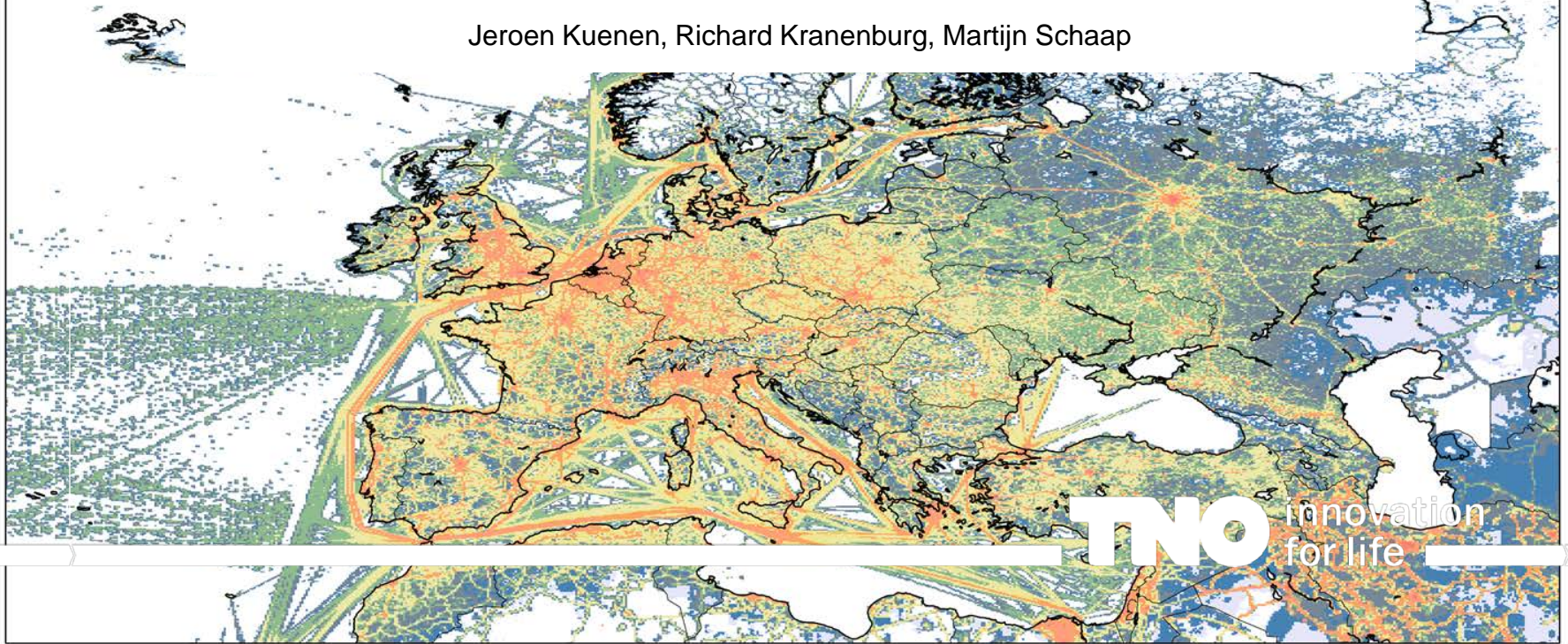


# PM SOURCE APPORTIONMENT

Jeroen Kuenen, Richard Kranenburg, Martijn Schaap

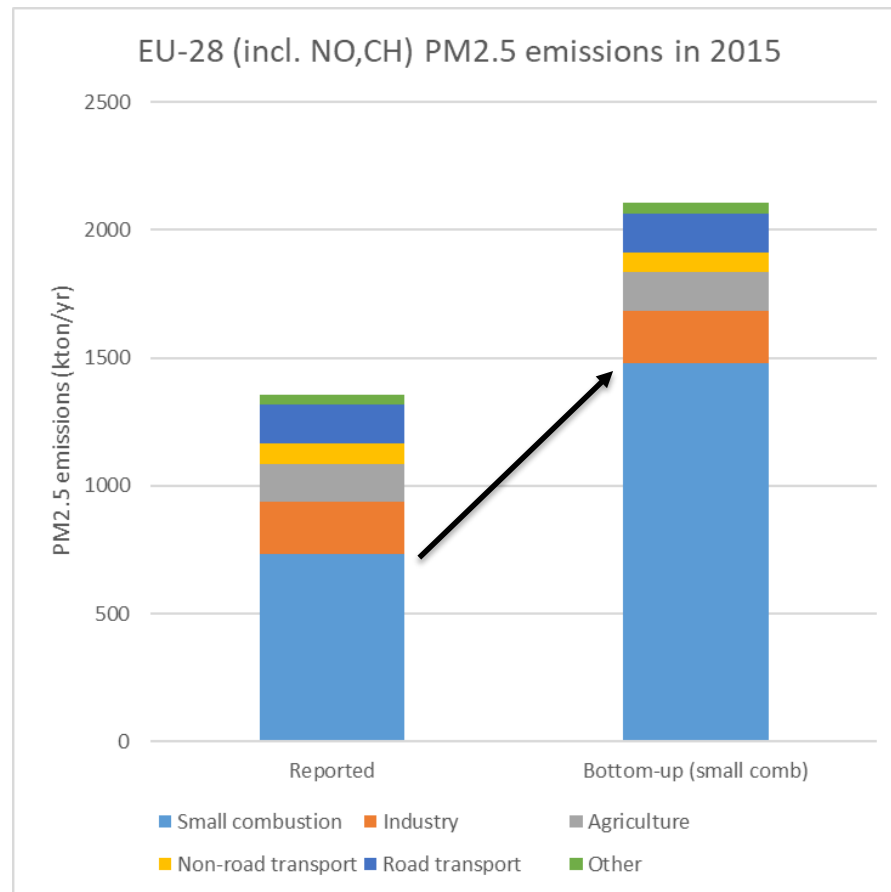


# OUTLINE

- › Emissions
- › Modelling using LOTOS-EUROS
- › TOPAS service

# EMISSIONS

- › Basis is the CAMS regional emission inventory which is largely based on official EMEP reporting with modifications (e.g. completed & improved spatial representation)
- › Condensable particulate matter (formed shortly after emission upon cooling of exhaust gases) plays large role in PM emissions
