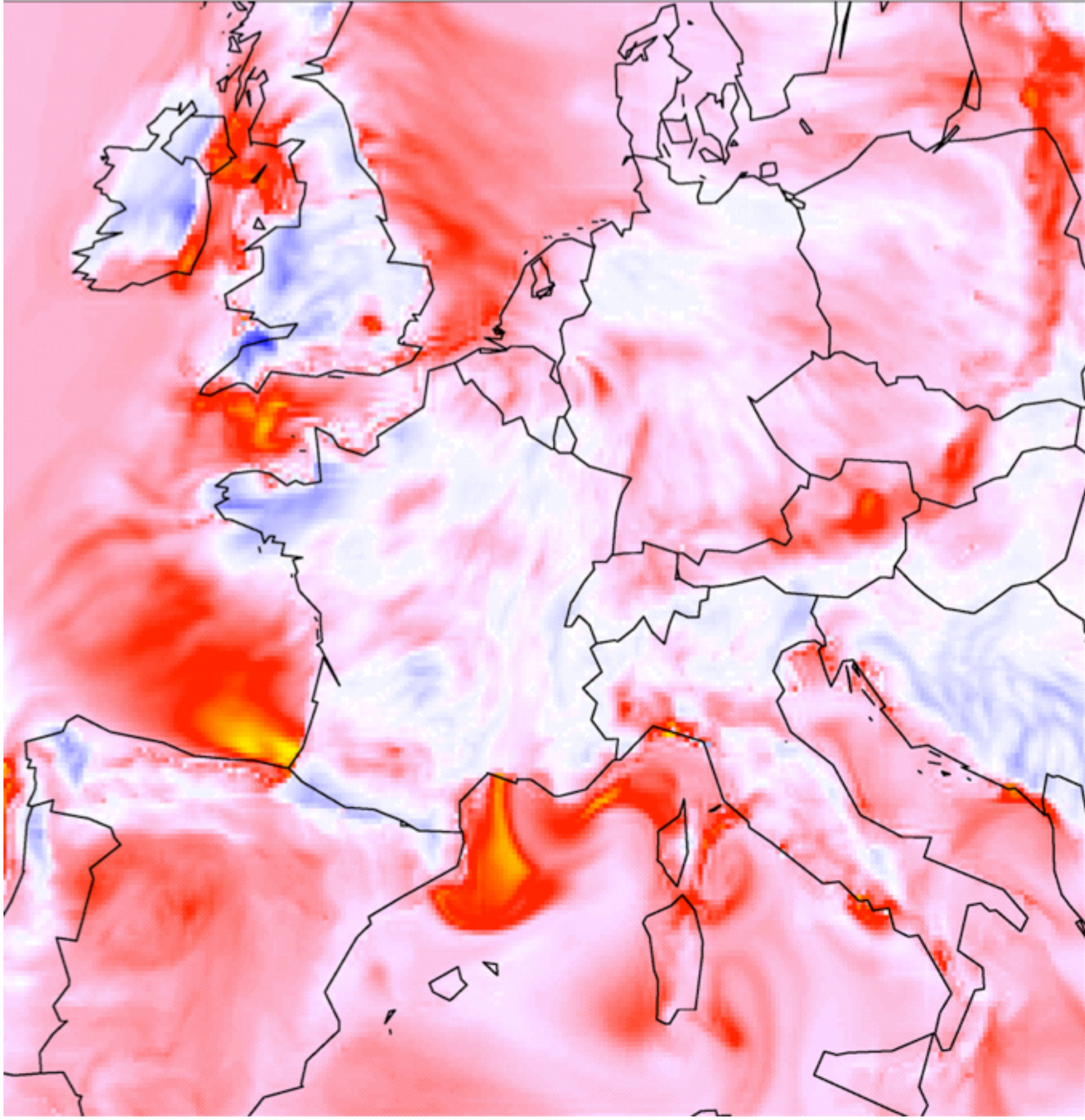
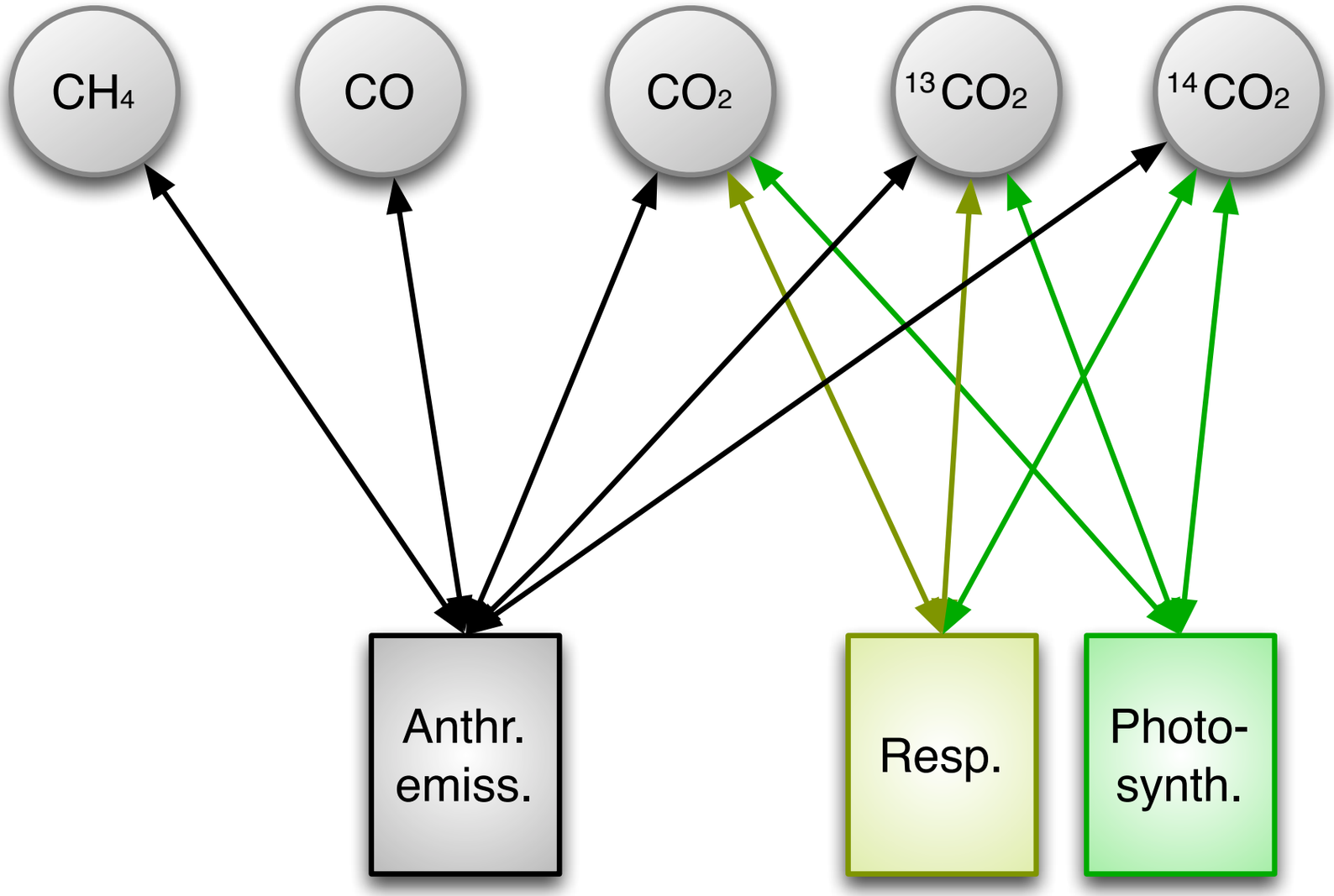
# Regional inverse modeling of GHGs: next development steps

