Uptake of satellite data for emission inventories

Some examples and discussion

Verification of spatial distribution

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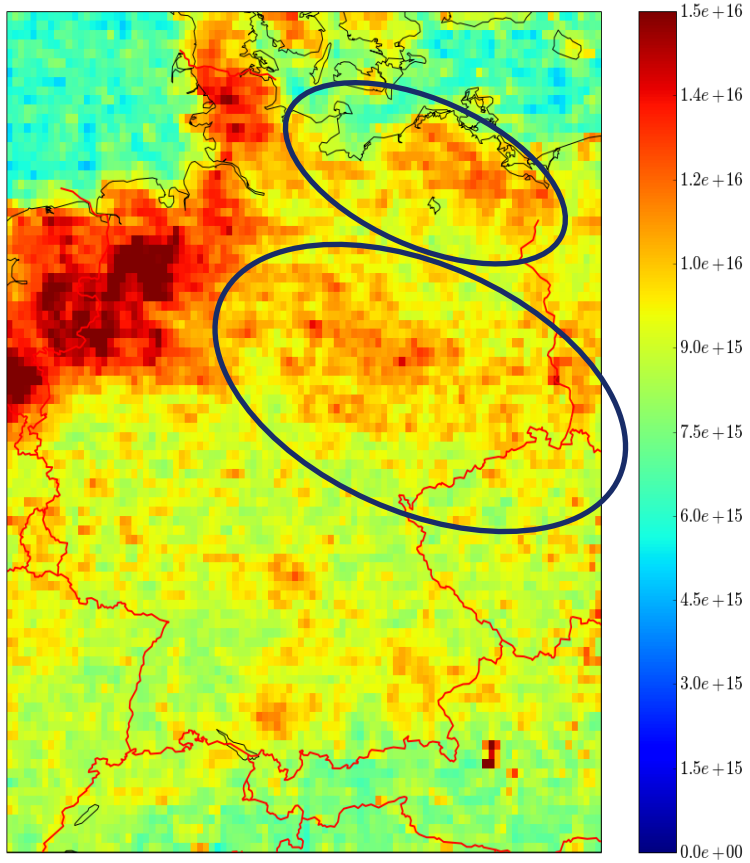
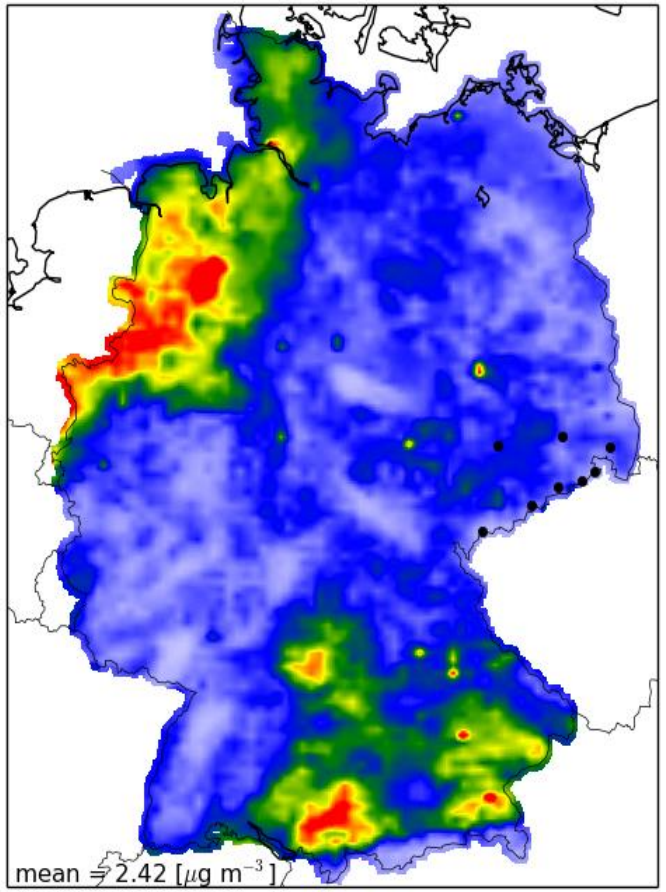
- Satellite data identifies regions in Germany with substantial NH3 emisisons which were not in the emission inventories

