Including satellite data in a regional methane inversion system: case study over Europe



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Distribution of methane emission sources over Europe decade 2003-2012







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Inverse Modeling

1st step

coarse

Full Period

Global Inversion

 f_1

✓ TM3 as a global coarse-grid 3-dimensional transport model (Heimann and Körner, 2003) is combined with the fine-scale regional Stochastic Time-Inverted Lagrangian Transport model STILT (Lin et al., 2003) using the CarboScope-Regional of Rödenbeck et al. (2009) to obtain high-resolution flux estimates.

coarse

coarse

Intermediate

step

Full Period

 $\Delta c_{mod_1} = A_{coarse}^{glob} f_1$

 $\Delta c_{mod_1,cis} = A_{coarse}^{reg} f_1$

POI



Assessment of Vertical Resolution

- To represent the column measurements in STILT:
- ✓ Integrated footprints for 10 days back trajectory
- They were divided into four different parts containing various numbers of release levels
- ✓ The planetary boundary layer (PBL) height computed by STILT is used to identify the first two division points and the others are set as 10 km and 19km.
- The vertical spacing of the release points were selected as 100, 500, 750, 1000 m for the lowest part to the highest based on sensitivity tests.



Regional atmospheric transport model

Satellite Retrievals







- We used the GOSAT product generated using SRON's Full Physics (FP) algorithm (SRFP v2.3.8) and also SRON's proxy GOSAT XCH₄ product (SRPR v2.3.9) for 2010-2015.
 - Parameters applied to the data for filtration: data quality flag, glint, and only the land data.
 - Number of soundings obtained from SRPR product is four times more than SRFP.