Christoph Gerbig
(MPI-BGC)



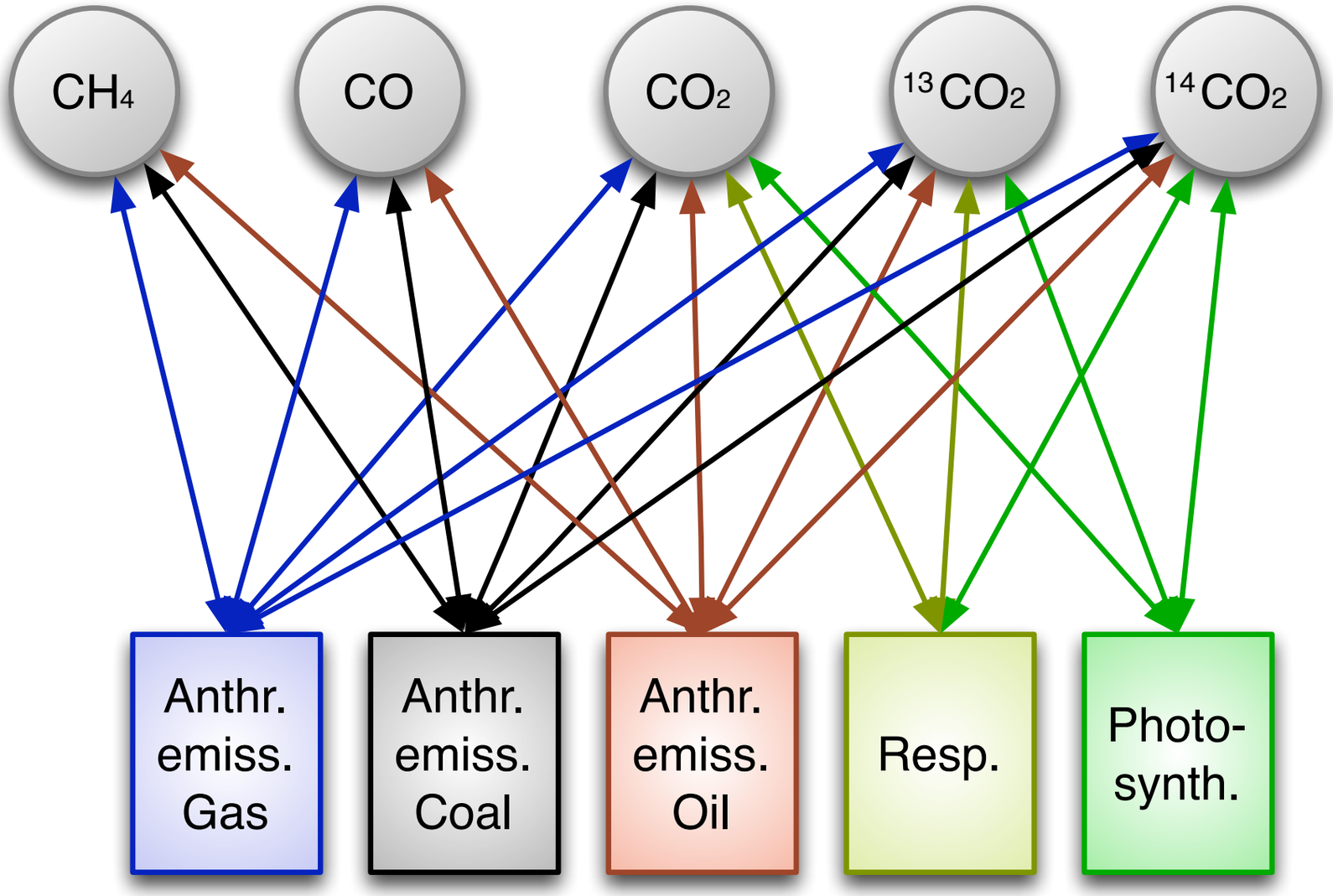
ICOS-D Meeting, Garmisch-Partenkirchen, 12 Mai 2015

