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Methane emission from Western Siberia derived from the integral methane balance in the troposphere

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Although a number of estimates of methane emissions from large Earth regions have been proposed, based on either empirical or inverse transport modeling approaches, these emissions still remain highly uncertain motivating the development of new methods of surface flux assessment. In this study a new mathematical formulation for calculation of surface flux of methane, or any other gaseous component of the atmosphere, is developed. In it, the surface flux is retrieved from the integral balance of methane in bounded atmospheric domain. This balance includes the surface flux, the net advective flux through lateral boundaries of the atmospheric domain, methane sink due to oxidation by hydroxyl radical, and the rate of change of total methane amount in the domain.
Western Siberia, being on of the most prominent surface methane sources in Northern hemisphere, is used as a test region for the method. The components of methane balance are calculated using methane concentrations and wind speeds from MACC reanalysis at 1.125 deg. grid (http://www.ecmwf.int/research/EU_projects/MACC), and hydroxyl concentrations provided by (Spivakovsky, 2000). The total methane flux from Western Siberia is thus assessed at 6 h resolution for 2001-2011. The time averaged total flux corresponds well to empirical estimates (M Glagolev, 2011) at diurnal and annual timescales. It may be anticipated that the method will be useful in close future when the satellite-retrieved methane concentration profiles will achieve high accuracy.
References:
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