

RECEPTOR MODELS: ADDING ANOTHER TOOL TO THE TOOLBOX

Towards an update of SA guide

CT1 - Source apportionment

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MOTIVATION

European Guide for Source Apportionment: Fit for Purpose

Some comments during revision:

“Receptor models output are discusses without any introduction or explanation”

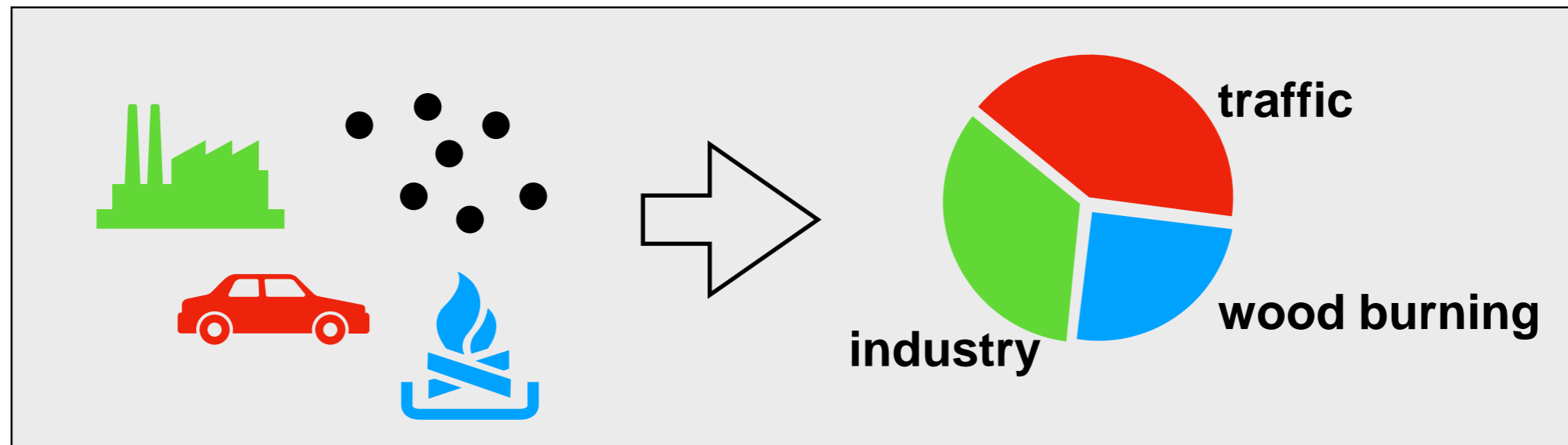
“[Receptor contributions do not differentiate between background and local] is only partially true, because it depends on the input to the models, i.e. the measured species and the timeframe”

“... in source-receptor modelling, these secondary species will be apportioned ...So a comment should rather be added here about interpreting the apportionment of secondary species”

Need to update the guide with more details on receptor models, advantages, and constraints/assumptions.