# synergy of tracers



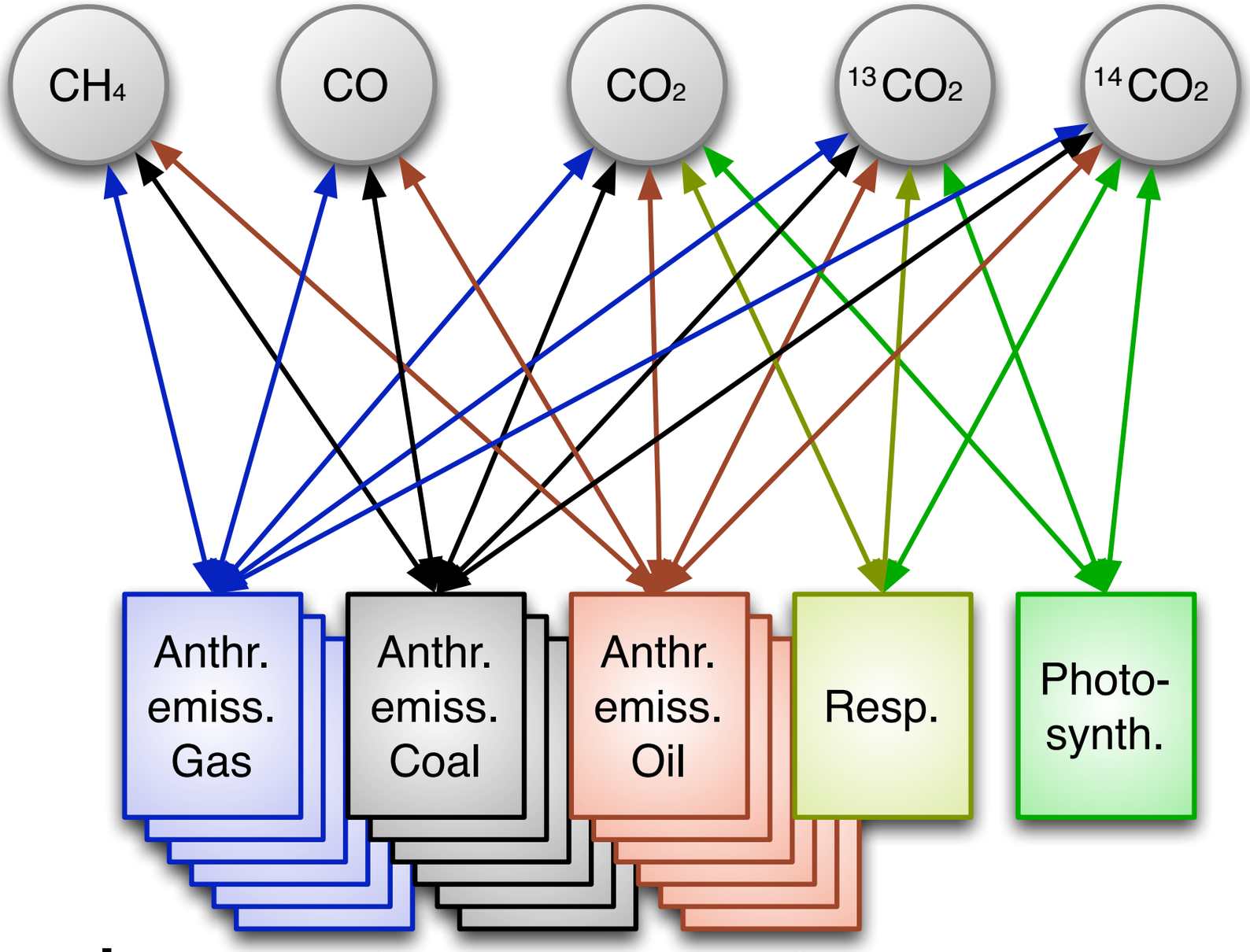

## multi-species constraints

# synergy of tracers




## multi-species constraints

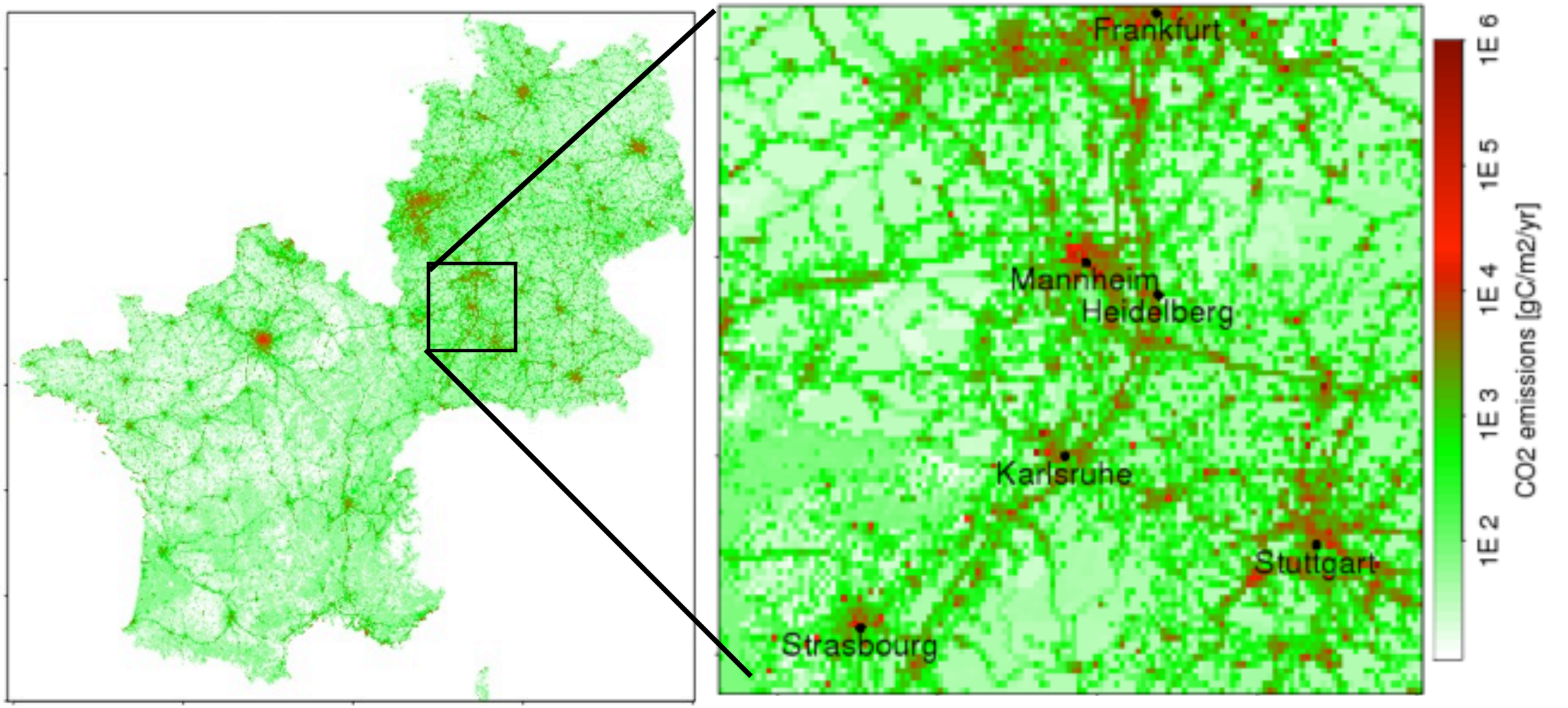
