Use of surface concentrations and absorption measurements for evaluation of modelled BC

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Major scientific foci of the study

Linking AEROCOM/ FP6 EUCAARI/ FP6 EUSAAR/ AERONET model and observations to explore the link from BC emissions to forcing over Europe:

- General Circulation Models (GCM):

  MPI-HAM- Max Planck Institute – Hamburg, DE

  CAM4-Oslo - University of Oslo, NO

  HadGEM2 - Hadley Center, UK

  and others

Major scientific foci of the study

- Harmonisation of measurements-models interface

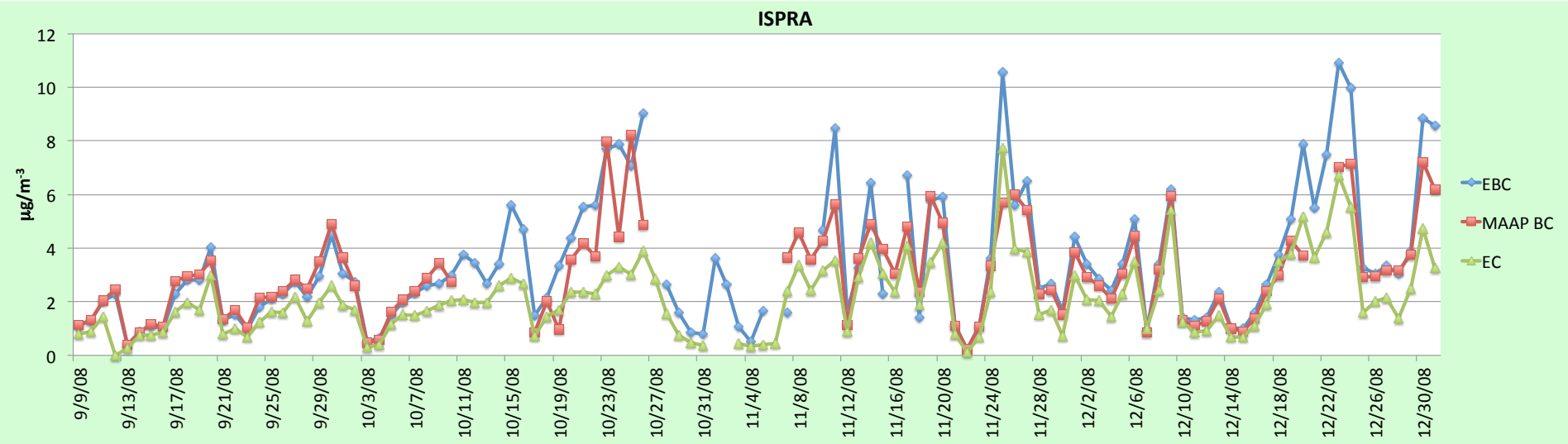
- high quality measurements of surface concentrations and absorption in Europe 2008-2009-2010:
  - Not only evaluation of concentrations and absorption, but also testing the modelled relation between them using the measurements

Use of observations for model evaluation

- Black carbon: light absorbing portion of carbonaceous particles ….. but …..
- emission inventories used in models are of elemental carbon (EC) (Vignati et al, ACP, 2010)

  ➢ concentrations must be compared to EC measurements

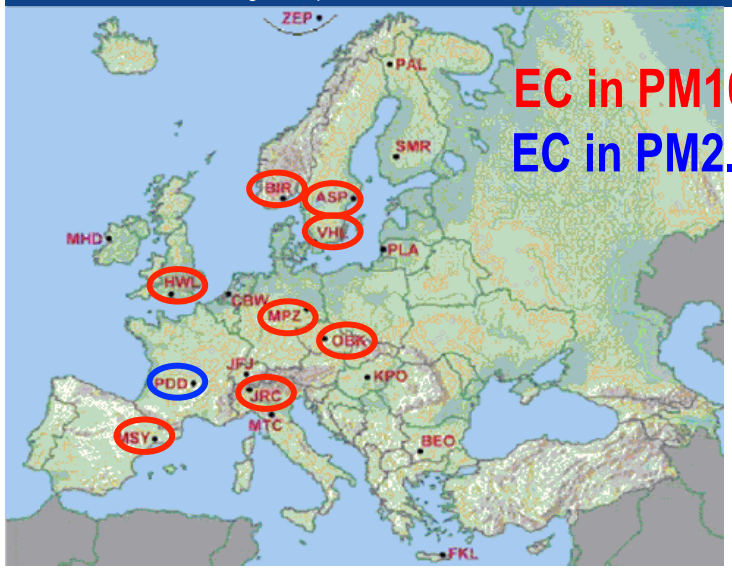
EC – BC – EBC ?????