RECEPTOR MODELS

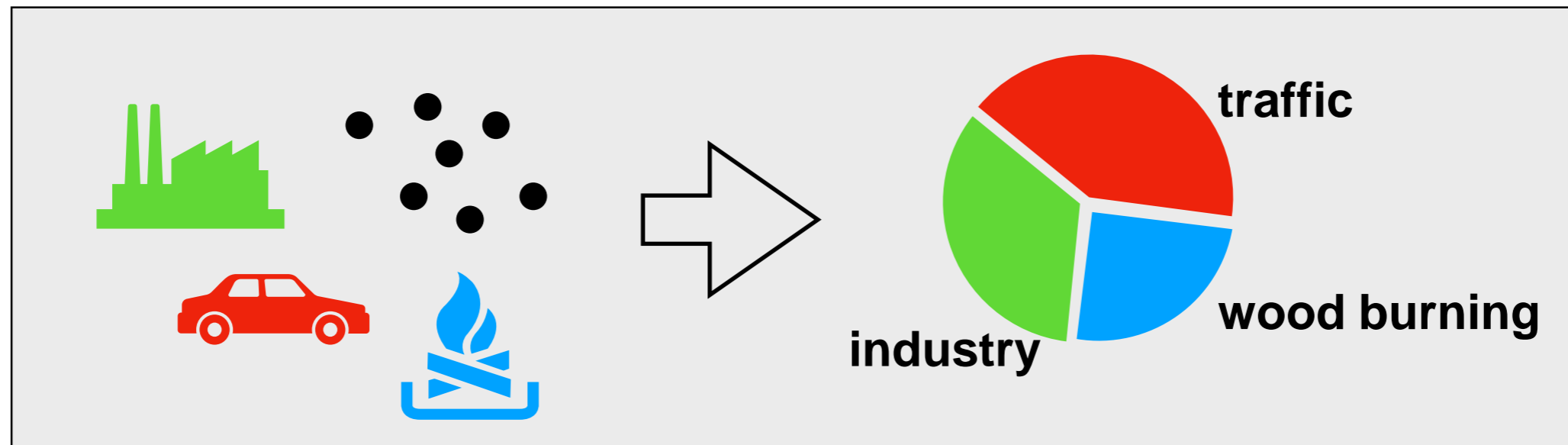
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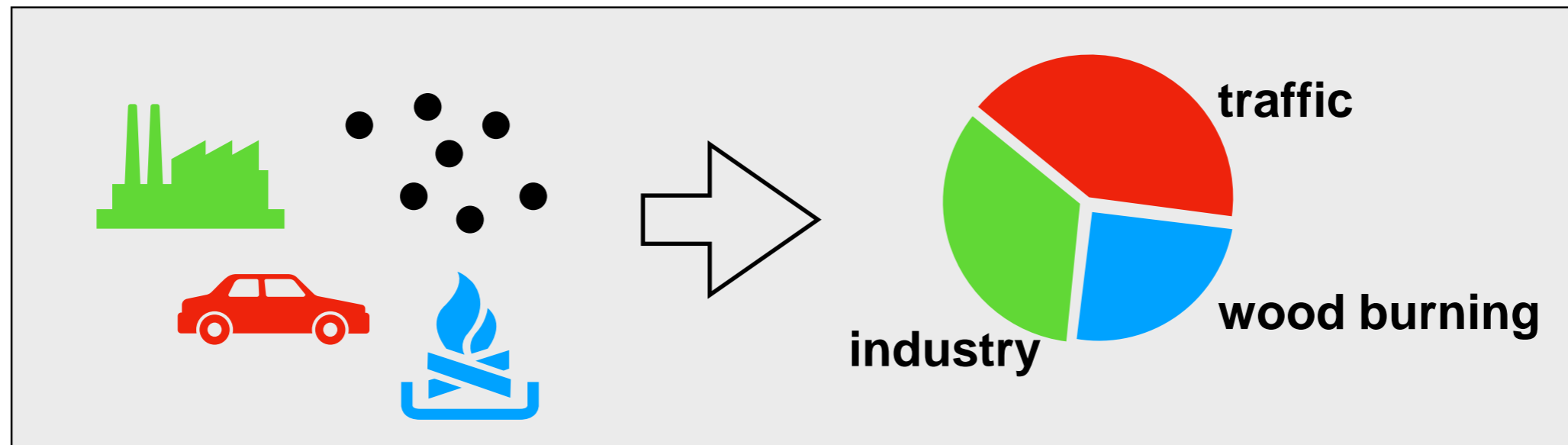
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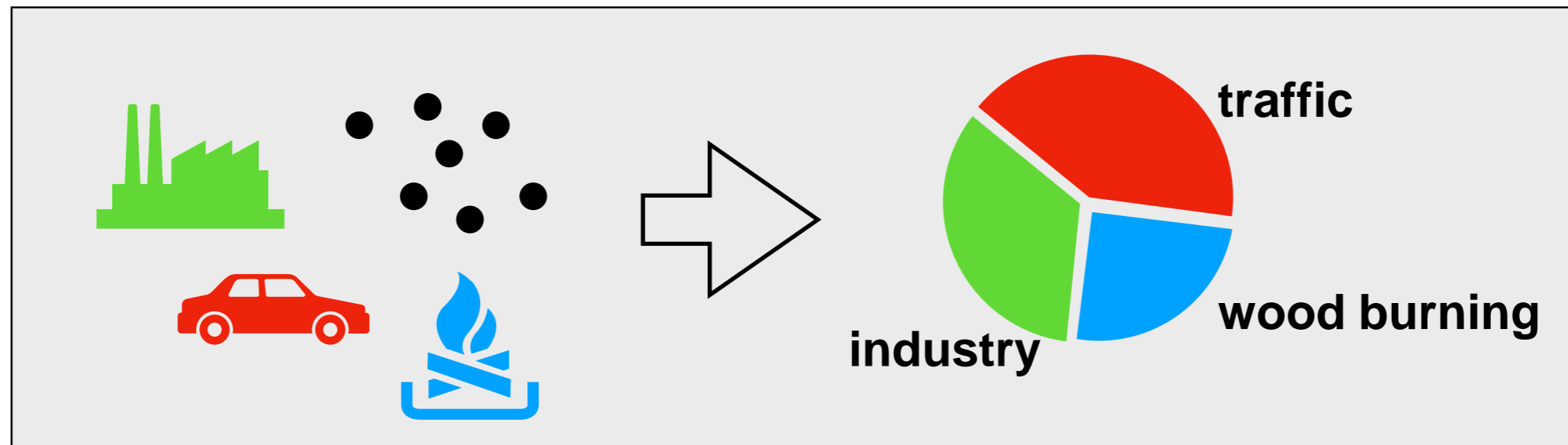
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1. Receptor models are multivariate **statistical tools**.
2. Receptor models identifies a mathematical solution, which **strongly depends on the characteristics of the database** we are investigating. They might not describe exhaustively the reality.
3. **Receptor model** identifies mathematical factors and the **user** interprets each factor as a possible source (“the two-character play”).