# synergy of tracers




# multi-species constraints

# Why regional?

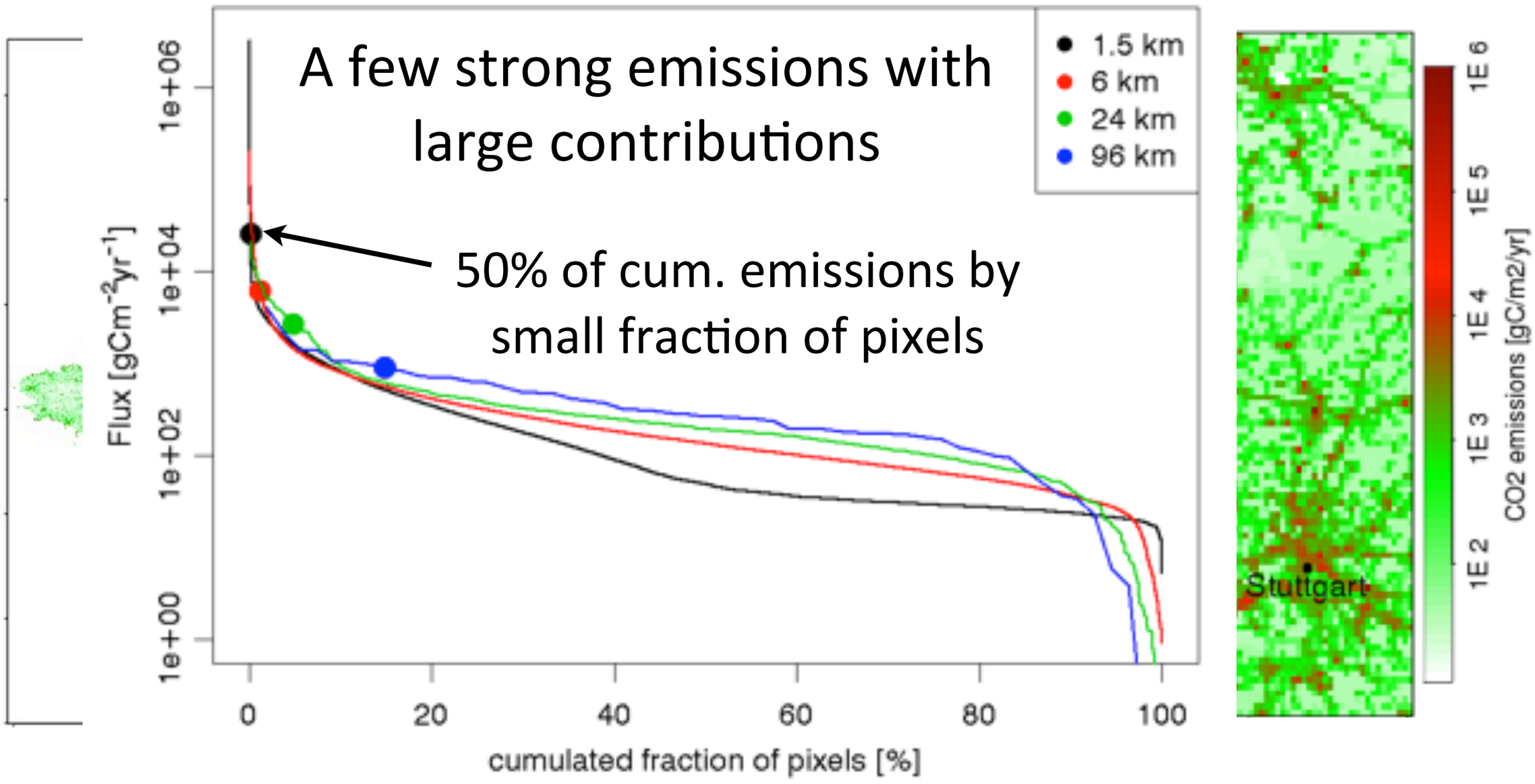
## Most anthropogenic emissions occur at small spatial scales




$CO_2$ emissions for Germany @ 1.5 km resolution (IER Stuttgart)

