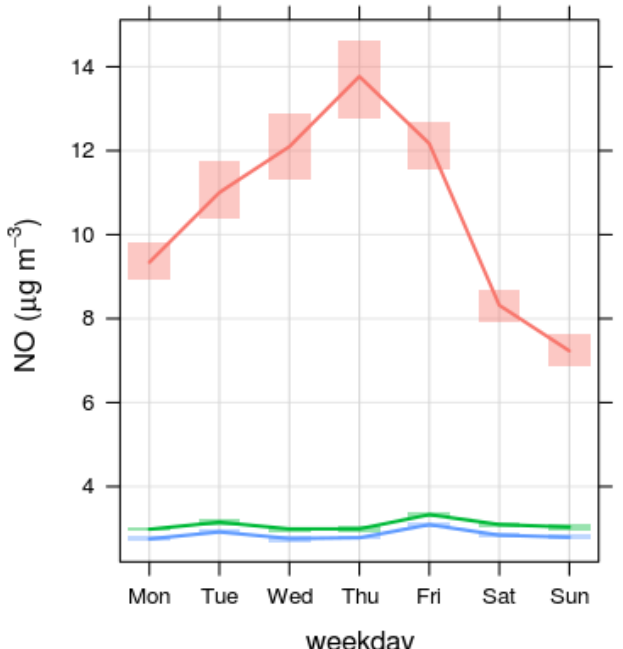

NO (µg m^{-3})
Mon Tue Wed Thu Fri Sat Sun
weekday

Bulgaria

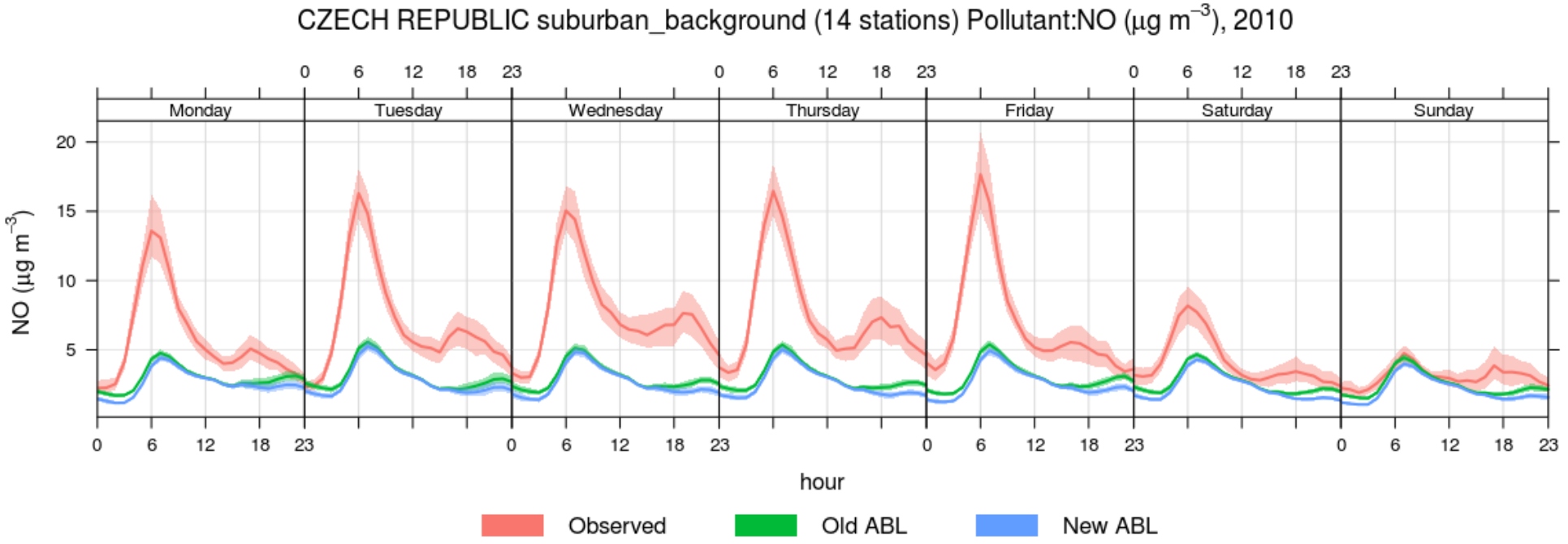

BULGARIA suburban_background (9 stations) Pollutant:NO (µg m^{-3}), 2010
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
NO (µg m^{-3})
hour
Observed
Old ABL
New ABL