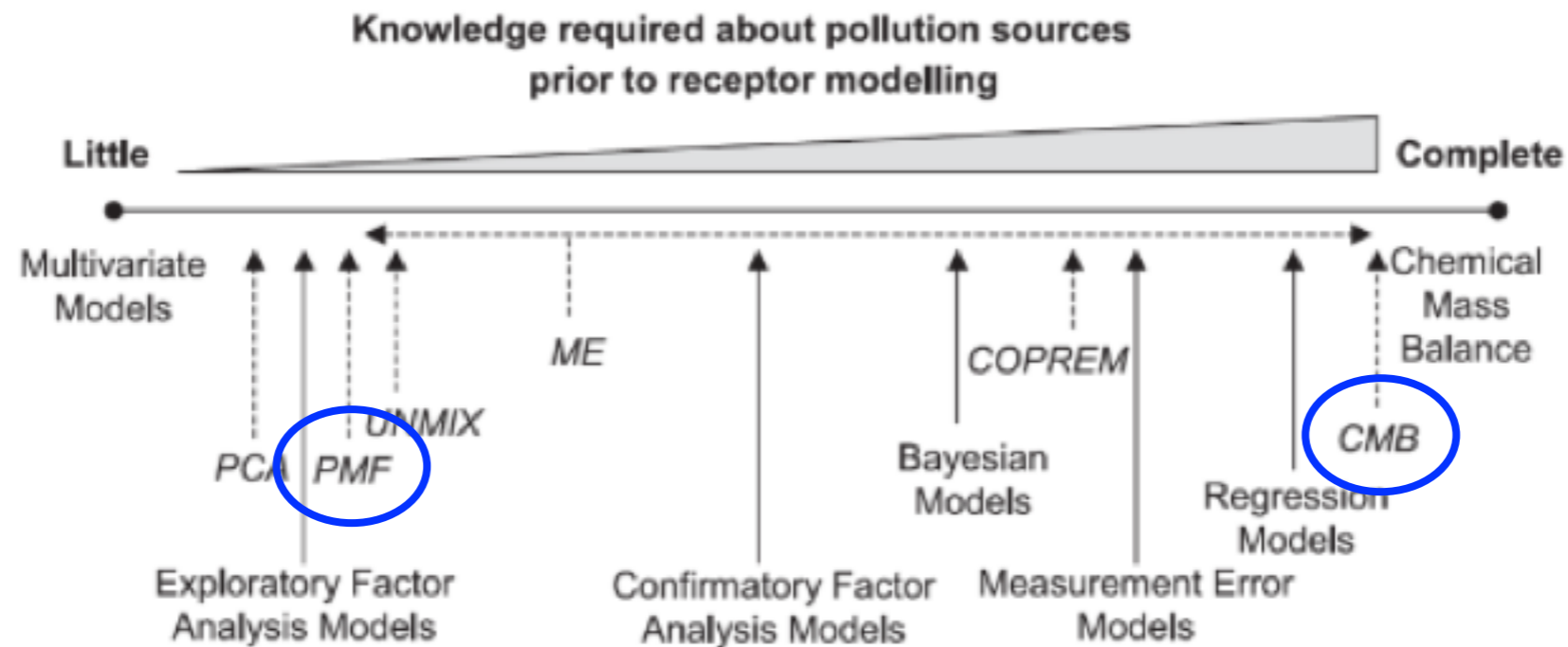


THE RECEPTOR MODEL ASSUMPTION

The species profile of each source is constant.

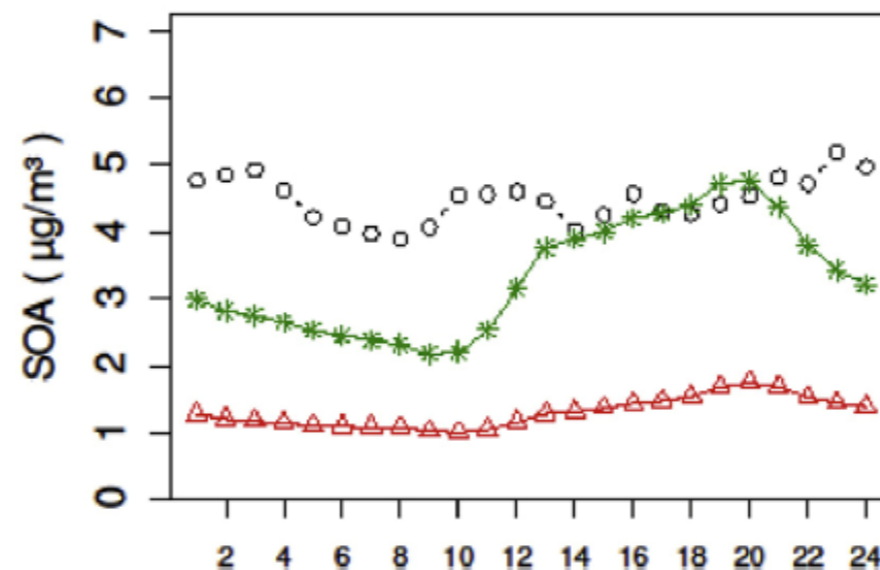
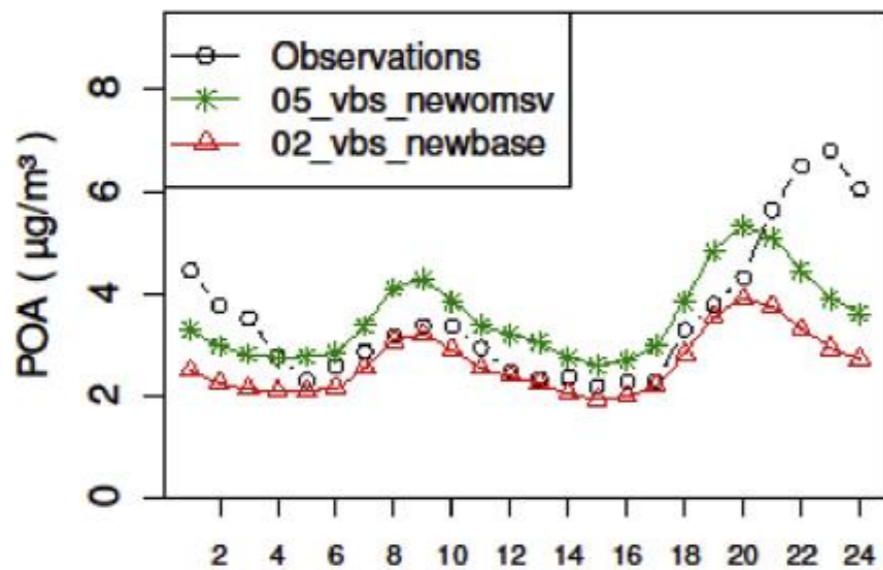