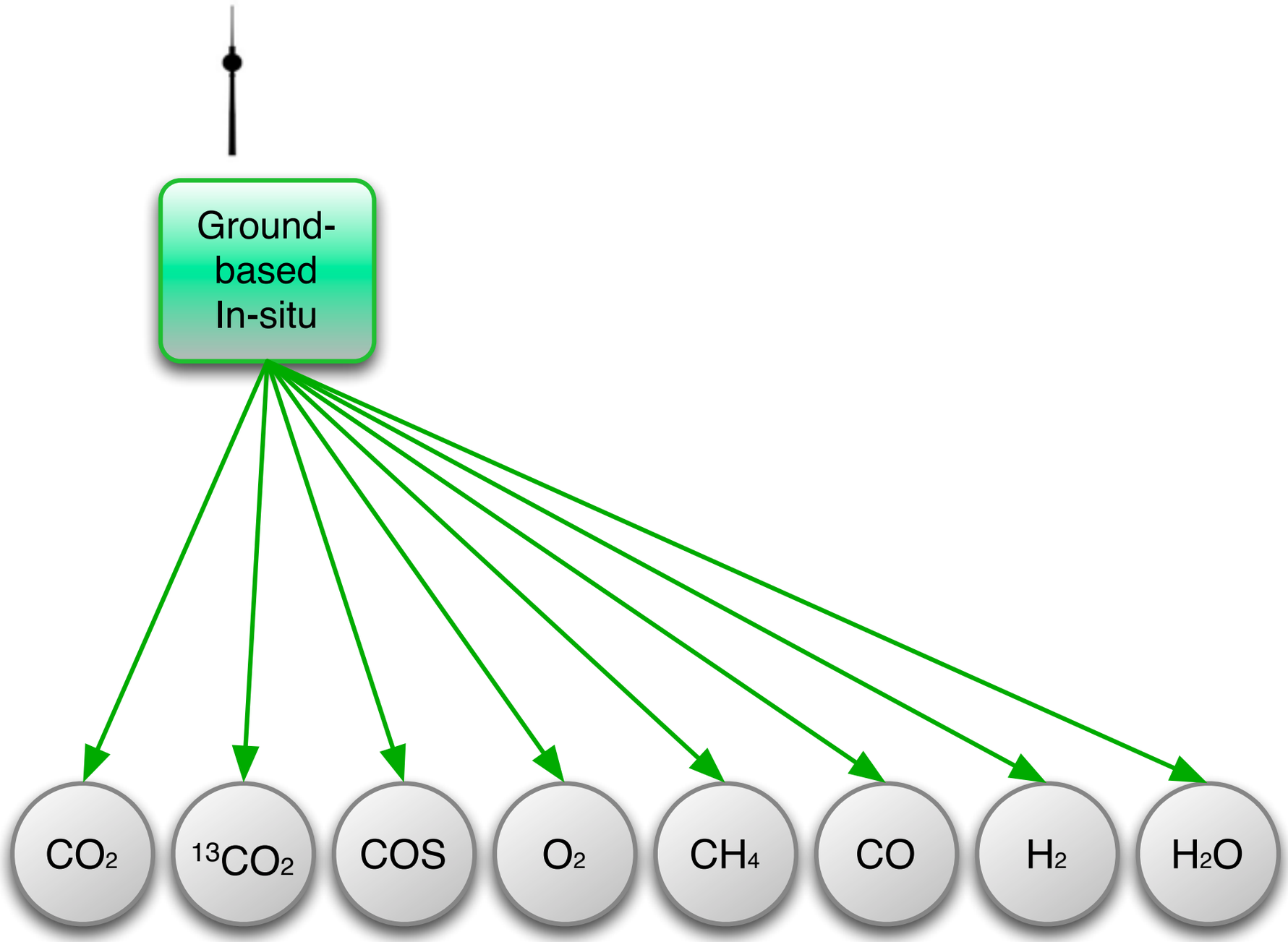
# Why regional?