- › Current reported PM2.5 emissions from small combustion only could potentially double
  - › Overall PM2.5 emissions increase by 30%
  - › Bottom-up for small combustions sources  
(update of numbers presented in Denier van der Gon et al. 2015)

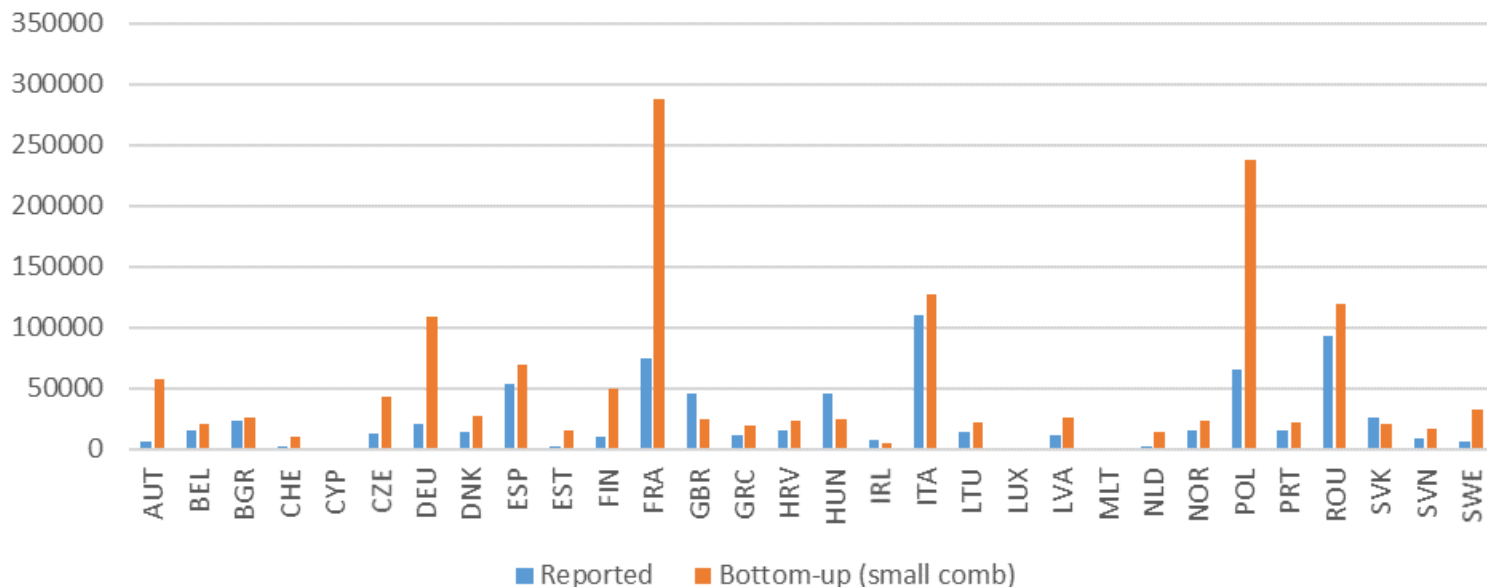




# CONDENSABLES

Current coverage of condensables in official emission inventories is a mix – need to harmonize before doing any source apportionment

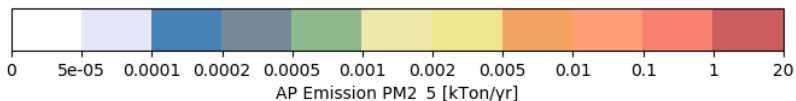
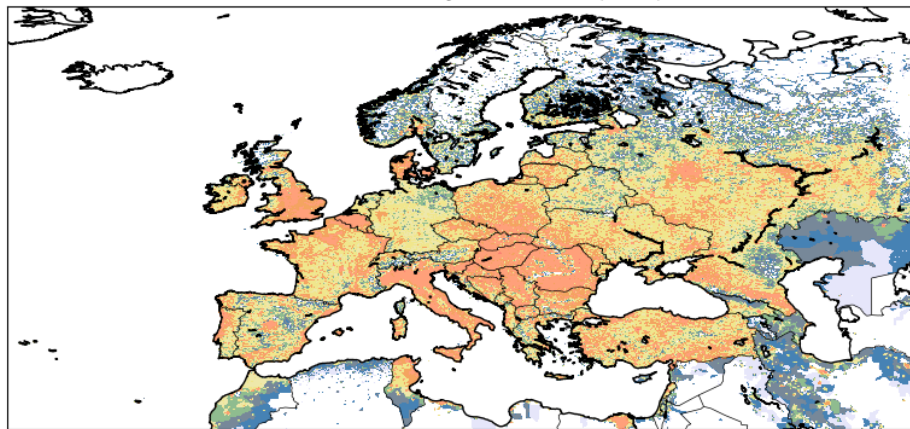
### Small combustion PM2.5 emissions