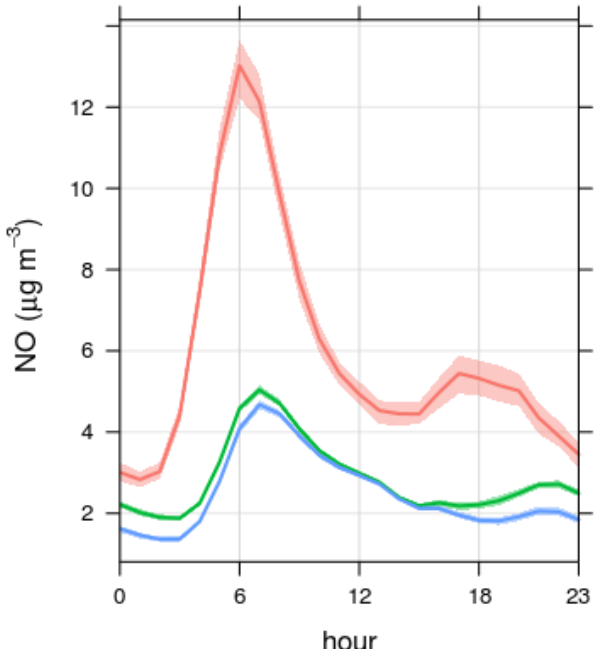

NO (µg m^{-3})
hour

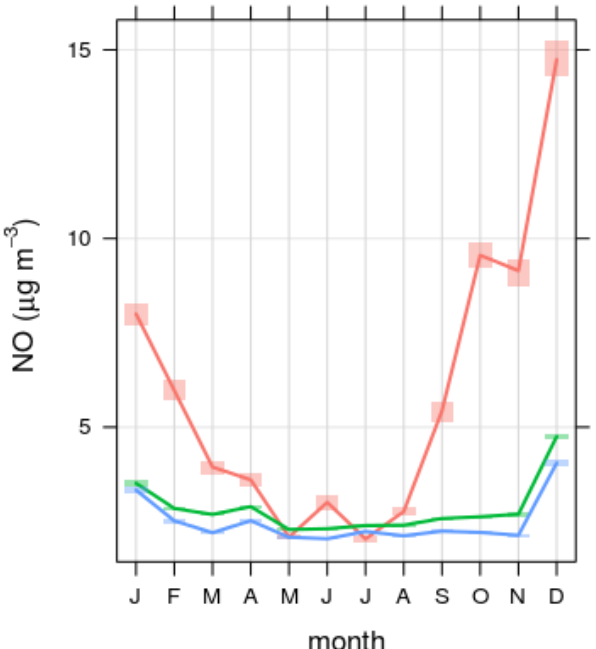

NO (µg m^{-3})
J F M A M J J A S O N D
month

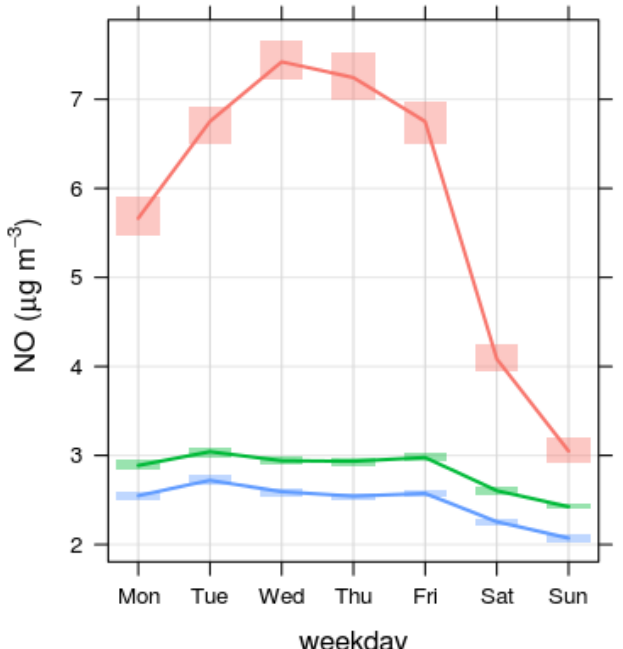

NO (µg m^{-3})