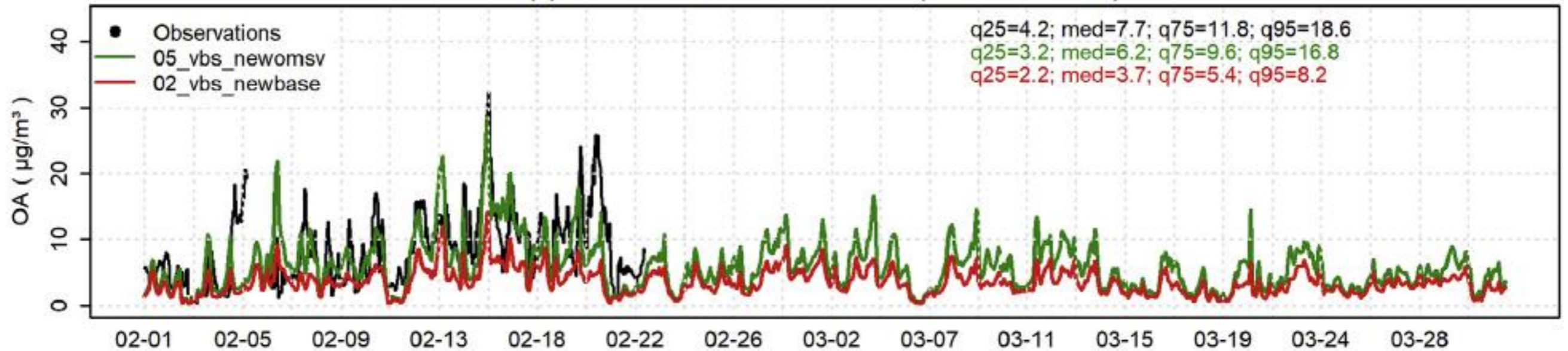
For non-reactive primary pollutants the assumption is true, then the concentration measured at the receptor site is proportional to the emissions.