Satelite-IASI-NH3: 8-year average



Modelled mean surface NH3



Dammers et al. 2019

Emission inventories use proxies e.g. number of farms to distribute country totals

However in eastern Germany part of emissions are missed because the proxy is less suitable (farmers often have larger land areas)

→ Used to improve the emission inventories

Verification of NH3 emissions

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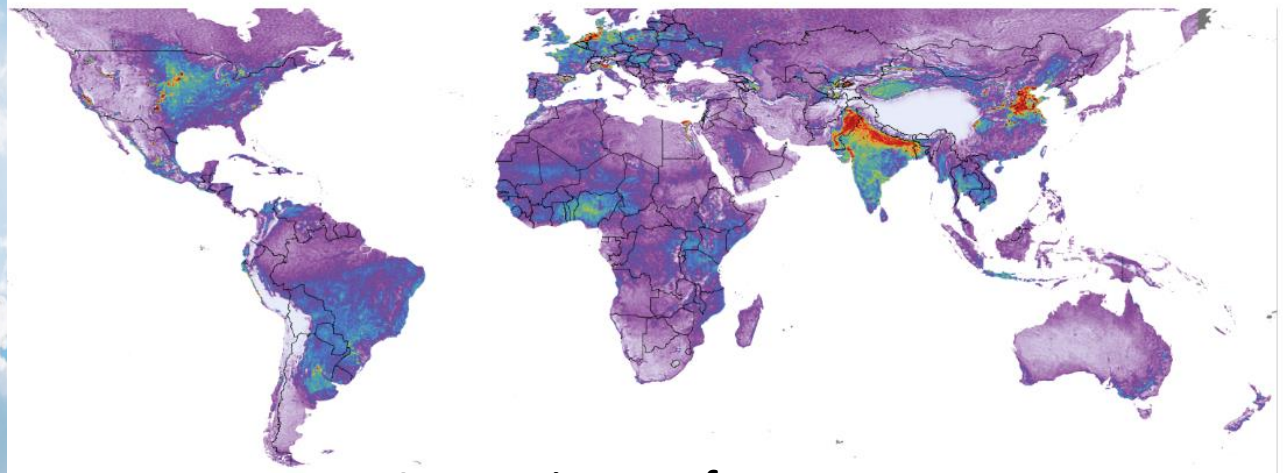
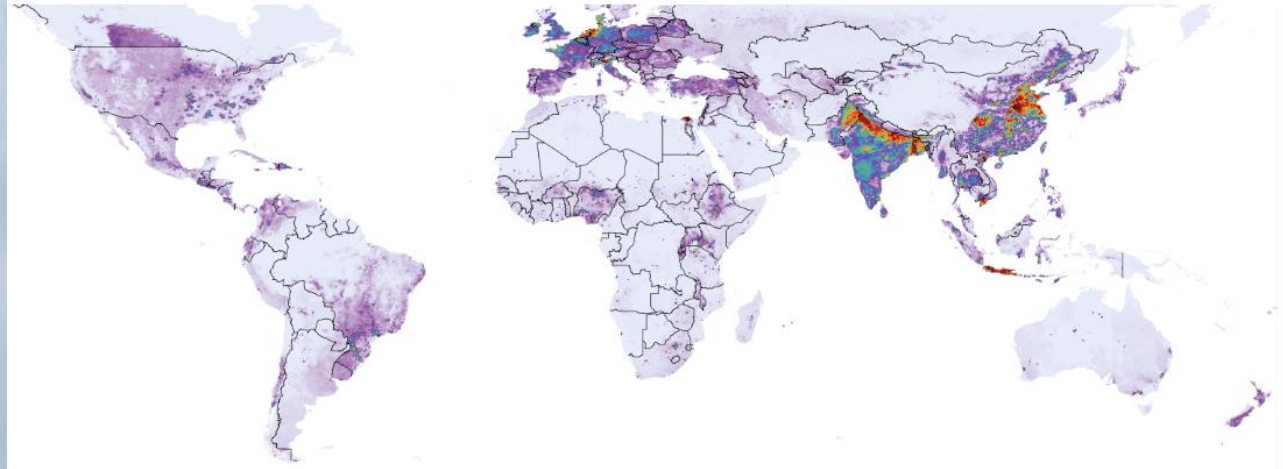
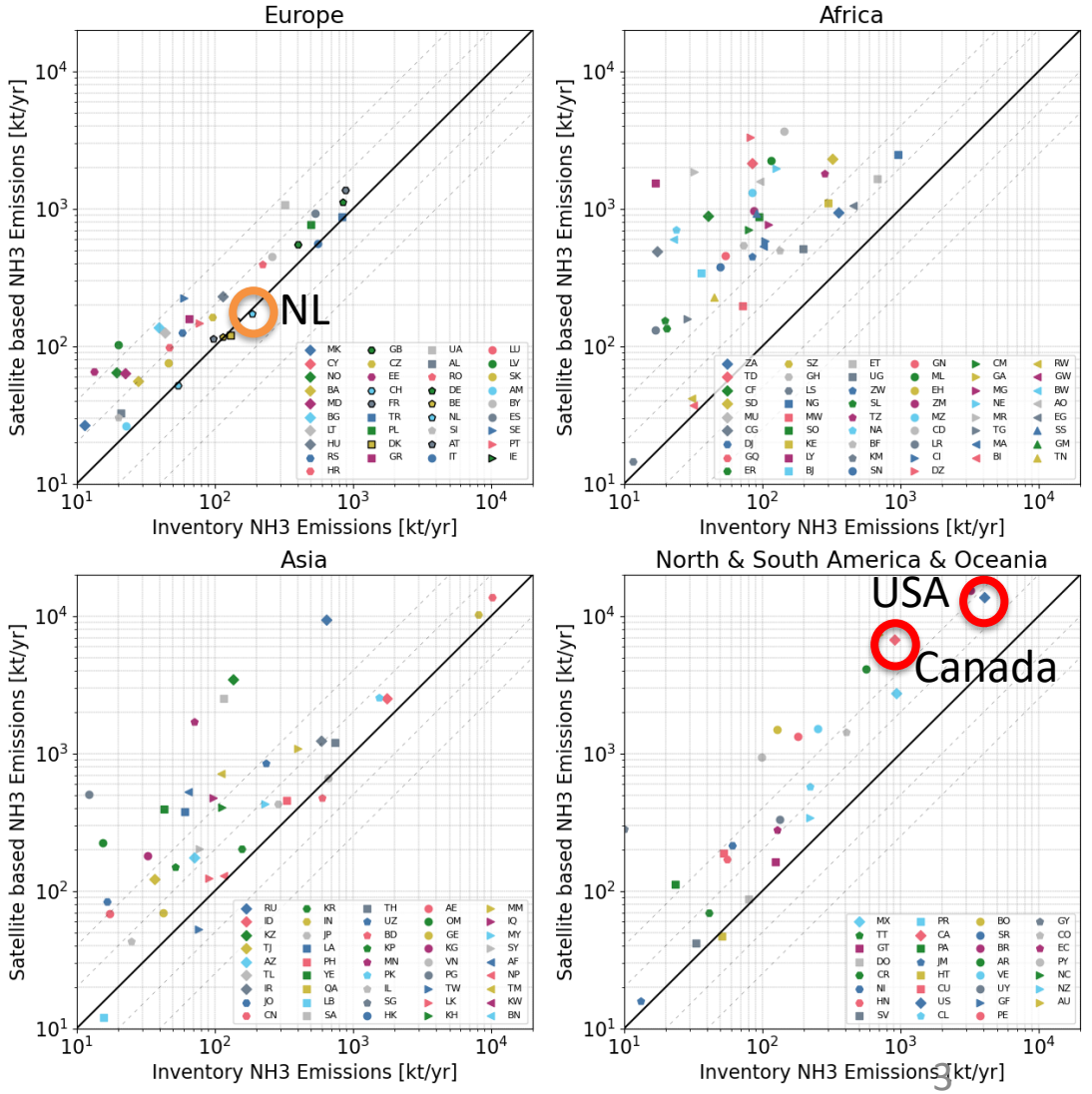