*Note: reported in 2017, may have changed since then*

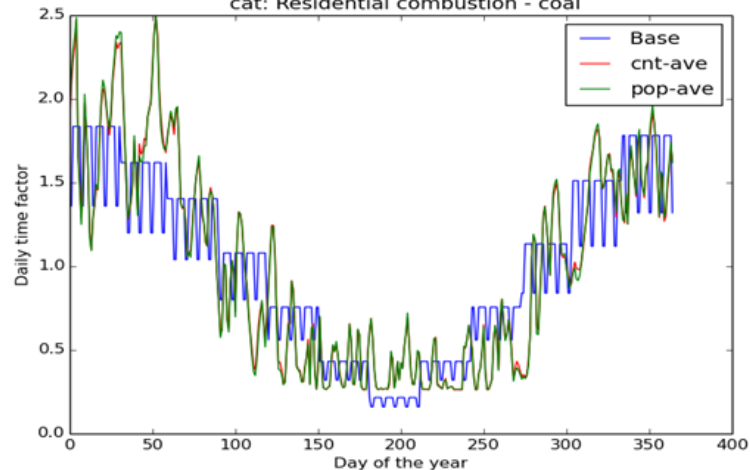
# EMISSION MODELLING (IN SPACE & TIME)

C - Other Stationary Combustion (2015)

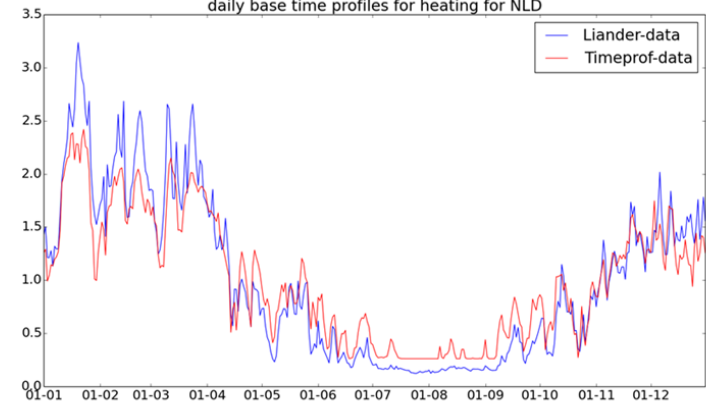


Novel spatial distribution developed for wood use depending on wood “availability” (more use near forests)  
Note discrepancies at country borders => artefact of reporting

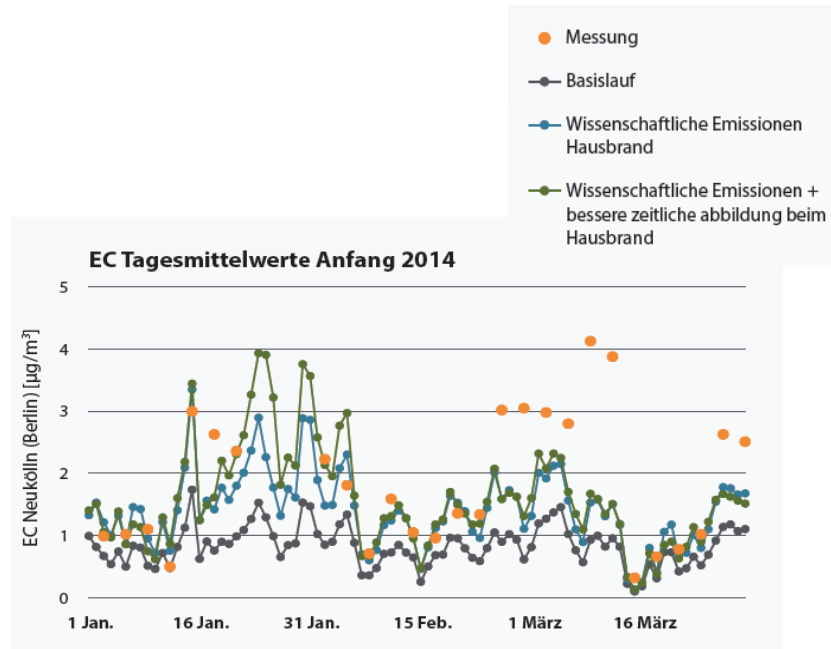
Timeprofile 2011 DEU  
cat: Residential combustion - coal