Mon Tue Wed Thu Fri Sat Sun
weekday

Cech Republic

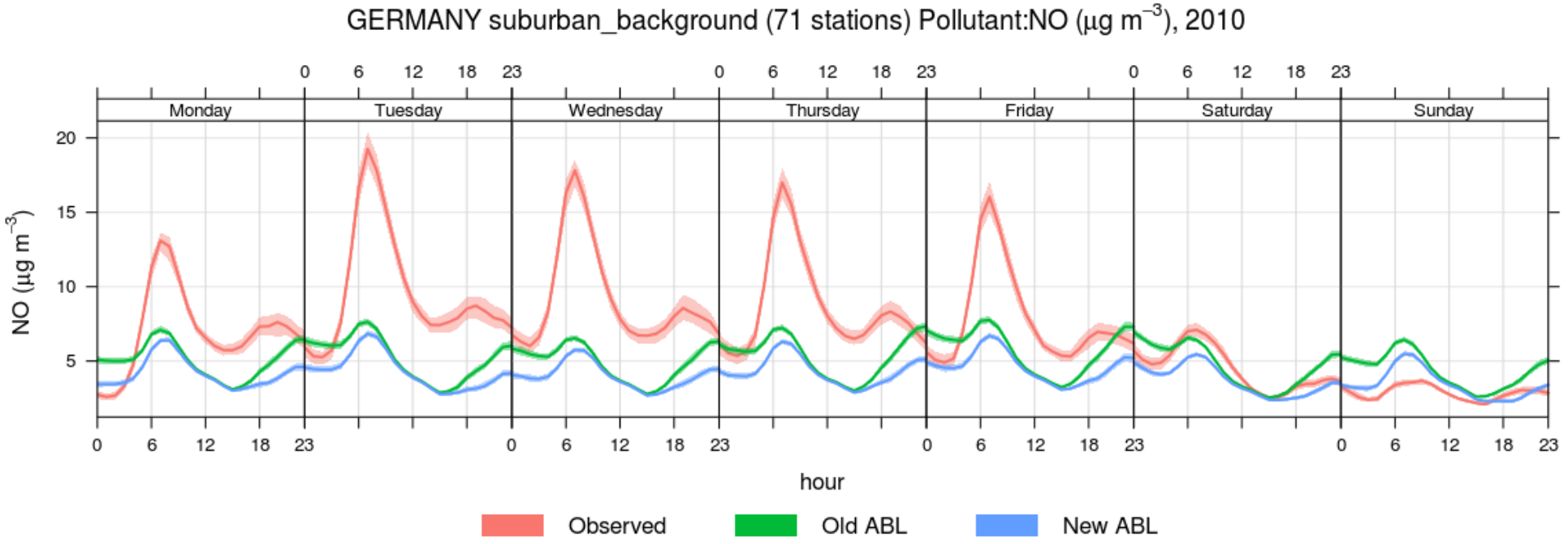


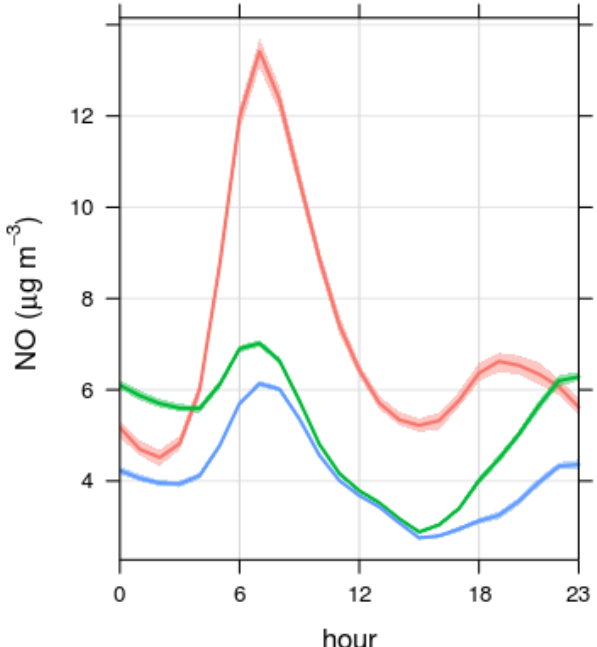


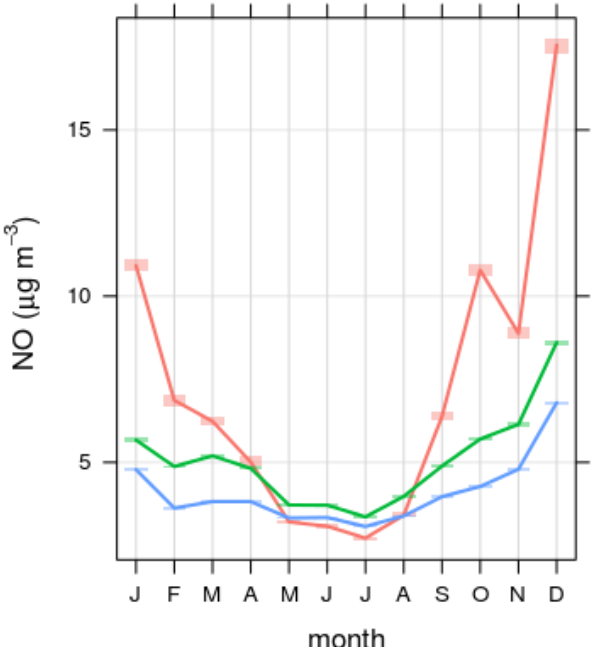


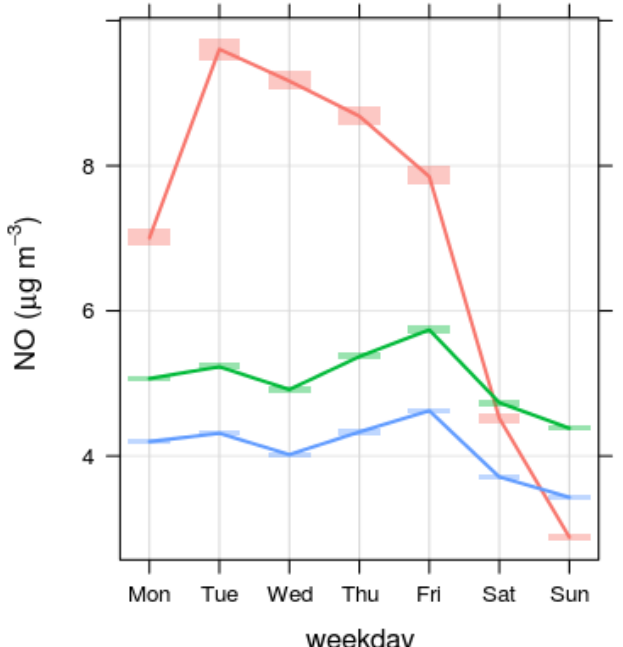


Germany