Ammonia seen from space



Best available knowledge based on emission inventories

Dammers et al. – in review



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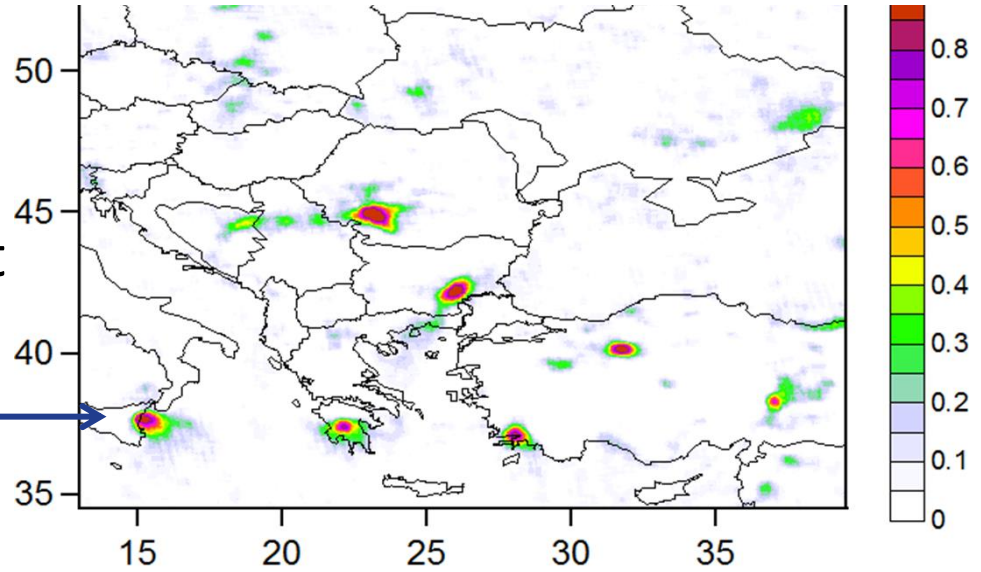
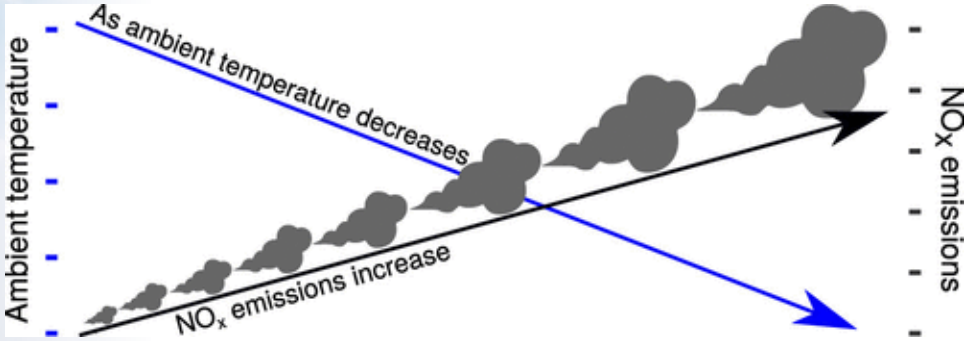
Application for point sources

- Inventories are well-developed for most developed countries – but satellite based emissions are a useful resource for verification
- Necessary to have relatively large point source emissions and good understanding of other emission sources

Checking point source locations e.g. for SO2



Fioletov et al., ACP, 2017 https://doi.org/10.5194/acp-17-12597-2017



Grange et al., Env. Sci. Tech., 2019

Satellite data can also contribute to a better understanding of seasonal variation of emissions, e.g. temperature dependency of road transport emissions

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Comparing methodologies

- Emission inventories are a key data source in policy
  - Emission reduction commitments e.g. UNFCCC/Paris Agreement, CLRTAP Gothenburg Protocol, EU NEC Directive
- However, issues may exist as these inventories rely on the availability of high-quality underlying information

"Traditional" emission inventories e.g. CAMS-REG/CAMS-GLOB-ANT	**Satellite-based emission inventories**
All relevant pollutants are possible	Selected pollutants only
Only "known" anthropogenic sources but **with sector detail**	**All sources** (incl. natural) but only totals (no sectoral breakdown)
Not always fully consistent between countries	Inherently **consistent across domain**
Spatially distributed emissions using proxies and point source (reported) data	**Spatial distribution explicit** in the observations
Only annual data, use of profiles for higher temporal resolution	**Good temporal disaggregation** (e.g. daily value)