## Most anthropogenic emissions occur at small spatial scales

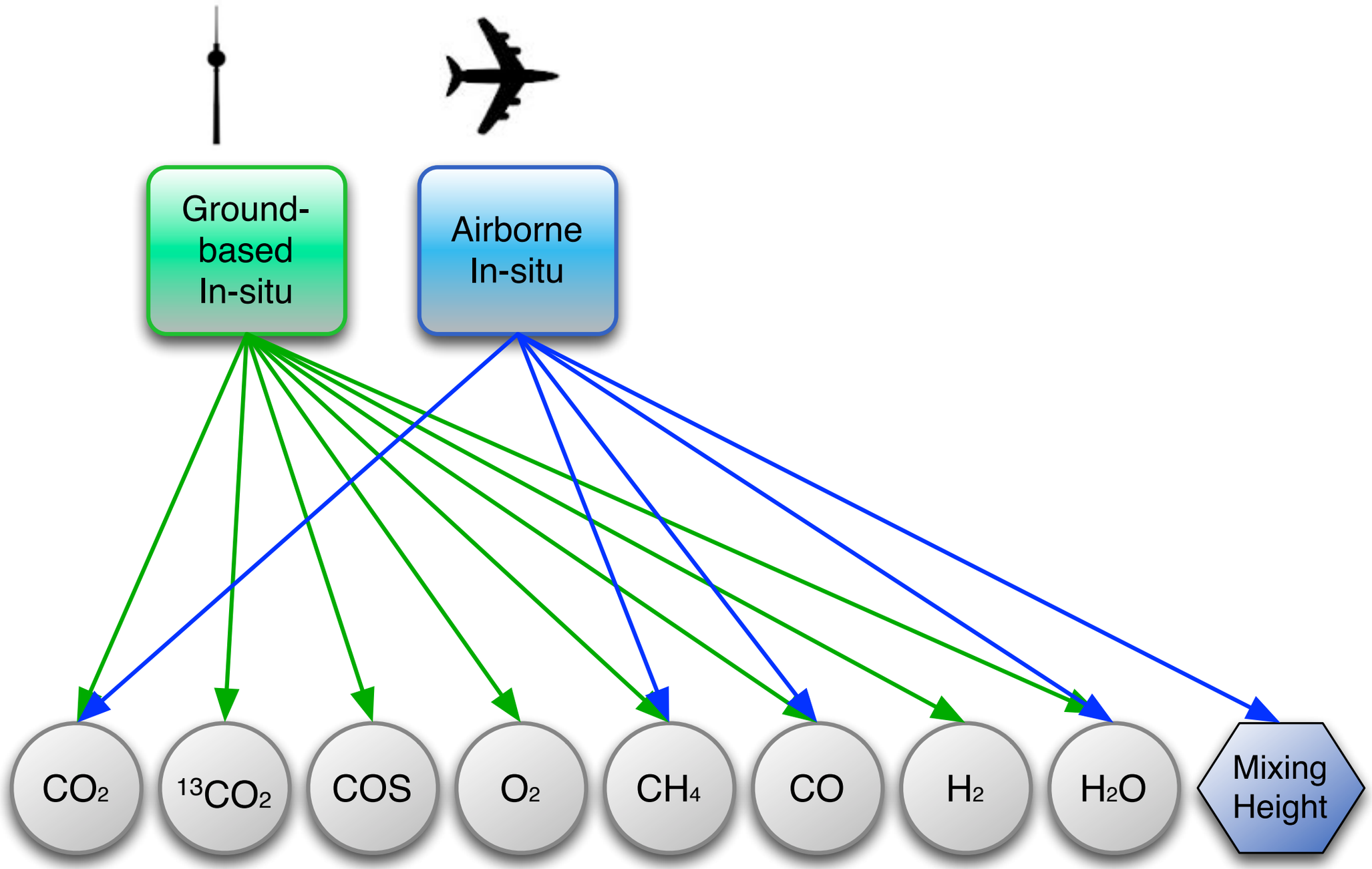



$CO_2$ emissions for Germany @ 1.5 km resolution (IER Stuttgart)