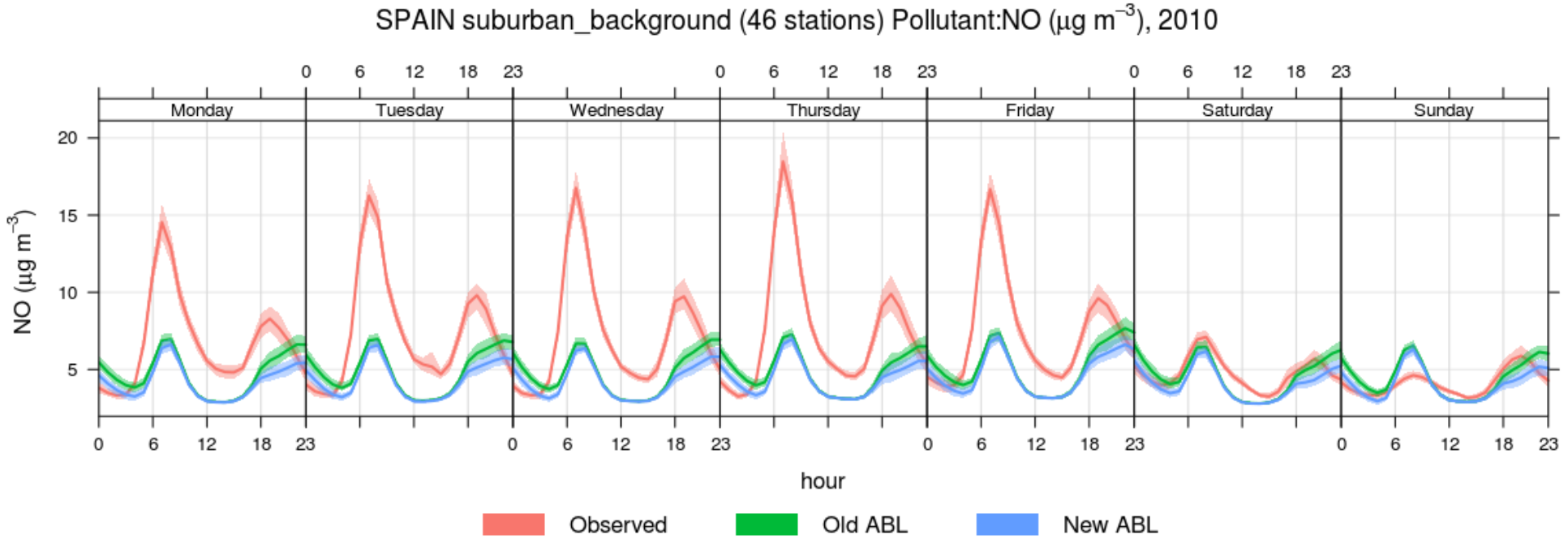

GERMANY suburban_background (71 stations) Pollutant:NO (µg m^{-3}), 2010
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
NO (µg m^{-3})
hour
Observed
Old ABL
New ABL