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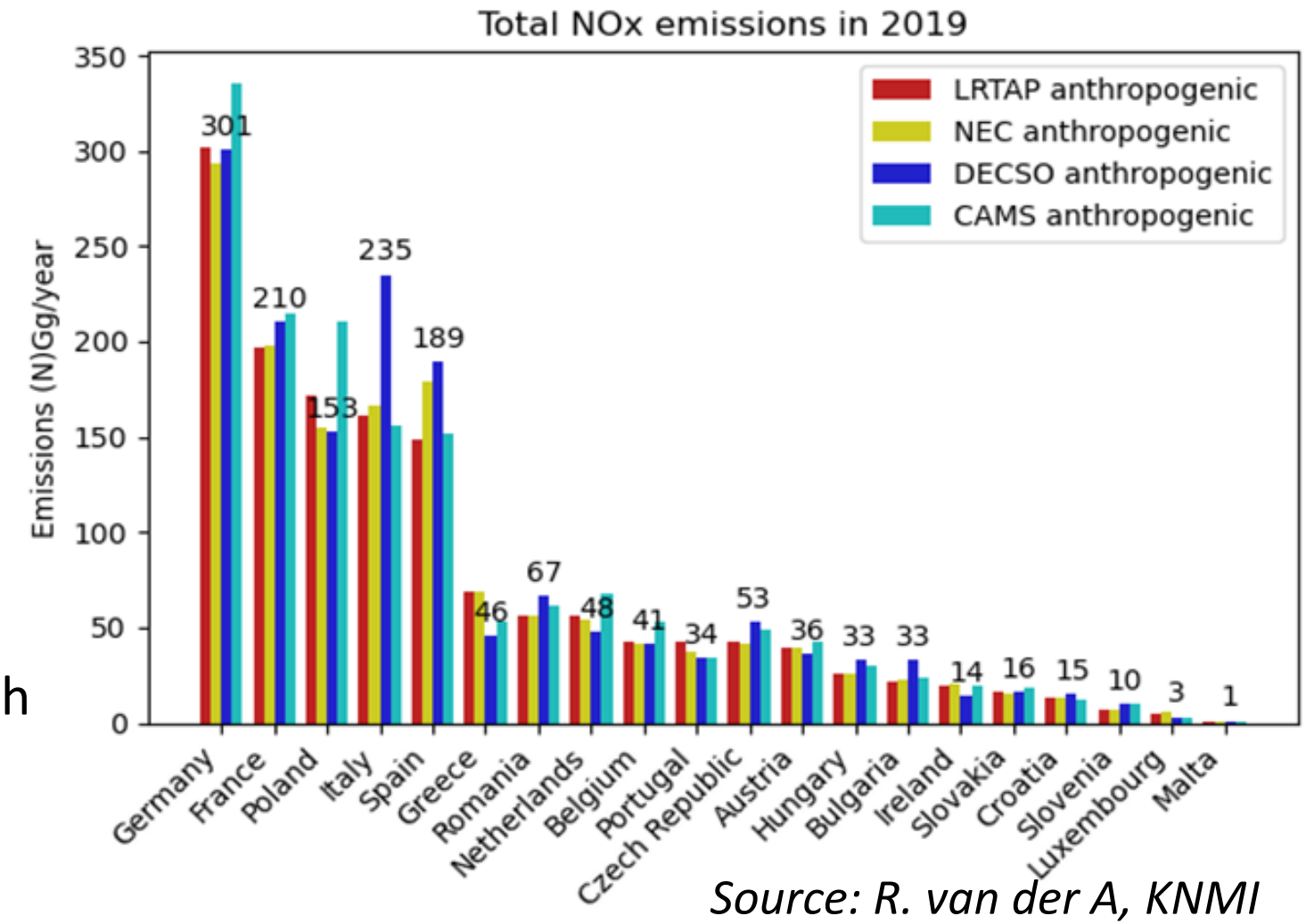
Comparing between countries

- Assess differences and similarities between inventory-based and satellite-based
  - Country level
  - Point sources
- Difficult to draw quick conclusions - this needs a deep dive into such comparisons involving both communities!