EBC – Aethalometer

EBC/EC and MAAP/EC from 0.8 – 2.5

Observed surface EC concentrations

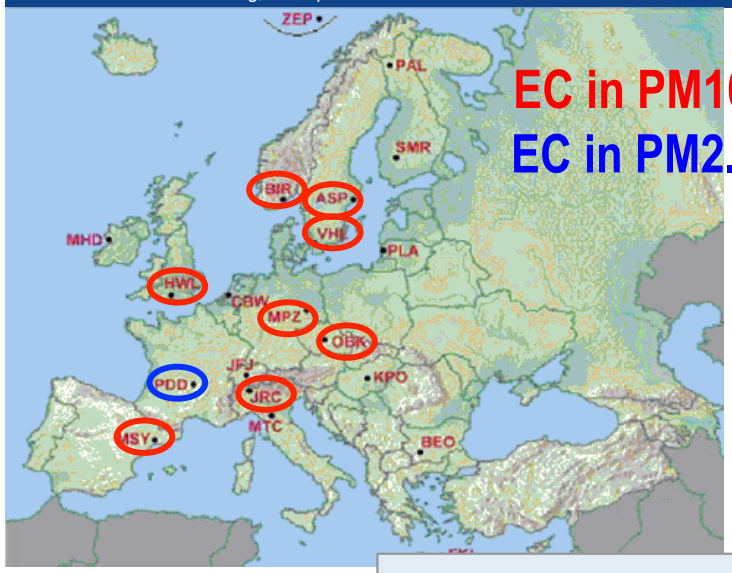


EC in PM10

EC in PM2.5

EUSAAR measurements