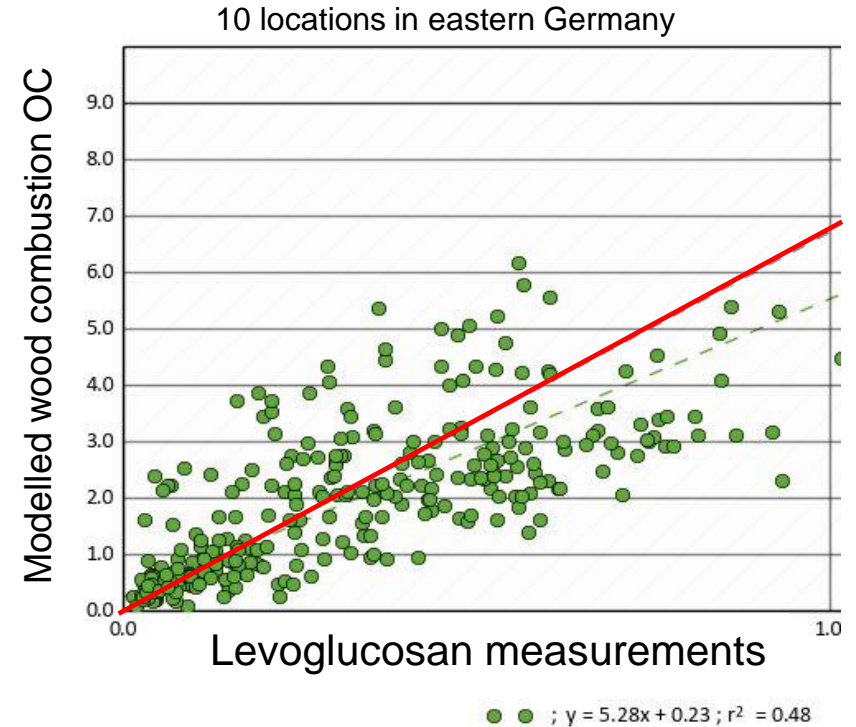
daily base time profiles for heating for NLD



# IMPACT ON MODELLED EC AND OC IN BERLIN AND EASTERN GERMANY

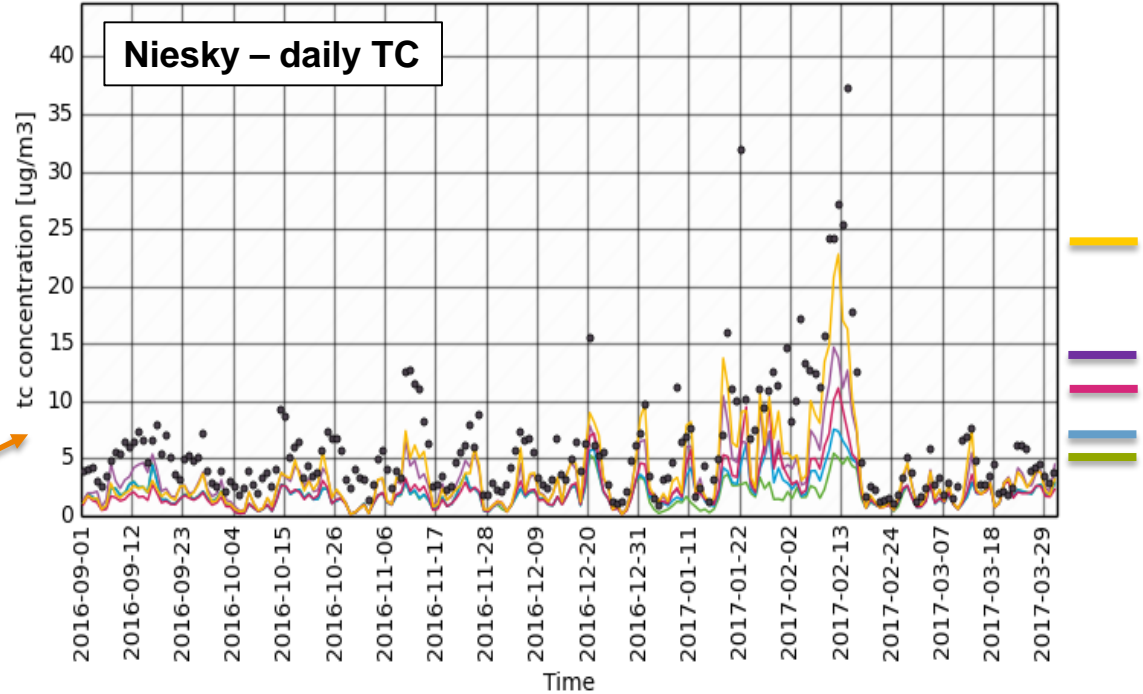


PM source apportionment



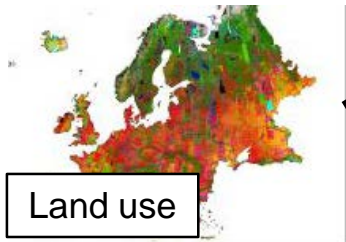
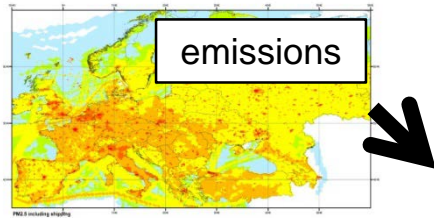
From literature: Levoglucosan : OC = 1 : 6.7 (red line)