Source: R. van der A, KNMI

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Ministerie van Infrastructuur en Waterstaat

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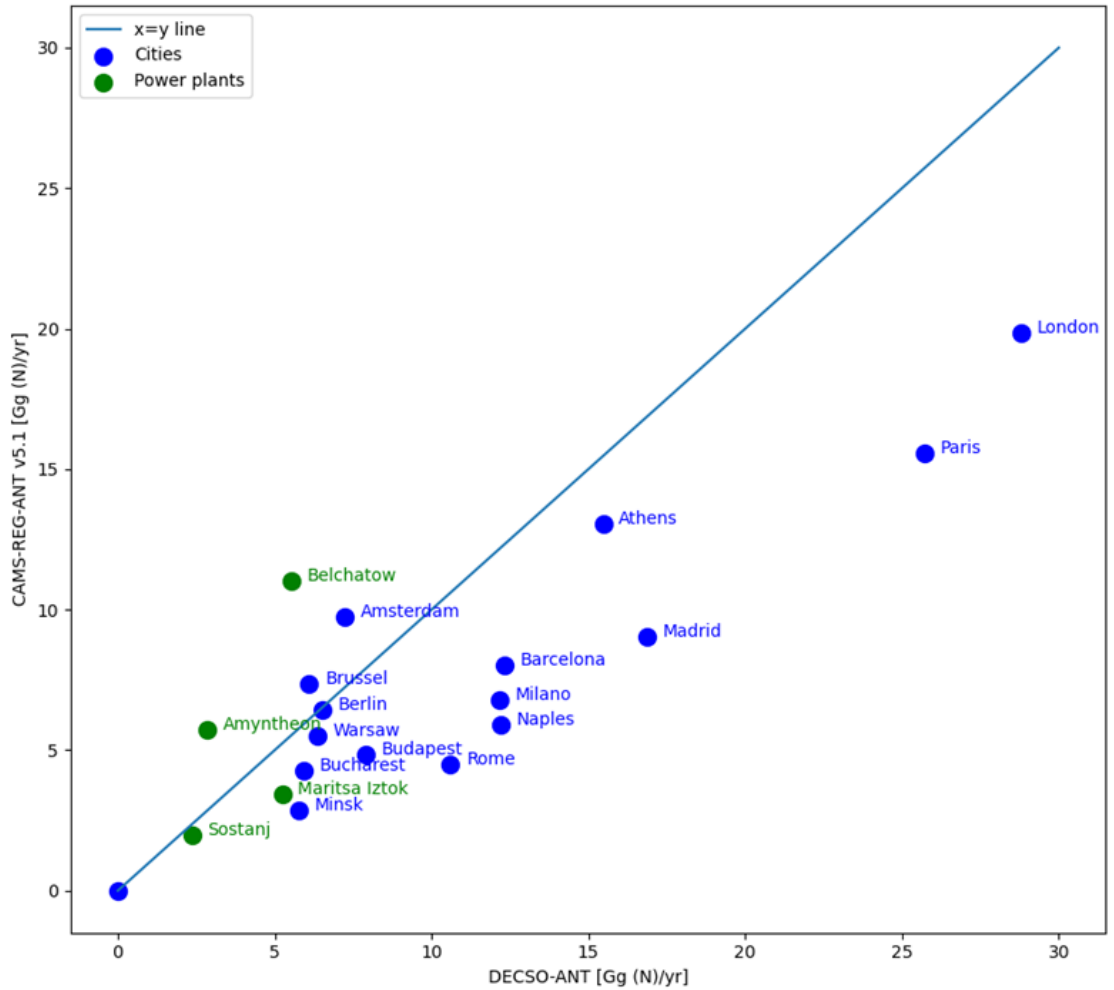
Zooming into city level

- Comparing city level emissions (2018/19) for NOx between
  - DECSO v6.3 (estimates based on satellite observations)
  - CAMS-REG-v5.1 emissions (based on country reporting, distributed using combination of road transport networks and population density)



Source: R. van der A, KNMI

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Next steps

- Traditional “bottom-up” emission inventories will remain important for policy applications (e.g. NEC Directive reporting)
  - Countries responsible for their own national system & methodology
  - Range of pollutants and sector breakdown needed
  - Hence, we need to keep working on improving these with the latest knowledge available

