3.039 Seasonal variation of surface methane observed in North India: An investigation on the contributions of emissions and transport.

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Abstract:

It is not straightforward to connect CH_4 emissions from the surface with the total column amount (XCH_4) that is obtained from passive nadir-sensors such as TANSO-FTS/GOSAT, as discussed in Chandra et al. (ACP, 2017). To reduce the uncertainty in CH_4 emissions on a regional scale from inverse analysis, information of CH_4 vertical distribution is critically important especially in North India where deep convection driven by Asian monsoon circulation lift atmospheric CH_4 to upper troposphere in summer (Xiong et al., ACP, 2009). For that reason, we started weekly flask sampling in North India at Karnal (29.7N, 76.9E) in 2014, which was later moved to Sonepat (29.0N, 77.2E) in 2015. The CH_4 mole fraction in the collected air samples was measured at NIES by gas chromatography with a flame ionization detector (GC-FID) with the NIES 94 CH_4 scale. Both of the sampling sites are situated in the middle of rice paddy fields where the local CH_4 emission should be the highest in the summer monsoon season (August-September). However, the 4-years long record at those stations indicate that the CH_4 concentration is in winter (December-January). This seasonality in surface observations is opposite to that has been reported from GOSAT, showing peak in summer. Comparison with model simulation by ACTM developed in JAMSTEC suggests that the CH_4 builds up at the surface during the winter because of the slow loss rate of CH_4 in the whole northern hemisphere, in addition to the weak vertical and horizontal transport (Patra et al., JMSJ, 2016). It is noteworthy that chemical analysis of the sampled air indicates clear positive correlation between CH_4 and CO. Besides, trajectories suggest significant air subsidence over Karnal/Sonepat in winter. Complete picture of sources and transport of the CH_4 will be presented by combined analysis of air-sampling data, trajectories and model simulations.