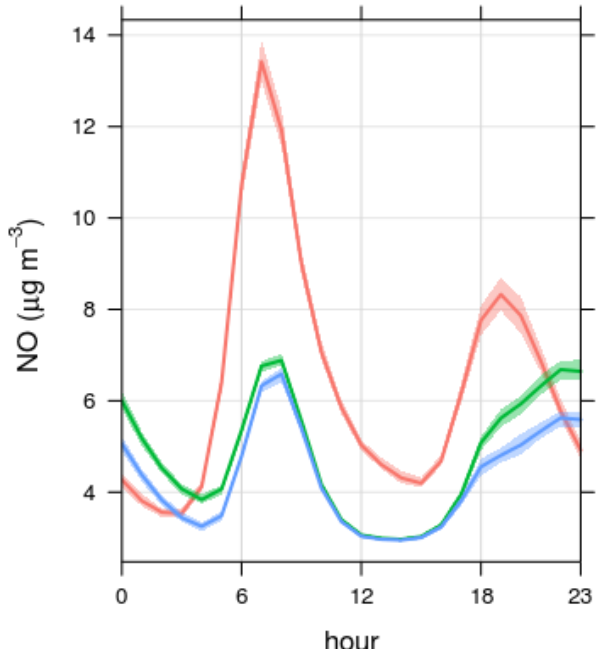

NO (µg m^{-3})
hour

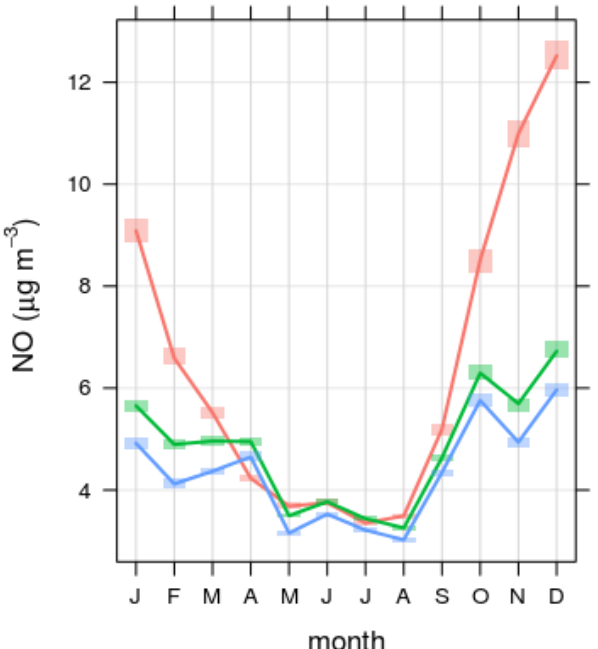

NO (µg m^{-3})
J F M A M J J A S O N D
month

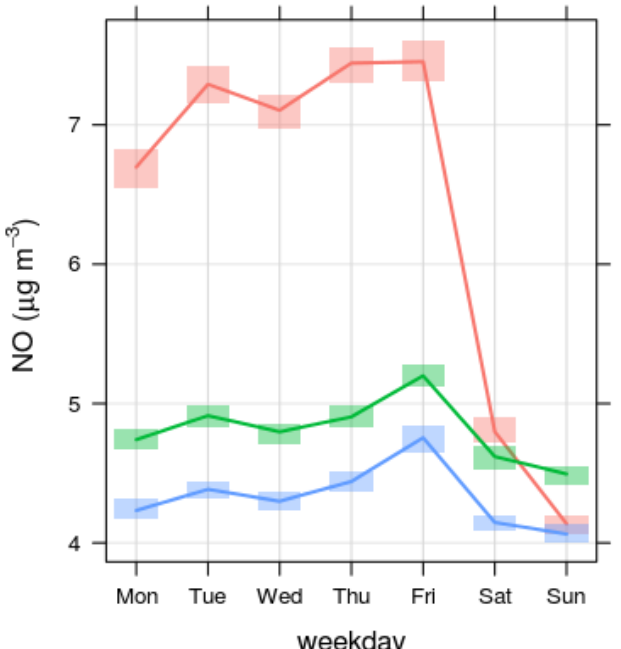

NO (µg m^{-3})
Mon Tue Wed Thu Fri Sat Sun
weekday

Spain

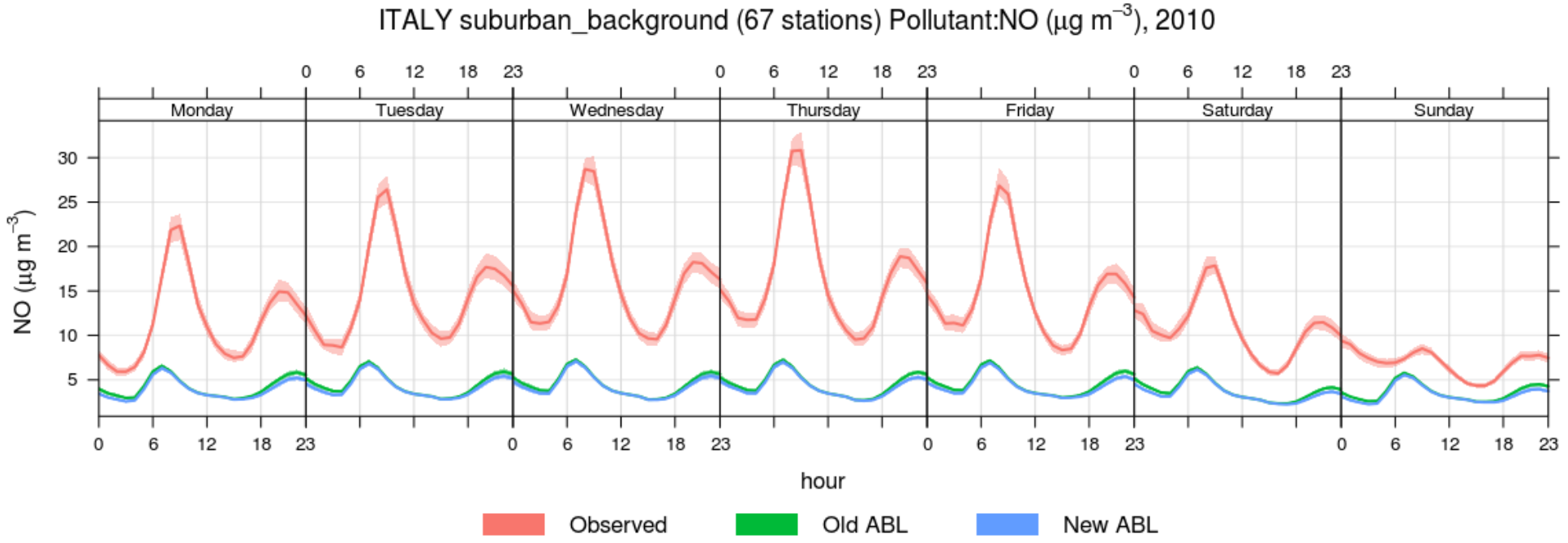

SPAIN suburban_background (46 stations) Pollutant:NO (µg m^{-3}), 2010
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
NO (µg m^{-3})
hour
Observed
Old ABL
New ABL