- But… satellite-based estimates can be very useful to fill gaps where bottom-up estimates are lacking
  - Verify potential missing areas of emissions or identify large discrepancies – can be further looked into in national scale studies
  - Provide estimates in regions where no bottom-up emissions are available

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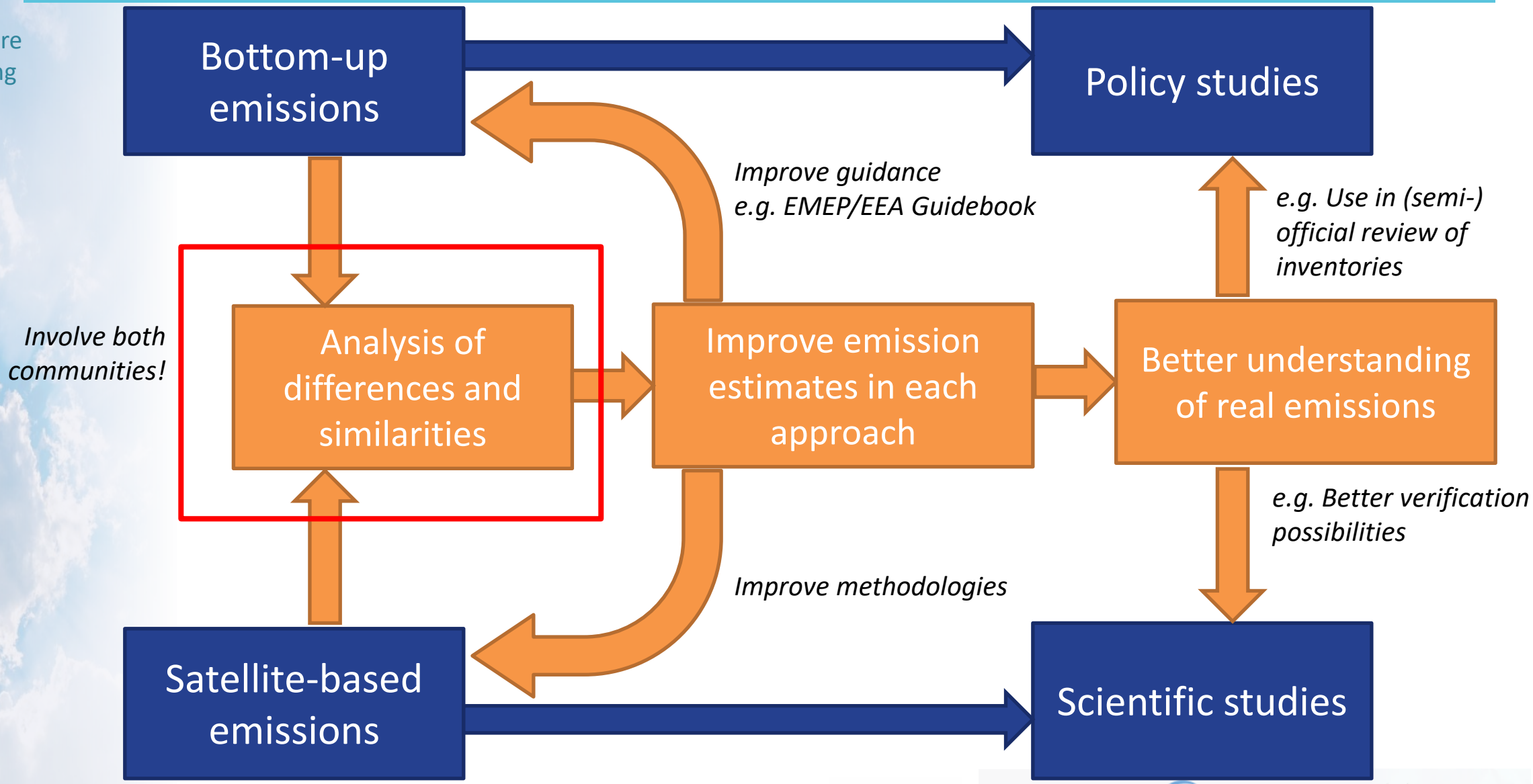
Next steps



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