If reactive primary pollutants or secondary pollutants show a species profile of constant over time at the receptor site, then RM can successfully identify these pseudo-sources (or components), but the concentrations are not proportional to the emissions.



EXAMPLE 1: Why CAMx-VBS fails in reproducing the [OA]?

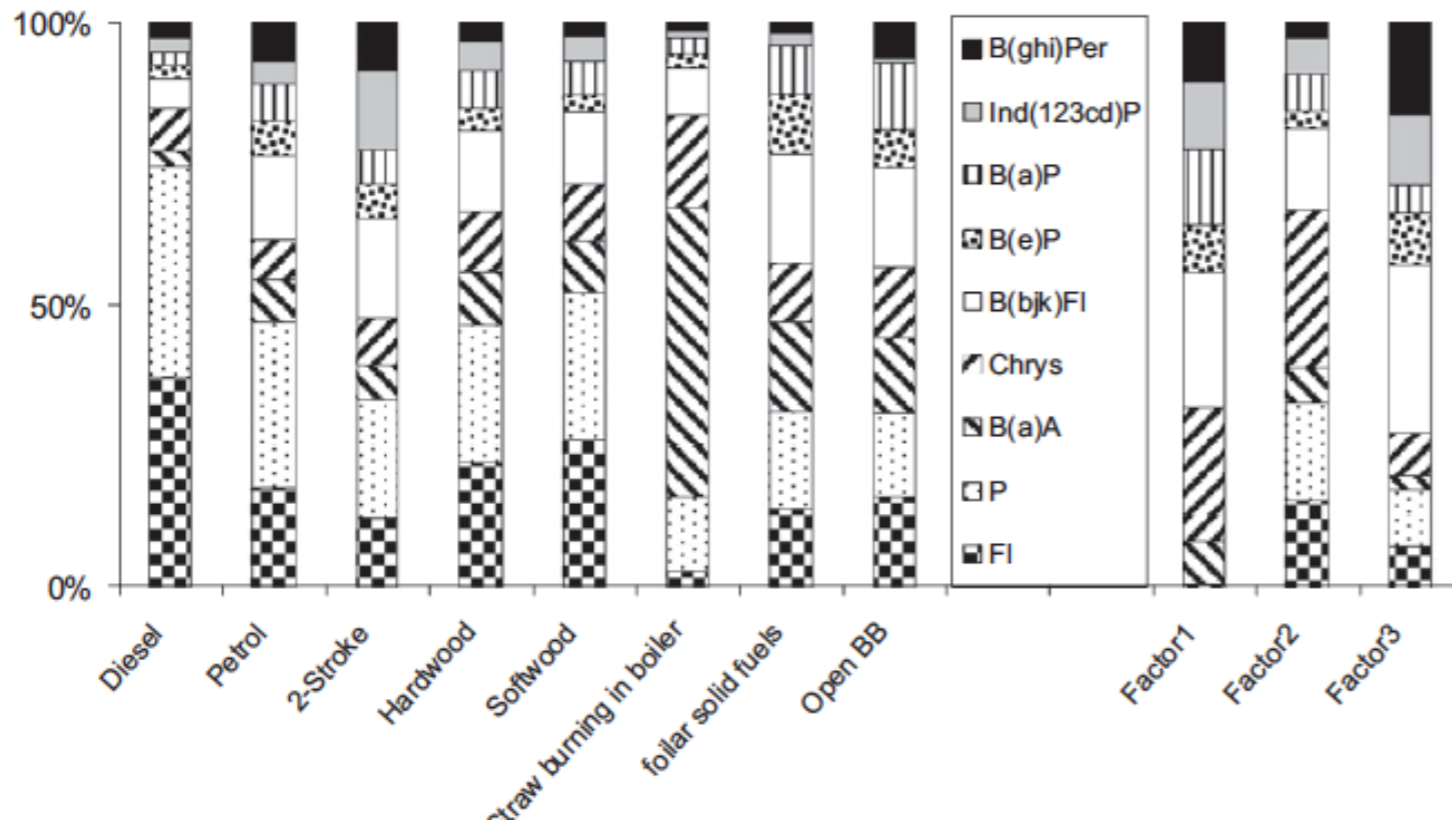
(a) OA for 2013/02/01 - 2013/03/31 (AMS-BOLOGNA)



