Norwegian Meteorological Institute
met.no MSC-W

uEMEP in the emep model
From regional to urban scales
AirQuip, Oslo, April 2017

Peter Wind

Local fraction

- The model computes the fraction of a pollutant that has its origin in each gridcell
- For a particular emitted pollutant and sector

$$Local\ fraction = \frac{Local\ pollutant}{Total\ pollutant}$$

Local fraction: time average

- The averaging must be done over the pollutants, not the fraction!

$$Local\,fraction = \frac{\sum Local\,pollutant(t)}{\sum Total\,pollutant(t)}$$

SR comparison

- Local fraction can also be computed by the «source-receptor method»: reducing the emission of one gridcell, and taking the difference.
- The SR method also include local pollutants leaving the gridcell and coming back
- Gives a robust method to compare with!

Method 1, local fraction update. **emissions**

Local emissions increase the local fractions

$$Local\,fraction\left(t+dt\right)=\frac{Local\,pollutant\left(t\right)+local\,emission\left(dt\right)}{Total\,pollutant\left(t\right)+total\,local\,emission\left(dt\right)}$$

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Method 2, local fraction update. **Advection**

Advection decreases the local fractions

$$Local\,fraction = \frac{(1-C) * localfraction * xn}{C * xn_{up} + (1-C) * xn}$$

xn: pollutant xn_{up}: upstream pollutant

C: Courant number = v*dt/dx

Method 3, local fraction update.
vertical diffusion

$$Local\,fraction = \frac{diffused\left(Local\ pollutant\right)}{diffused\left(Total\ pollutant\right)}$$

Method 4, local fraction update. **Chemistry, deposition, other**

$$Local\ fraction = Local\ fraction$$

We assume that the local and the non-local parts of the pollutant change in the same proportions

Applications

- Downscaling
- Different vertical profiles for local and background pollutants
  - Better modelling of depositions
  - Better estimation of surface concentrations (health effects)
- Better understanding of origin of pollutants

Generalization: Neighbor local fraction

- Contributions due to emissions in the neighboring gridcell
- Local pollutants from the neighboring gridcell i+1 are advected into gridcell i and accounted for separately
- Iterate neighbor's-neighbor...