# IMPACT OF IMPROVEMENTS ON TOTAL CARBON



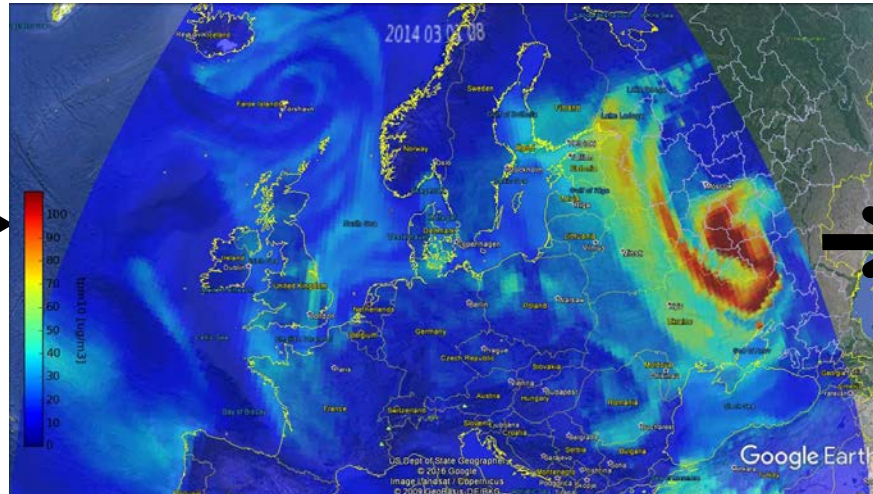
- base
  - RWC+snow
  - heating+snow
  - RWC+heating+snow
  - • Measurement
- snow-update

# CHEMISTRY TRANSPORT MODELS PROVIDE THE LINK BETWEEN EMISSION AND CONCENTRATION

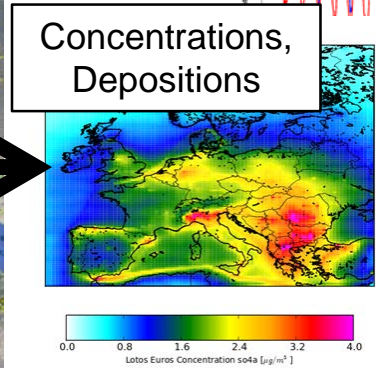


PM source apportionment

The weather and thus pollutant formation and transport are highly variable

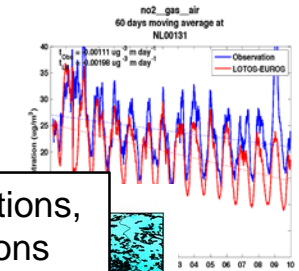


Particulate matter  
Labelling approach to track origin of PM



Source contributions

- The Netherlands - Road transport
- Belgium - Power generation







# GOAL OF TOPAS



<https://topas.tno.nl>

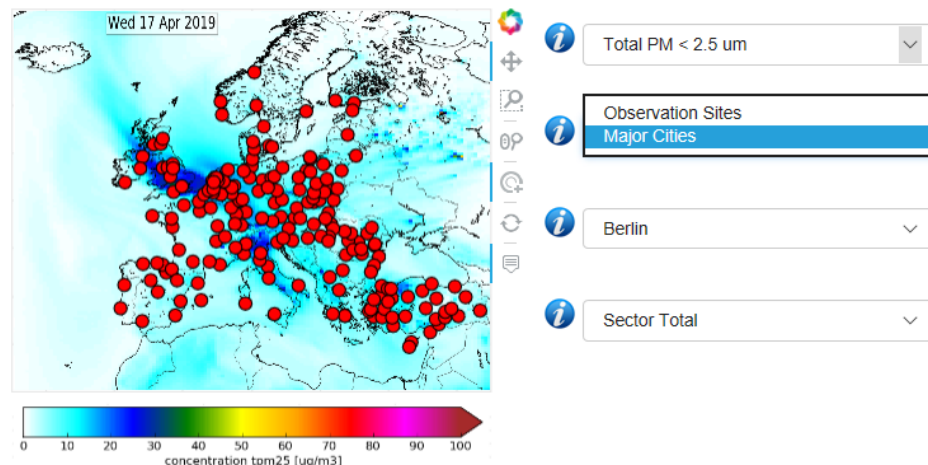
**To quantify the origin of air pollution on a daily basis using our latest insights.**

The prototype TNO Operational Pollution Apportionment Service (TOPAS) is based on the chemical transport model LOTOS-EUROS with its labeling approach forced by TNO emission information and CAMS products.