Observed surface EC concentrations

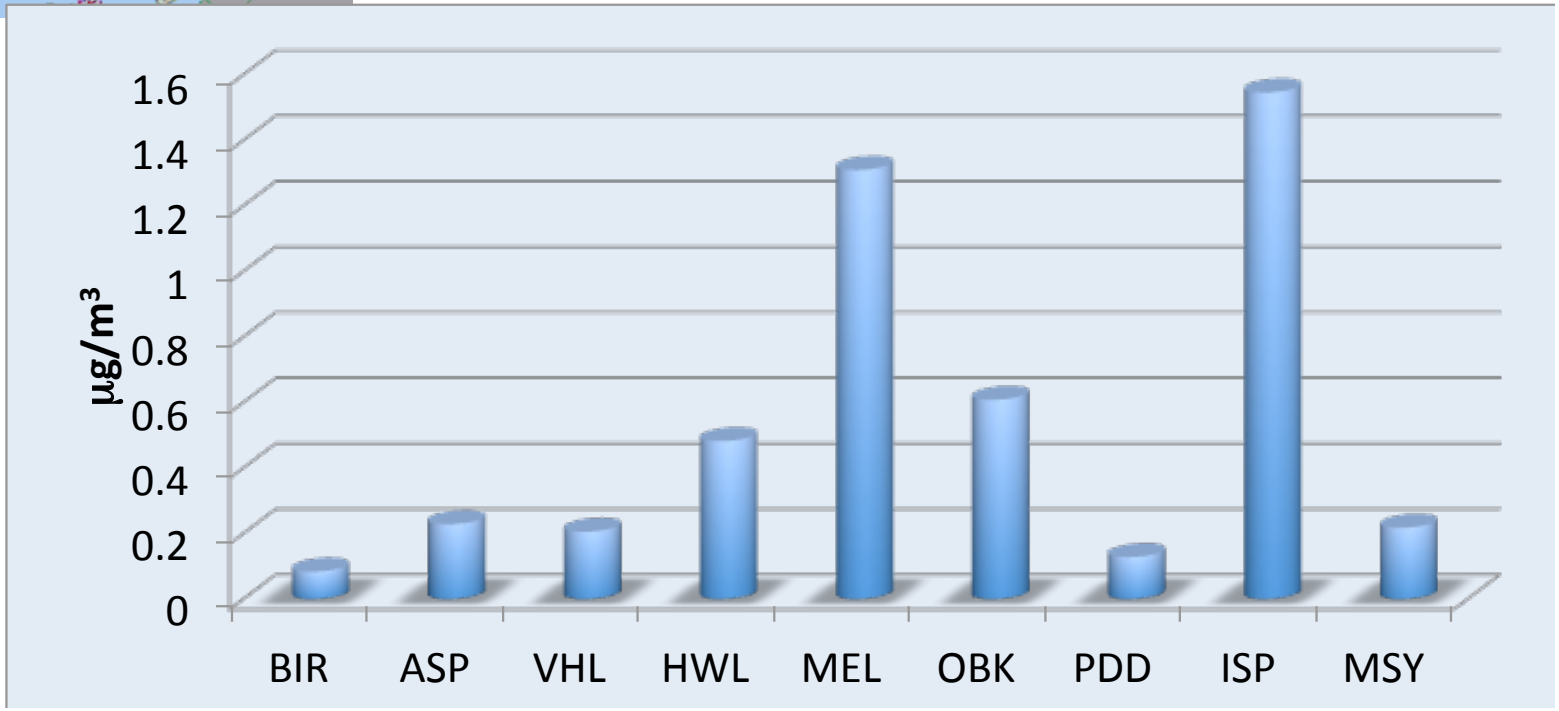


EC in PM10

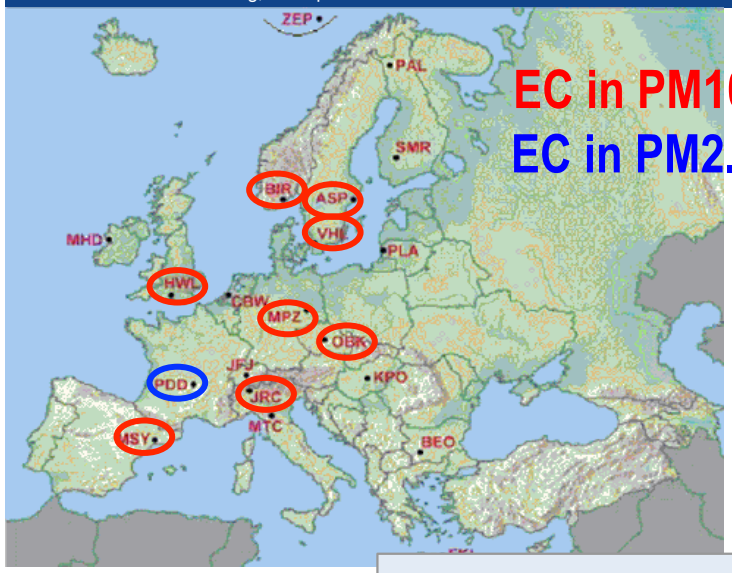
EC in PM2.5

EUSAAR measurements

2008 annual average



Observed surface EC concentrations