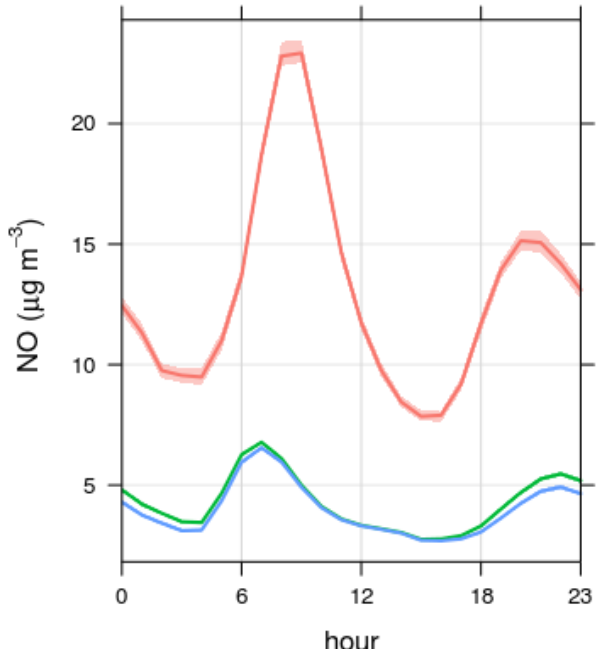

NO (µg m^{-3})
hour

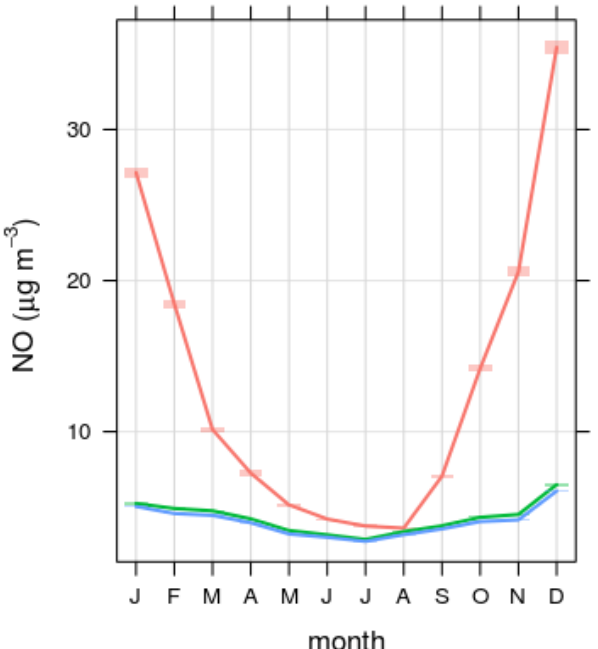

NO (µg m^{-3})
J F M A M J J A S O N D
month

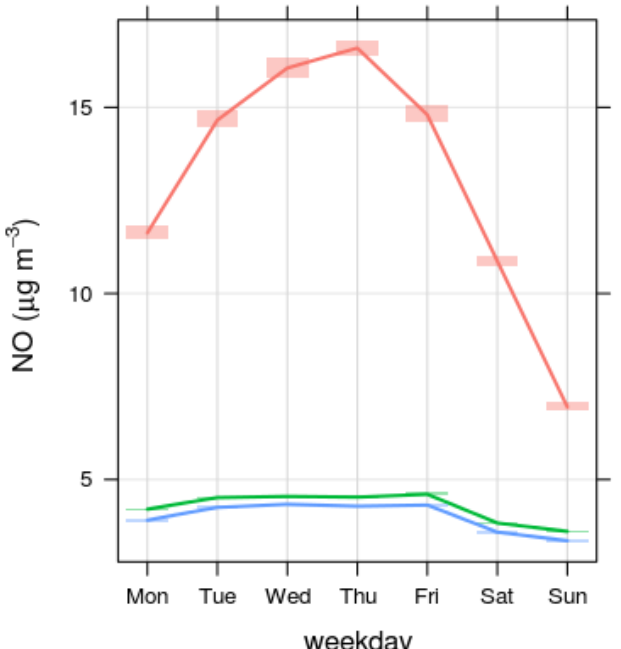

NO (µg m^{-3})
Mon Tue Wed Thu Fri Sat Sun
weekday

Italy

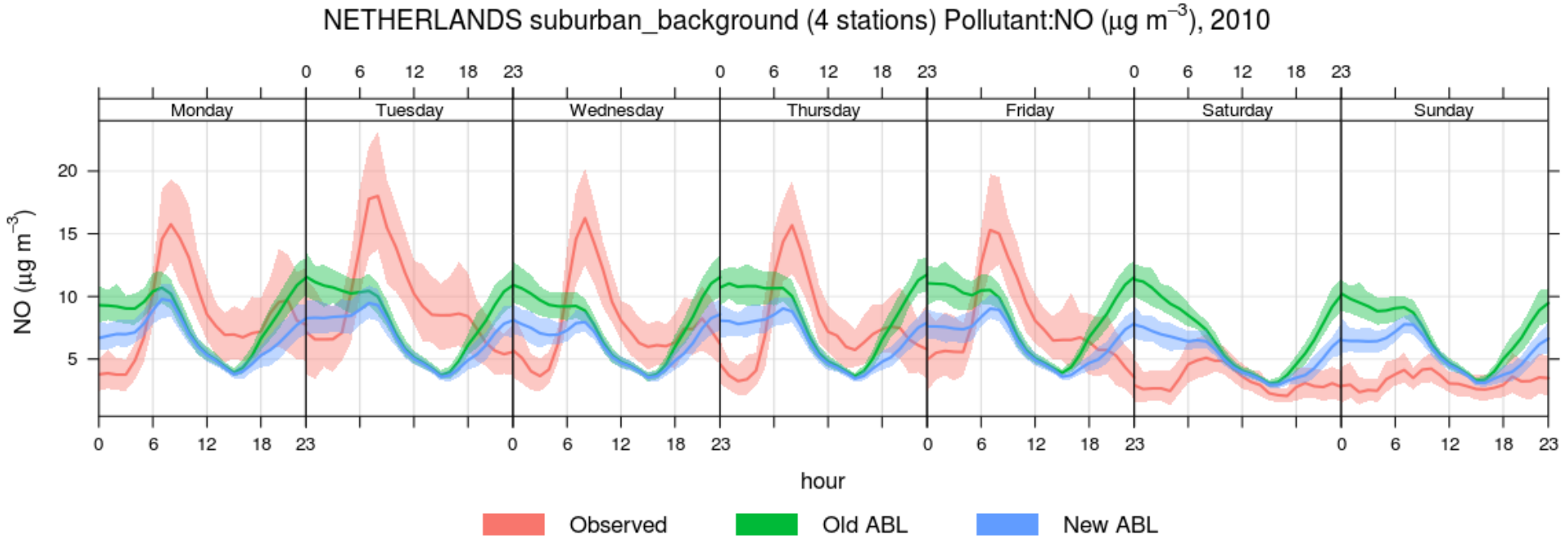

ITALY suburban_background (67 stations) Pollutant:NO (µg m^{-3}), 2010
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
NO (µg m^{-3})
hour
Observed
Old ABL
New ABL