TOPAS aims to differentiate the origin of PM in:

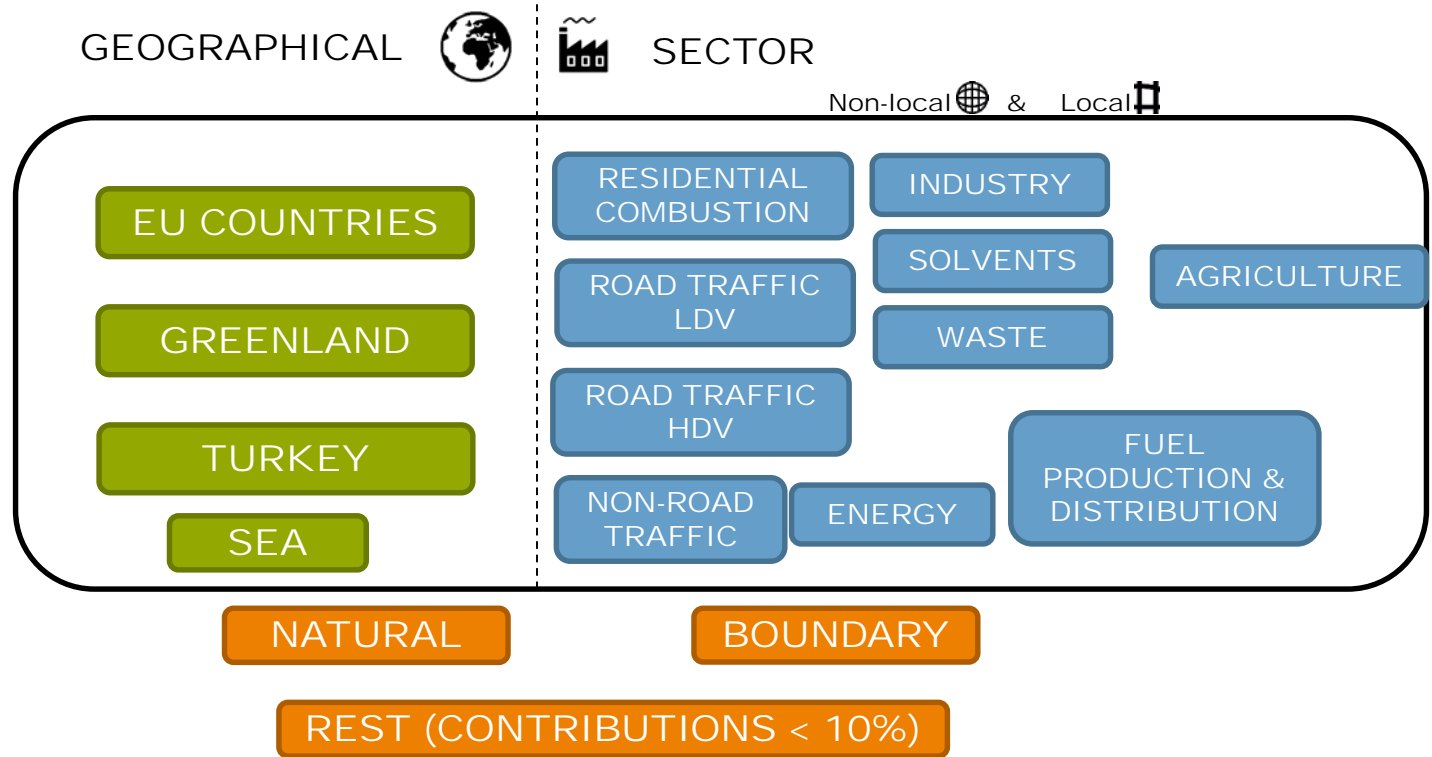
- Local contributions
- Source sector contributions
- Transboundary contributions
- Natural contributions

Daily **modelled** PM10/PM2.5 based on hourly model output (model resolution  $0.5 \times 0.25^\circ$ )