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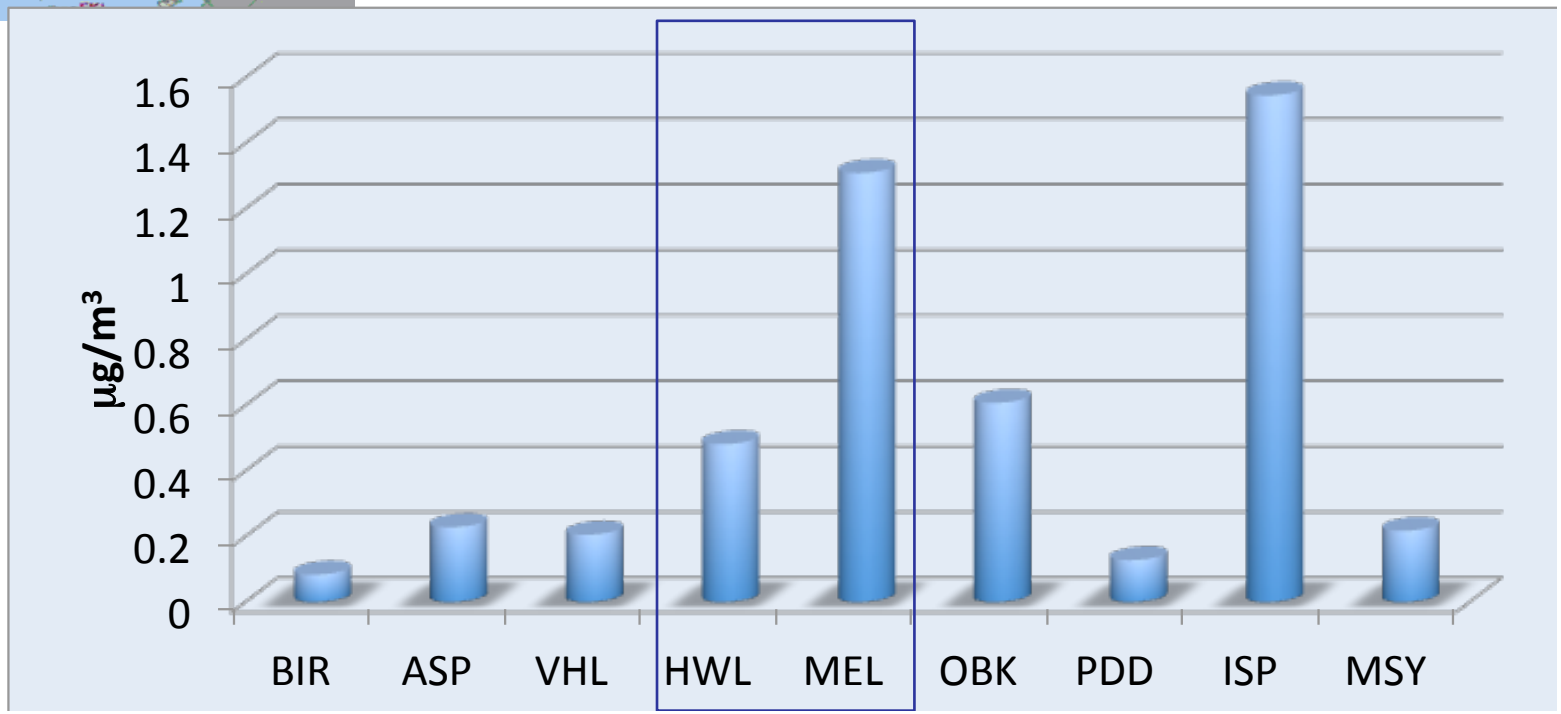
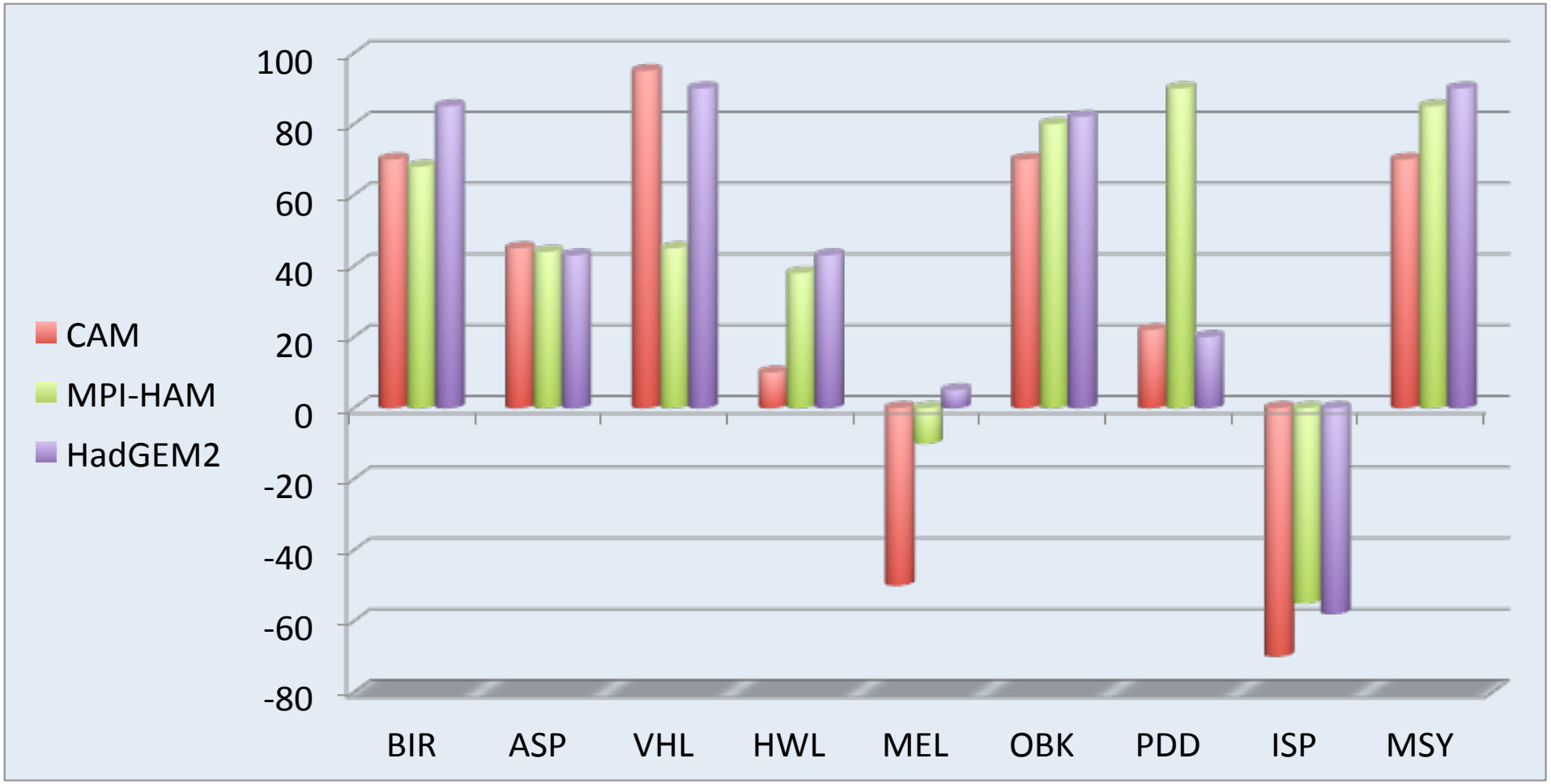
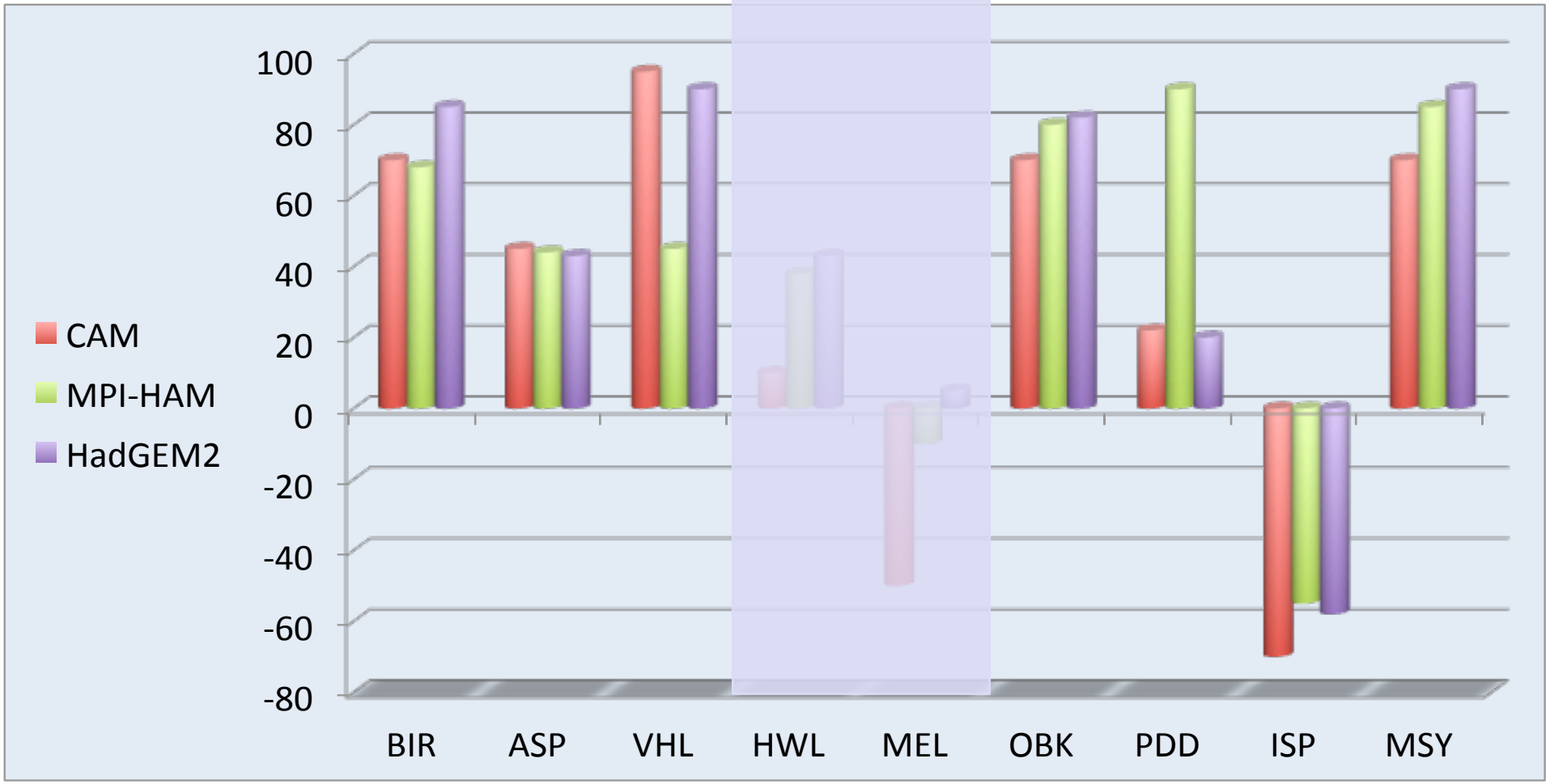