Revising the S/IVOC emission parametrisation and volatility distribution helped in reconciling SOA in model and observations.

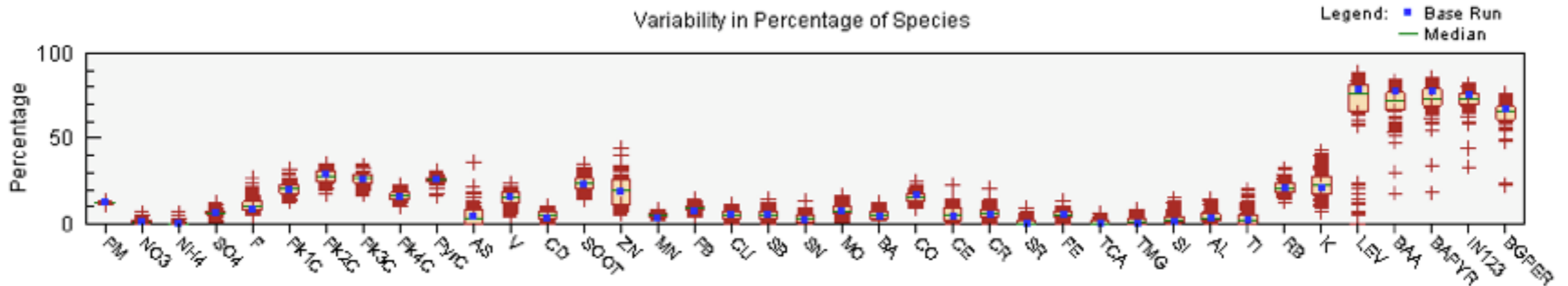
Giani et al., 2019, Atm Env

EXAMPLE 2: What is the main source of BaP in the PV?



PMF using PAH concentrations as input: High collinearity of variables does not allow to detangle different sources.

PMF using PM₁₀ composition: a subset of PAHs is selected and results are consistent with other RMs studies.



Belis et al., 2011, Atm Env

CONCLUSIONS

- RM are extremely useful to improve understanding of PM sources from in-situ observations and when the knowledge of emission strength is uncertain (e.g. the contribution of wood burning for residential heating in urban areas);
- RM are complementary to deterministic models for the identification and quantification of air pollution sources, emissions, and chemical processing.

