Title:

Observation of CH4 at high Latitudes from Space by the French-German Climate Mission MERLIN

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Abstract

CH4 emissions and sinks are tightly coupled to the global climate system and the water cycle. A global warming in Arctic regions might foster the melting of permafrost soils which contain significant amounts of carbon in organic form which under anaerobic conditions might be converted to CH4 and partially released to the atmosphere. Large seasonal variations of methane concentrations are expected between 60N and 70N. There exist also very large deposits of CH4 as hydrates on ocean shelves that are vulnerable to ocean warming. Paleo records indicate that both processes can have important feedbacks in the climate system. For reducing uncertainties on the global methane budget and climate feedback, monitoring of atmospheric CH4 at high latitudes is therefore of paramount interest. We report on the mission MERLIN which is the French-German climate monitoring initiative on global observations of atmospheric methane (CH4). As a novel feature, the space instrument of this small satellite mission will be based on a pulsed lidar system for the measurement of spatial and temporal gradients of atmospheric CH_4 columns along the satellite sub-track. The lidar instrument permits all-season and all-latitude coverage as it is not relying on sunlight. Initial impact studies clearly indicate substantial reduction of the prior methane flux uncertainties in key observational regions when using synthetic MERLIN observations in the flux inversion experiments. Together with the data from current and forthcoming observational network and appropriate modelling and interpretative activities, MERLIN observations will allow to constrain further development of models of the terrestrial biosphere thus improve the projections of future trends in carbon sources and sinks particularly at high latitudes.