Normalised model bias



Normalised model bias



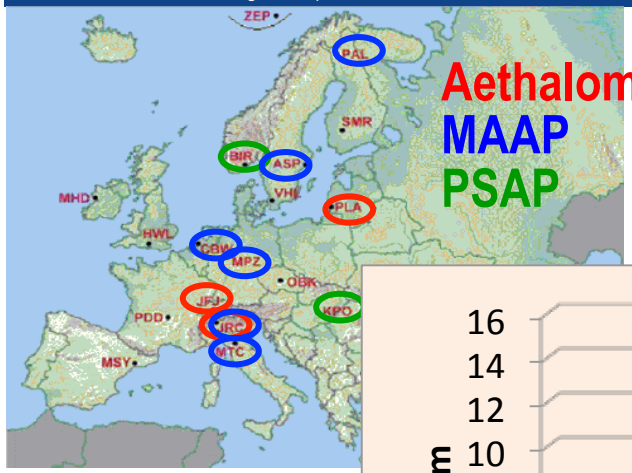
Use of observations for model evaluation

- Black carbon: light absorbing portion of carbonaceous particles ….. but …..
- emission inventories used in models are of elemental carbon (EC) (Vignati et al, ACP, 2010)

  ➢ concentrations must be compared to EC measurements

- modelled surface absorption coefficient (output at 550 nm) should be compared to observations at close wavelength