# Synergy of observing systems

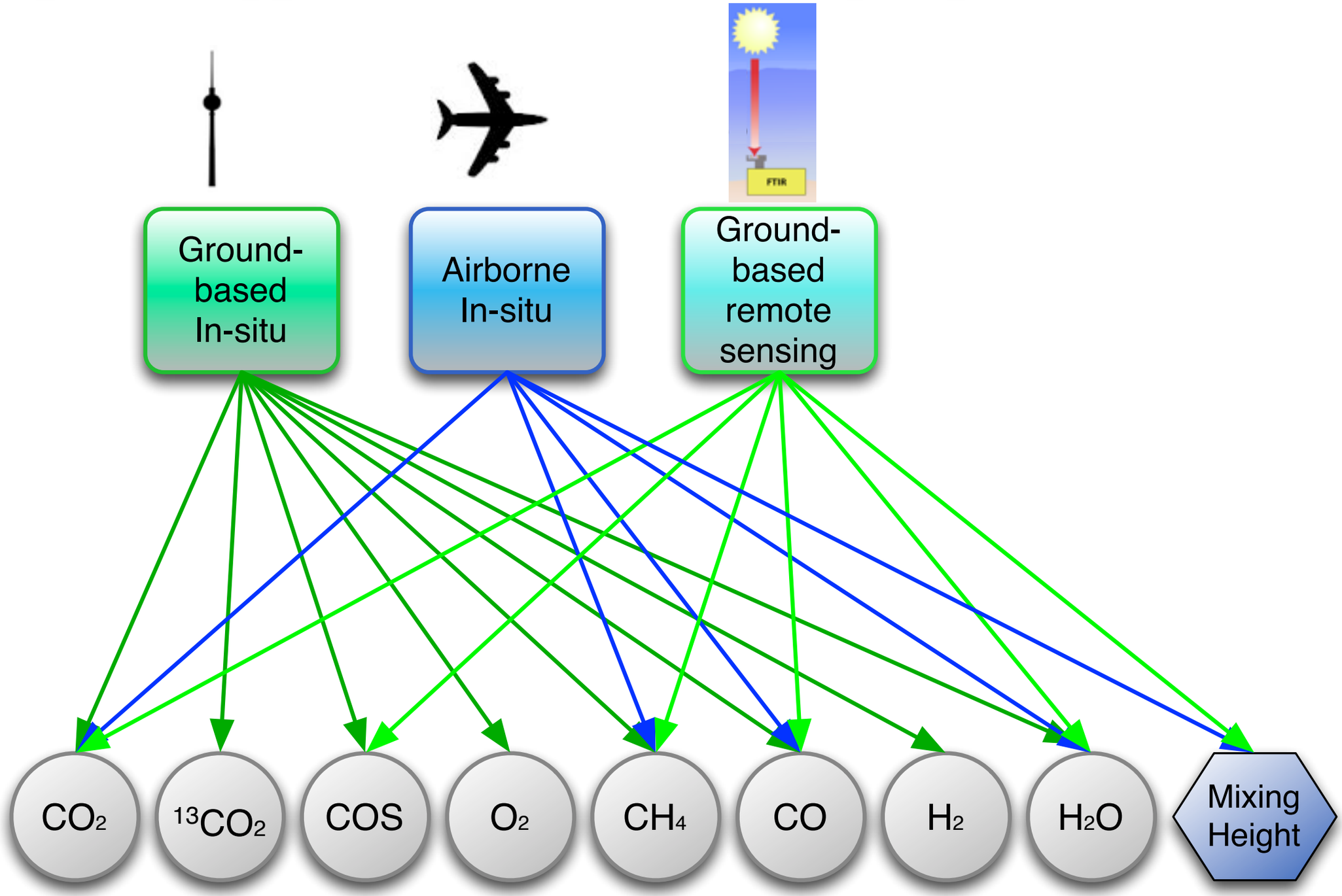


# Synergy of observing systems



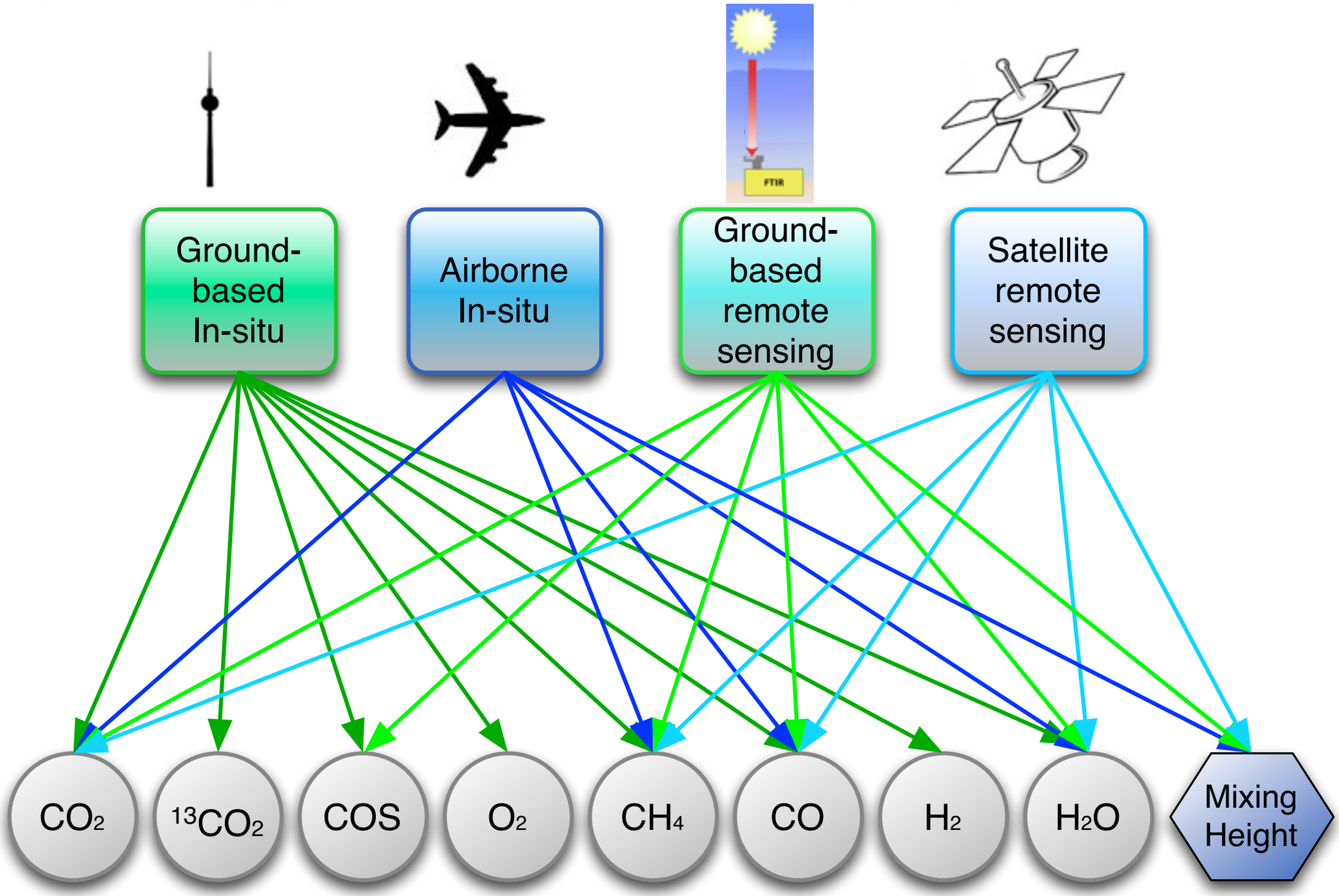

## multi-platform constraints

# Synergy of observing systems




# multi-platform constraints

# Synergy of observing systems




# multi-platform constraints

# Implementation steps

- Add fossil fuel emissions to „Unkowns“ in inversions
  - $CO_2$ + CO
  - emissions by fuel type, category, and species
  - increased resolution (from current 0.25 degree to 0.1 degree)
  - assumptions on a priori uncertainty covariances
  - assessment of required error distribution (Gauss vs. Poisson)
- Add additional observations
  - implementation of urban open path observations
  - implementation of near-urban column observations
  - Implementation of additional tracers (CH4, isotopes)