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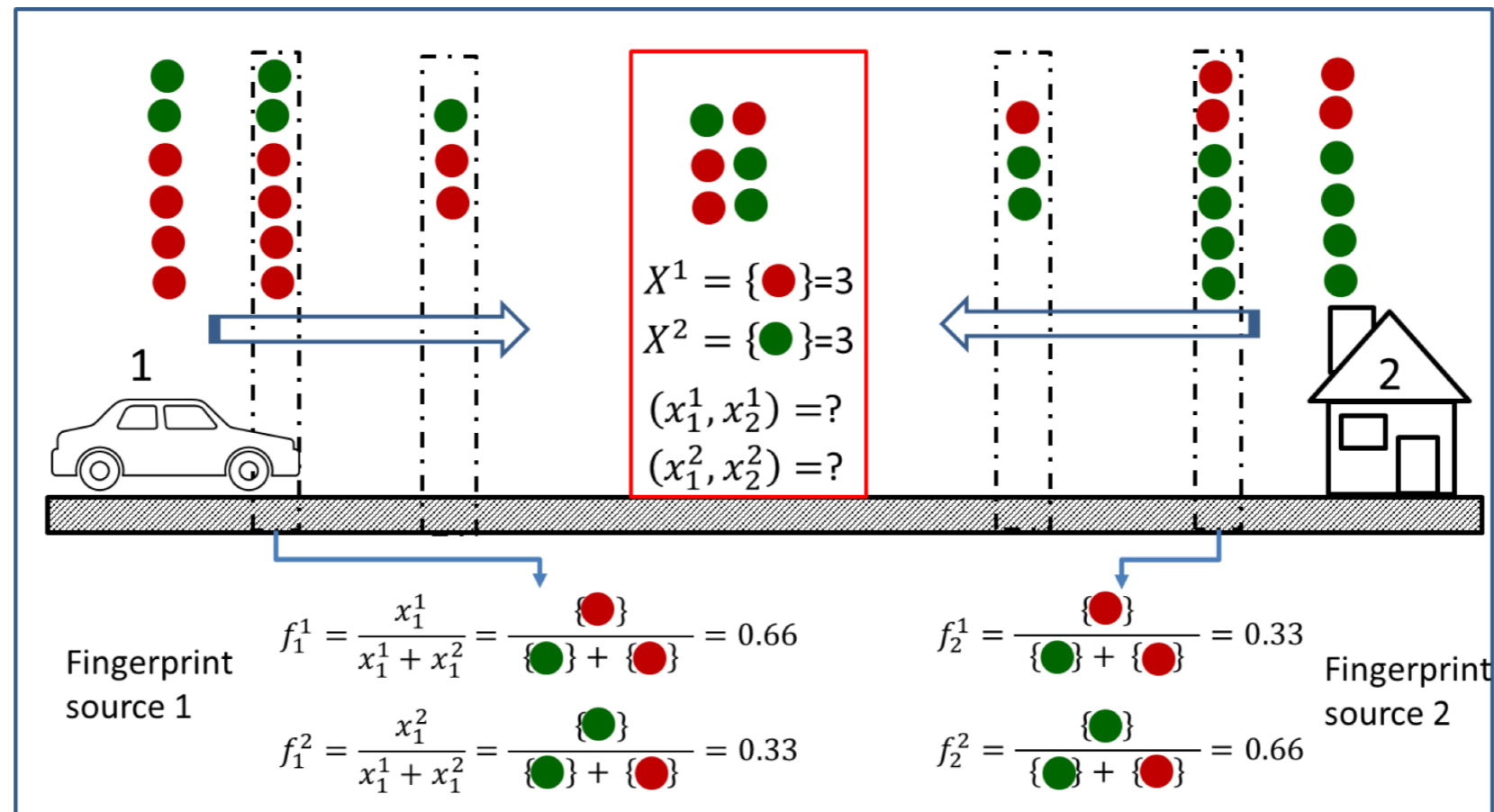
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FUTURE WORK: What?

- **For which specific purpose should we use of RM?**
- **What prevents from using RMs (assumptions and limitations)?**

FUTURE WORK: How?

- Work on simple examples to understand the main assumptions and limitations (outcomes to be discussed at the technical meeting)



Contribution of the community is welcome.