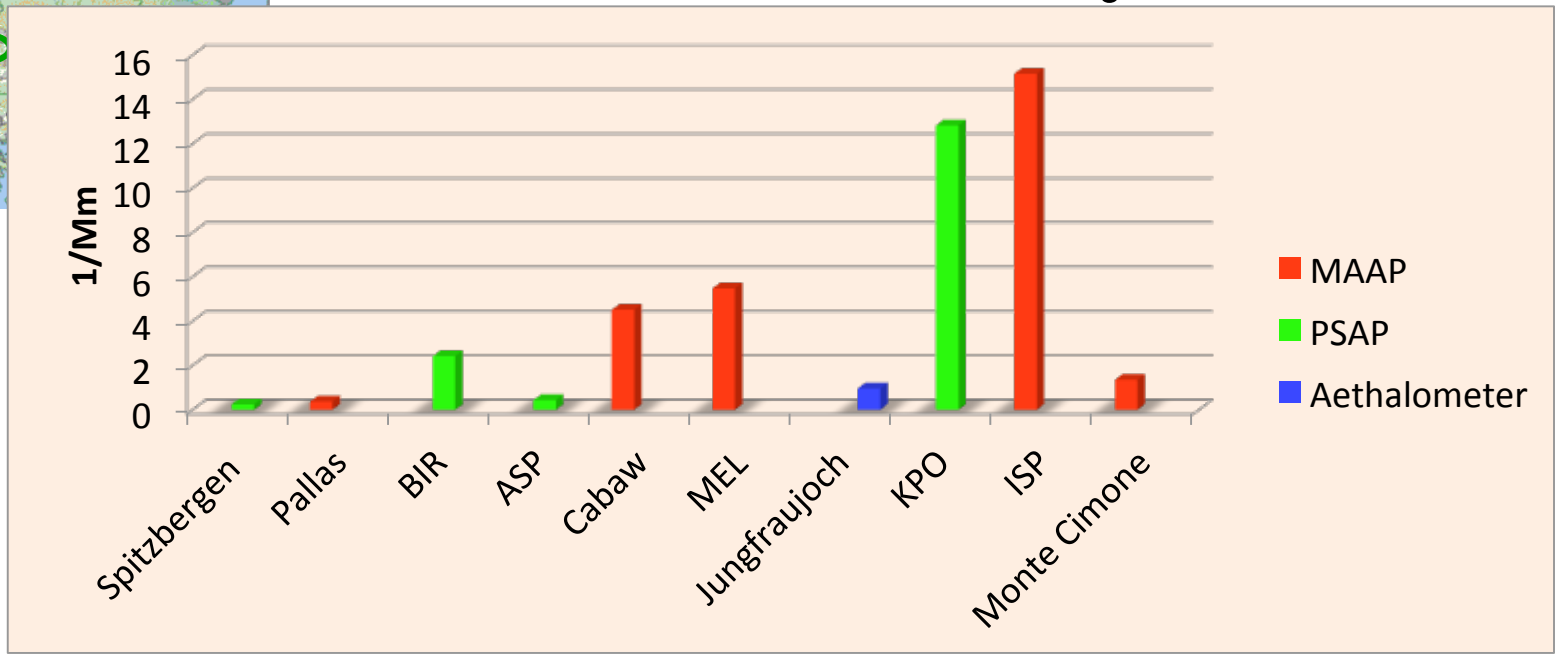
Evaluating surface absorption



Aethalometer
MAAP
PSAP

EUSAAR measurements on EBAS dataset (NILU)

