

CRABONTRACKER EUROPE-CH4 INVERSE MODEL FOR INGOS PROJECT

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In this study, we present methane emission estimates from CarbonTracker Europe-CH4 (CTE-CH4) inverse model, developed for InGOS project. CTE-CH4 is a methane version of CarbonTracker model (Peters *et al.*, 2005). The model is based on ensemble Kalman filter based assimilation method, with focus on Europe and European boreal regions. The system uses the latest version of the atmospheric chemistry-transport model TM5 (Krol *et al.* 2005) as an observation operator, driven by the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA-Interim meteorological fields. The emissions estimates from biosphere (LPX-Bern 1.0: Spahni *et al.*, 2013), anthropogenic activities (Emission Database for Global Atmospheric Research version 4.2 FT2010, InGOS version), fire (Global Fire Emissions Database version 3.1), termites (Ito *et al.*, 2012) and ocean (Bates *et al.*, 1996; ECMWF ERA-interim), were used as informative prior emission estimates. For the flat prior inversion, no temporal and spatial variation is included in all of the prior emission estimates. The biosphere and anthropogenic emissions were optimized per week and region in the model. The regions were defined by TransCom and land-ecosystem maps. Measurements of atmospheric CH₄ from InGOS network is used to constrain emissions from

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Europe. Furthermore, discrete air sampling observations from NOAA's global cooperative air sampling network were used to constrain the emissions outside Europe. The results were compared with other models and UNFCCC, and validated by estimating atmospheric mole fractions using optimized emissions and compared with in-situ and aircraft observations within InGOS project.