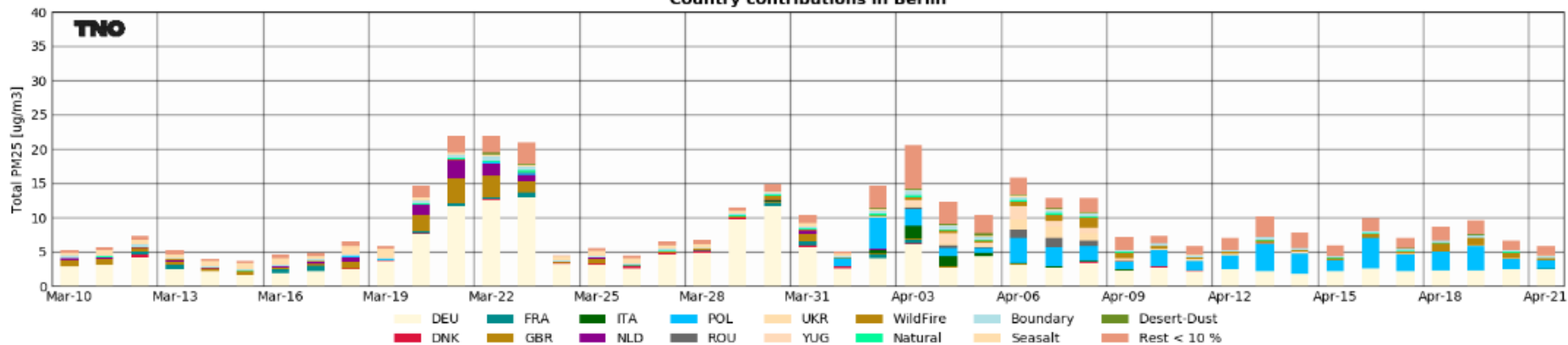


# WE EXPLOIT THE LABELLING SYSTEM OF LOTOS-EUROS – TWO SIMULATIONS IN PARALLEL

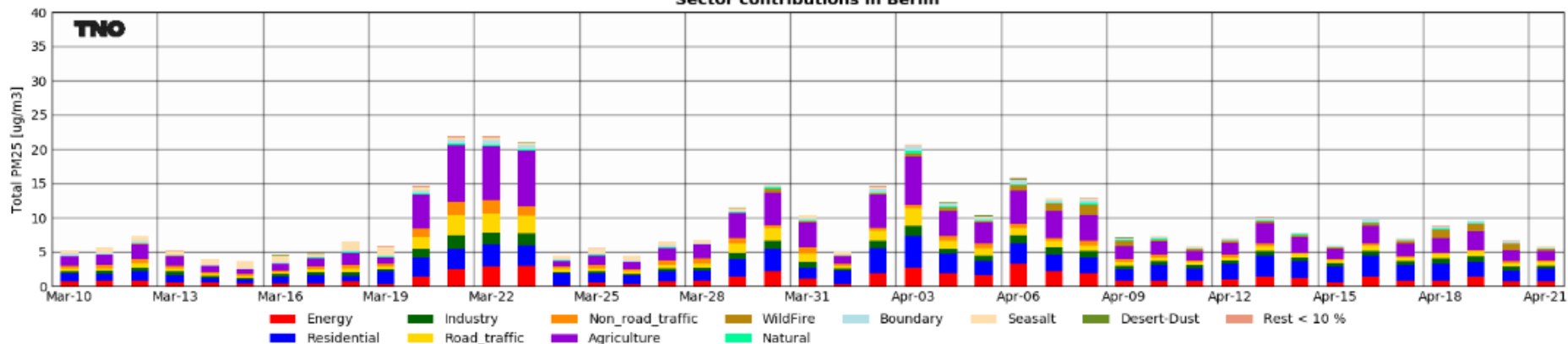




Country contributions in Berlin

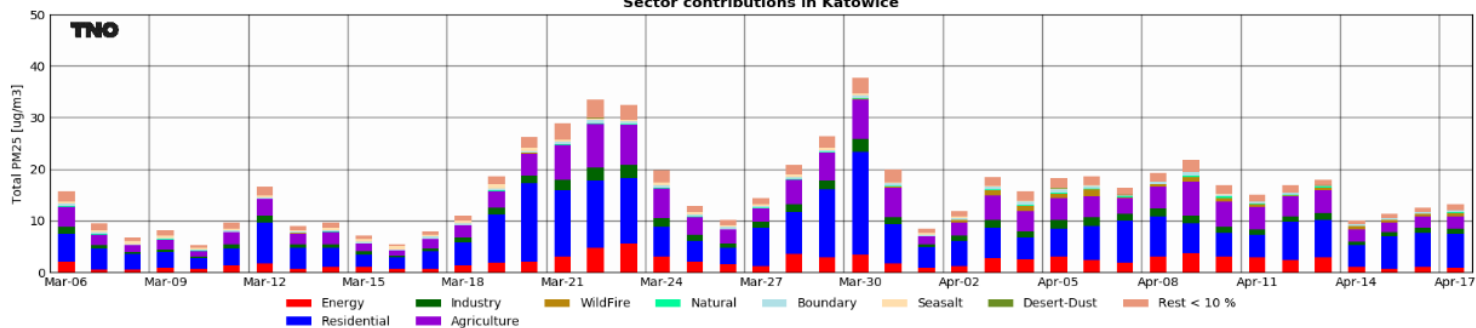


Sector contributions in Berlin

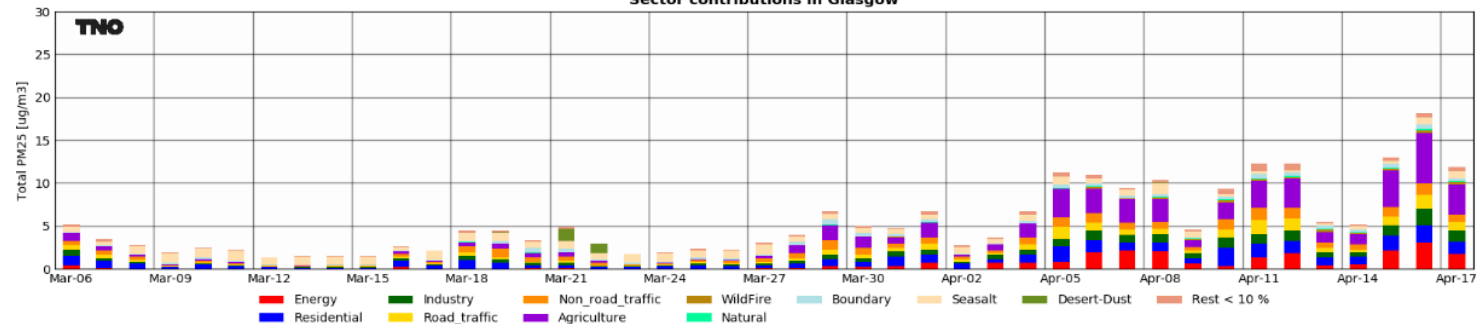




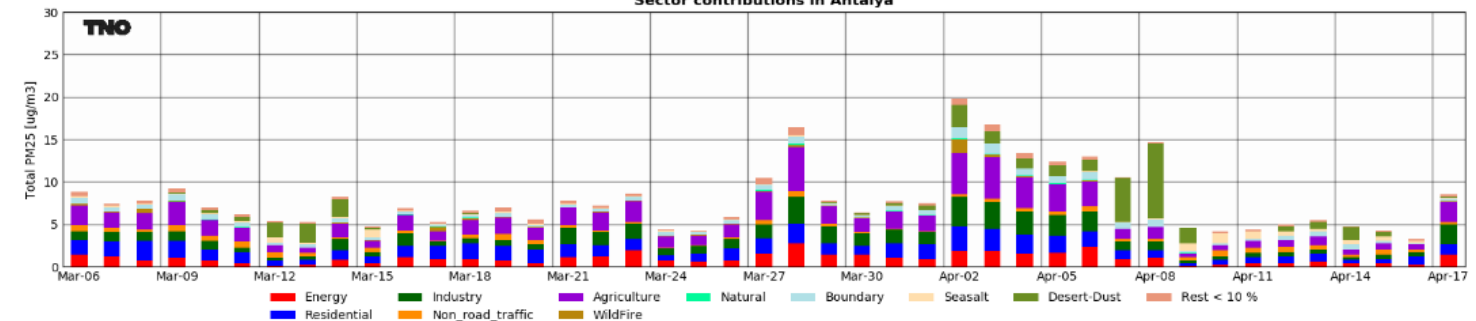
Sector contributions in Katowice



Sector contributions in Glasgow



Sector contributions in Antalya



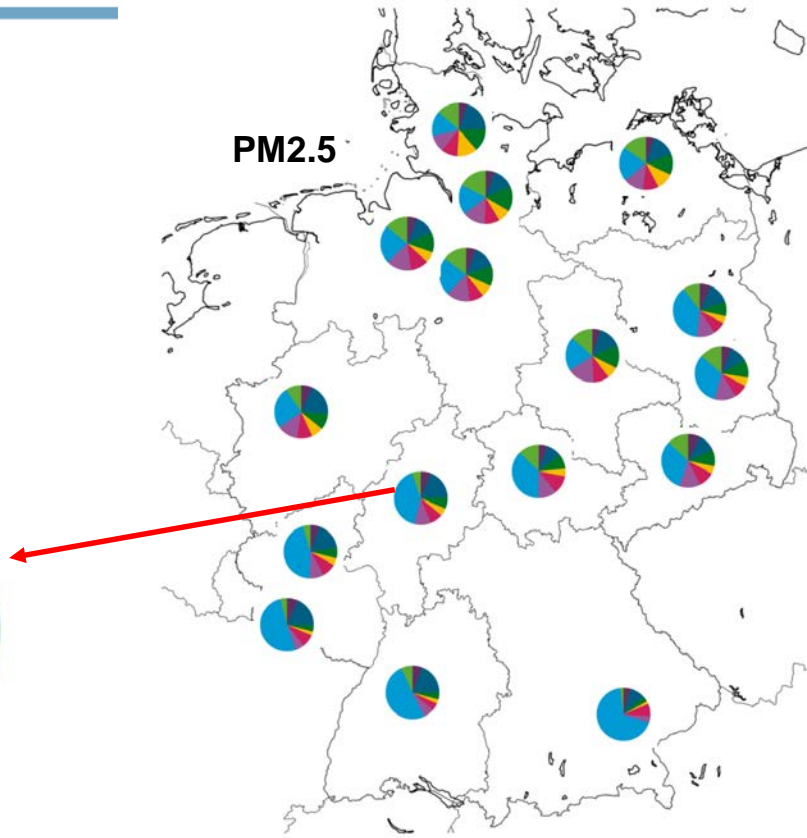
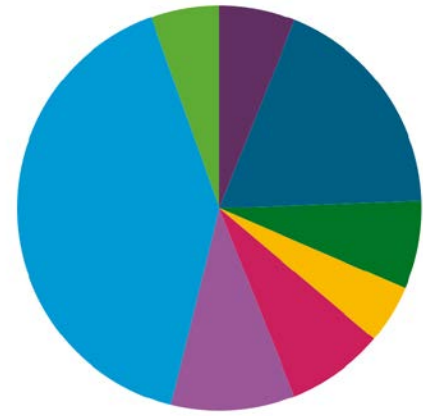
A nighttime photograph of a city street. On the left is a brick building with lit windows. On the right is a modern building with a curved facade and lit windows. A road with a metal railing runs across the middle. Green light trails from a moving vehicle or light source curve across the scene from the right towards the center. The overall lighting is dark with warm city lights and vibrant green highlights.

› THANK YOU FOR YOUR  
ATTENTION

Take a look:  
[HTTPS://TOPAS.TNO.NL/](https://topas.tno.nl/)

**TNO** innovation  
for life

# 2018 ANNUAL MODELLED SECTOR ALLOCATION



- |            |              |                  |         |
|------------|--------------|------------------|---------|
| Energy     | Industry     | Non-Road-Traffic | Natural |
| Res. Comb. | Road-Traffic | Agriculture      | Other   |