2008 annual average



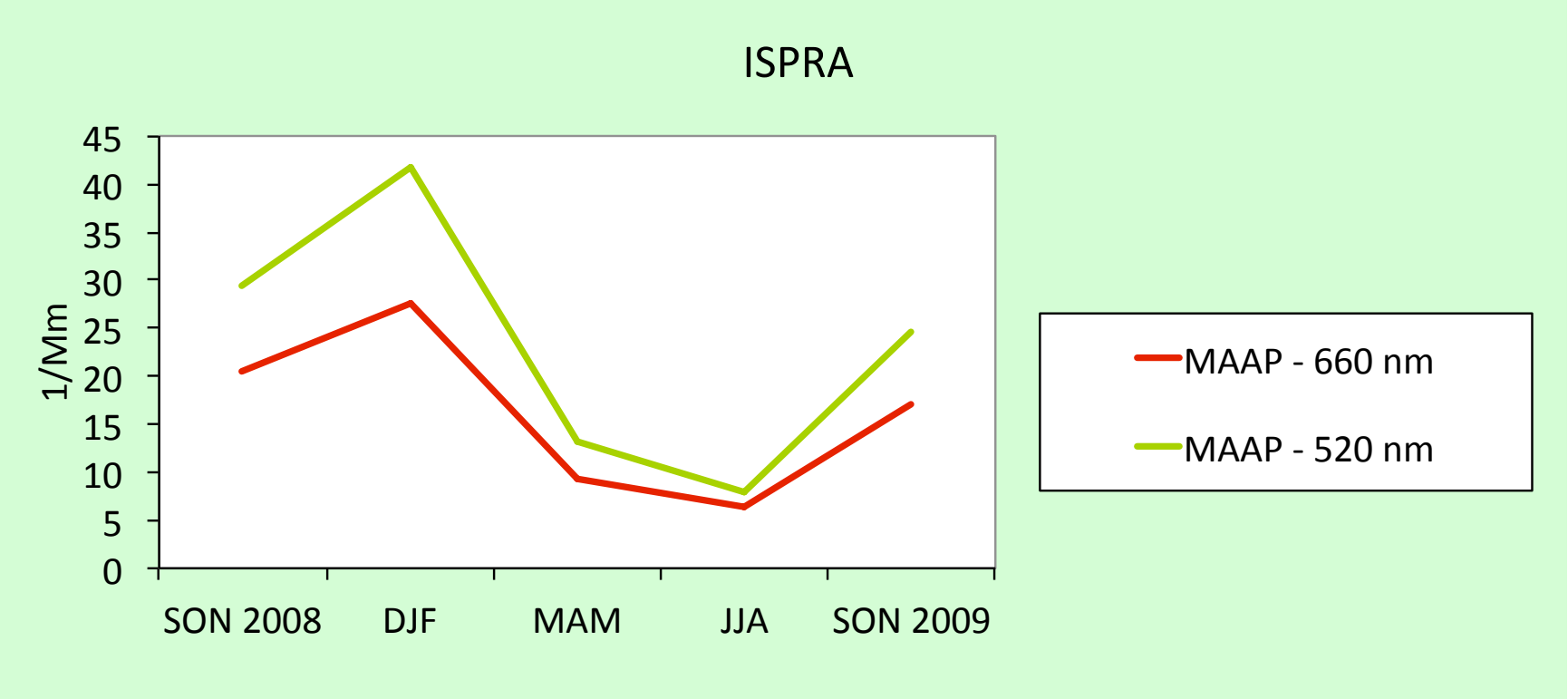
MAAP – 660 nm

PSAP – 520-530 nm

Aeth – not corrected

Modelled absorption output at 550 nm

Absorption at different wavelengths



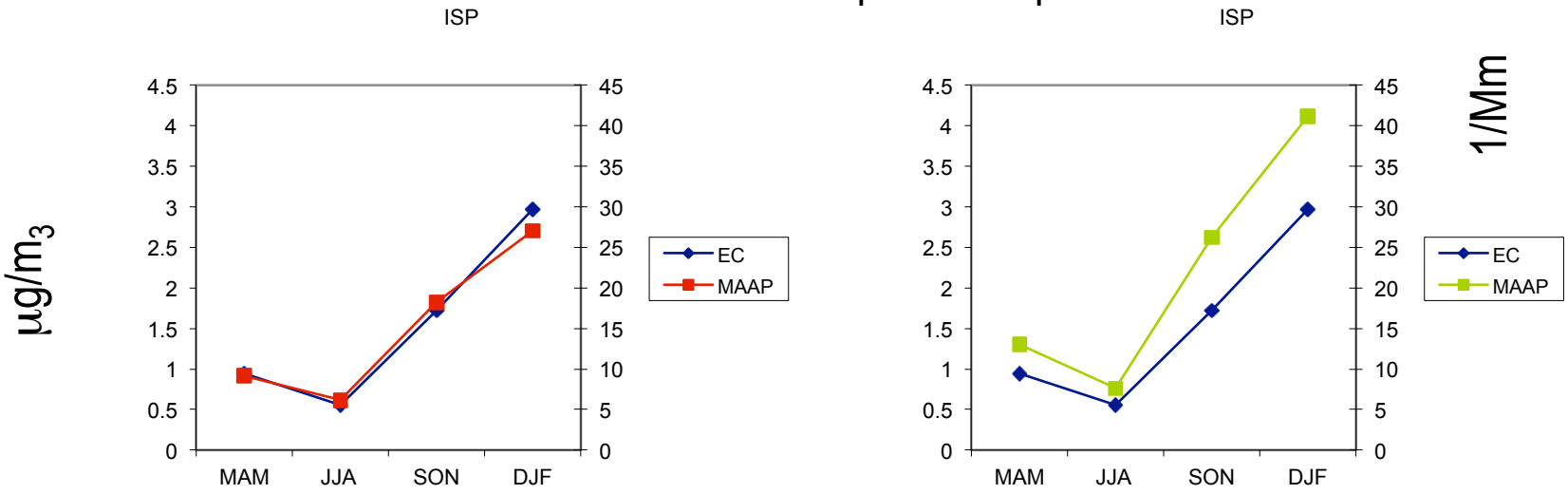
$$\sigma(520)/\sigma(660) = 1.2 - 1.5$$

Possible correction with the aethalometer

Depending on the “colouring” particles: brown carbon, dust,…

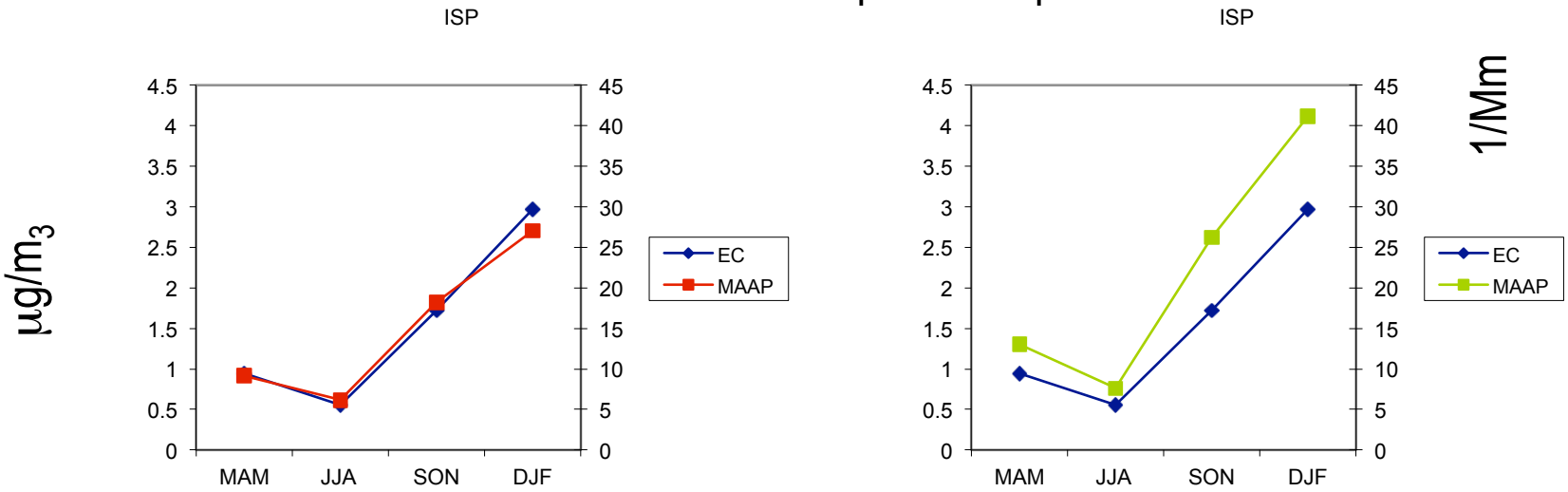
Absorption/EC ratio

Measured EC and absorption in Ispra