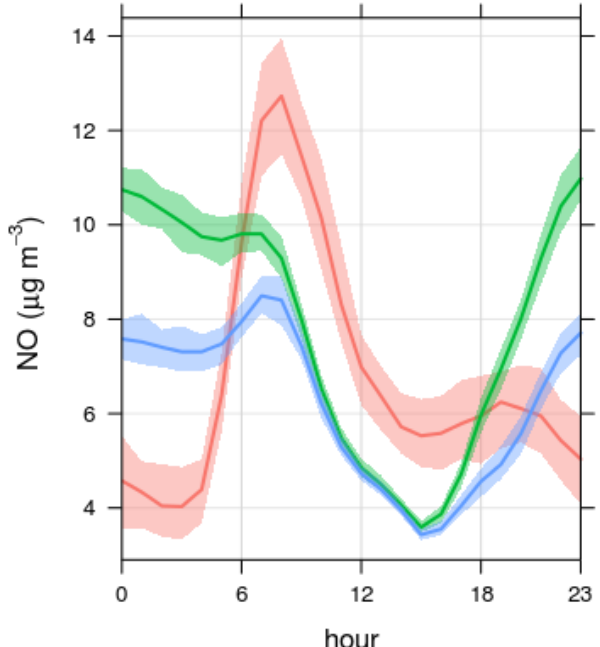

NO (µg m^{-3})
hour

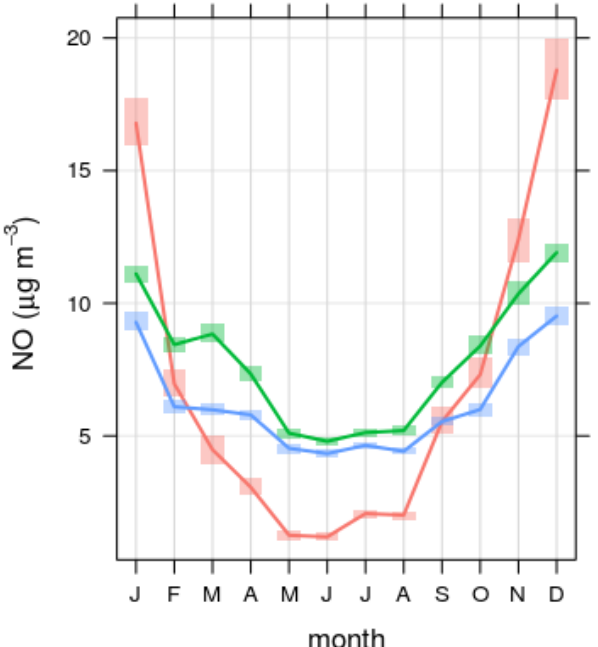

NO (µg m^{-3})
J F M A M J J A S O N D
month

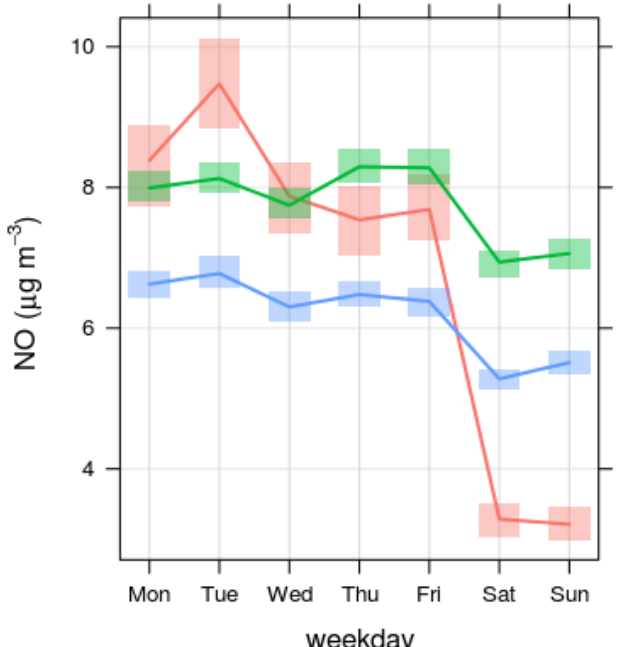

NO (µg m^{-3})
Mon Tue Wed Thu Fri Sat Sun
weekday

Netherlands

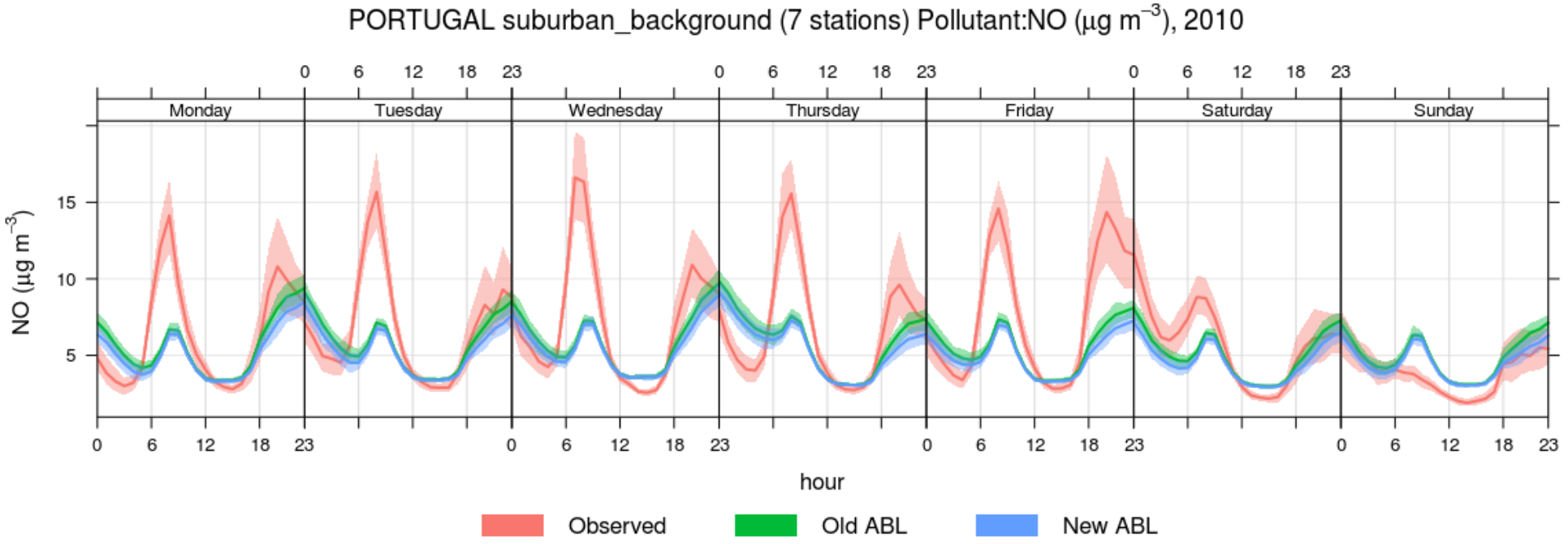


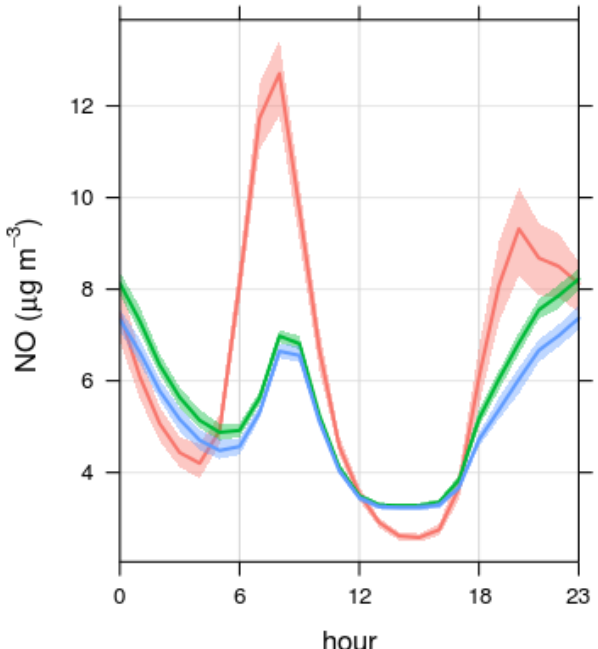


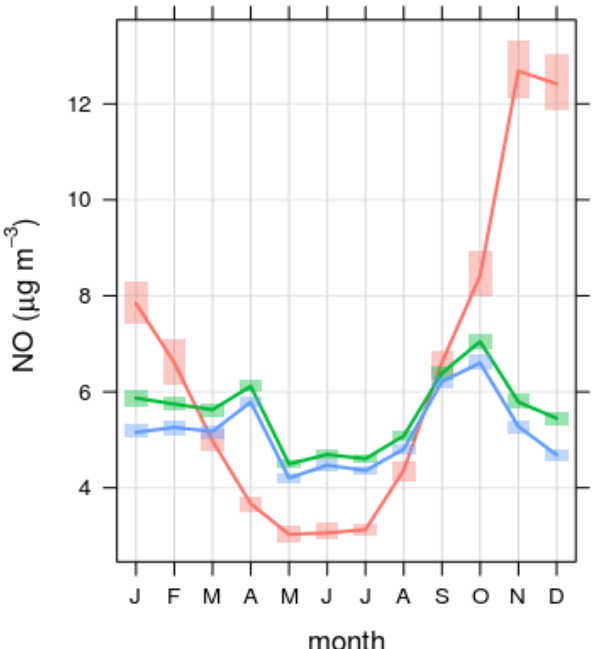


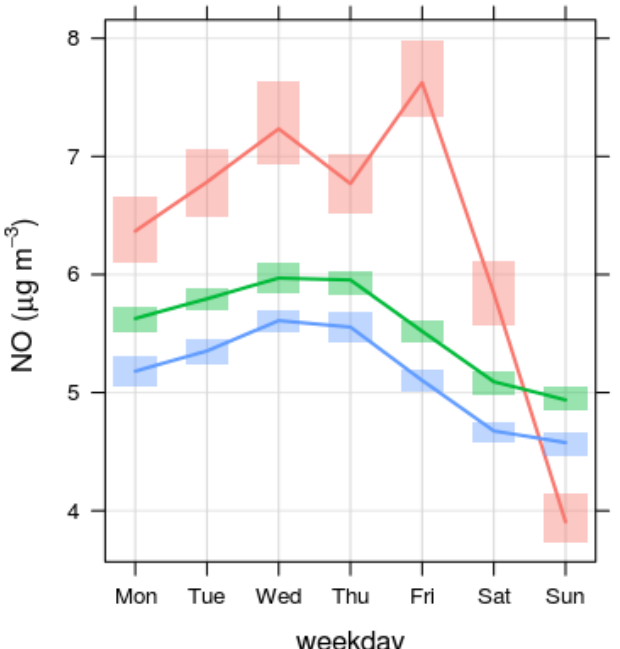


Portugal


PORTUGAL suburban_background (7 stations) Pollutant:NO (µg m^{-3}), 2010
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
NO (µg m^{-3})
hour
Observed
Old ABL
New ABL


NO (µg m^{-3})
hour


NO (µg m^{-3})
J F M A M J J A S O N D
month


NO (µg m^{-3})
Mon Tue Wed Thu Fri Sat Sun
weekday

ABL exercise summary

ABL exercise:

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

Final remarks

Issues with comparisons

- Observed quantities differ from modelled
- Credibility of observations
- Supplementary information
- Amount of data
  e.g. 10^5 hours/year x 10^3 stations
- Way of comparison and metrics
- Attribution of discrepancies