An assessment of natural methane fluxes simulated by the CLASS-CTEM model using a one box model of atmospheric methane

*Vivek Arora[1], Joe Melton[2], David Plummer[1]

1. Canadian Centre for Climate Modelling and Analysis, Environment and Climate Change Canada, Victoria, British Columbia, Canada, 2. Climate Research Division, Environment and Climate Change Canada, Victoria, British Columbia, Canada

The change in and the absolute magnitude of natural methane emissions from wetlands and fire, and soil uptake of methane, simulated using the CLASS-CTEM modelling framework, over the historical 1850-2008 period, are assessed by using a one box model of atmospheric methane burden. This one box model of atmospheric methane burden also requires anthropogenic emissions and the methane sink in the atmosphere to simulate the historical evolution of global methane burden. A reconstructed set of global anthropogenic methane emissions for the period 1850-2008 is used which is based on the harmonized RCP and EDGAR data sets. The methane sink in the atmosphere is represented using bias-corrected methane life times from the Canadian middle atmosphere model (CMAM). The resulting evolution of atmospheric methane concentration over the historical period compares reasonably well with observation-based estimates. The modelled natural emissions are also assessed using an inverse procedure where methane life times required to reproduce the observed year-to-year increase in observed atmospheric methane burden are calculated given the global anthropogenic and modelled natural emissions that we have used here. These calculated methane life times over the historical period fall within the uncertainty range of observation-based estimates. The present-day (2000-2008) values of modelled methane emissions from wetlands and fire, methane uptake by soil, and the budget terms associated with overall anthropogenic and natural emissions are consistent with estimates reported in a recent global methane budget that is based on top-down approaches constrained by observed atmospheric methane burden. The modelled wetland emissions increase over the historical period in response to both increase in precipitation and increase in atmospheric CO2 concentration. In the absence of this increase the simulated year 2008 methane concentration is about 130 ppb lower than observed compared to the case when wetland emissions increase over the historical period.

Keywords: Methane, Wetlands, Fire