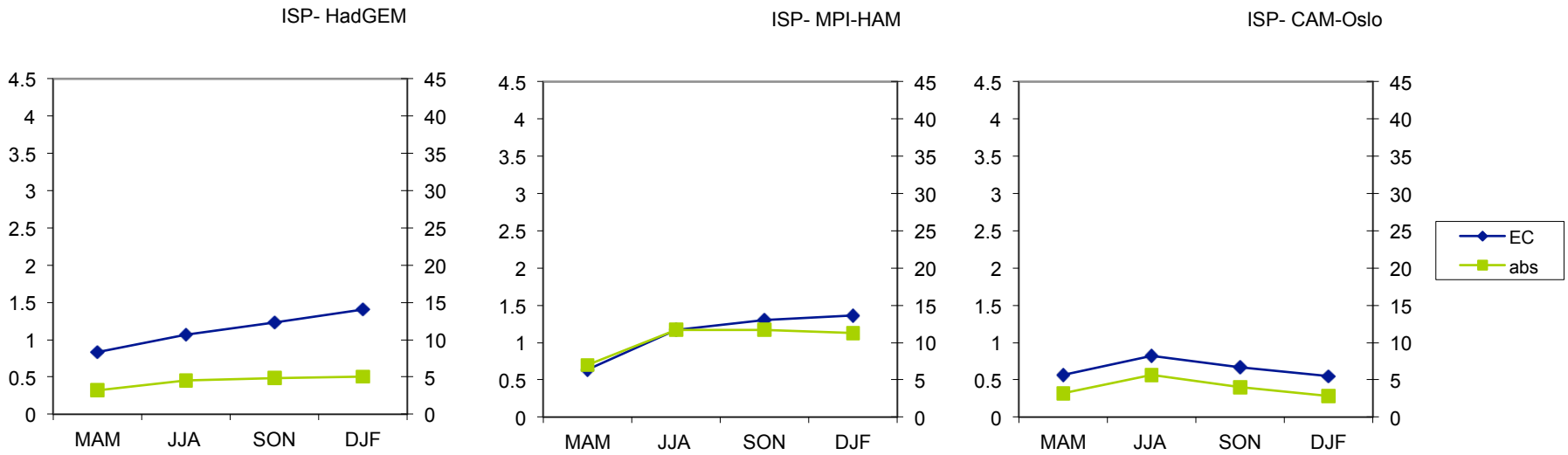


Absorption/EC ratio

Measured EC and absorption in Ispra



Modelled EC and absorption in Ispra



Resolved issues

- How do we have a coherent absorption dataset?
  - Aethalometer corrections coherently done for all stations
  - MAAP corrections for 550 nm using a broad range of the Angstrom exponent

Beyond Europe

- Is there the possibility to have quality controlled data to further evaluate the models (absorption/EC)?