Attribution of spatio-temporal anomaly patterns of atmospheric CH_4 to emissions from wetlands and rice paddies

University of Leicester

Laimonas Zubas, Earth Observation Science Group, Dept. Physics & Astronomy, University of Leicester ***lz34@le.ac.uk***

Introduction

- The quantification of individual methane sources and sinks is still largely uncertain.
- Here a forward modelling method is developed to infer patterns in atmospheric CH_4 from the spatio-temporal distribution of the surface emissions factoring in the atmospheric transport by an atmospheric transport model (UK met office NAME model).
- These modelled patterns associated with the regional sources will, in the future, be compared to satellite observations to test the validity of the emission inventories. This will lead to inversions of surface methane fluxes

Methane

- Methane is an important anthropogenic greenhouse gas.

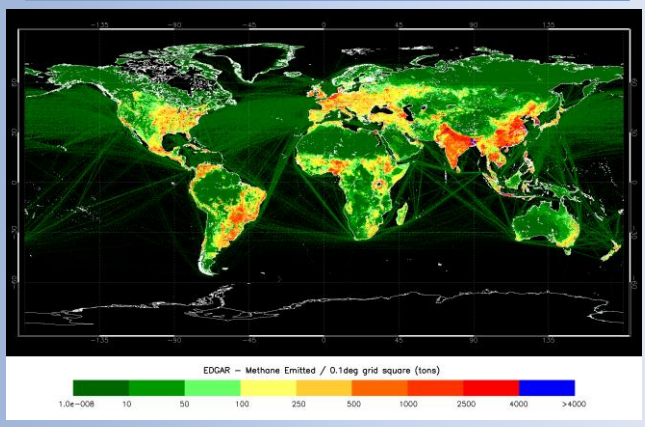


Figure 1. *EDGAR emission estimates in tons per grid square. For the year 2005.*

- Most of CH_4 is removed from the atmosphere by reaction with the hydroxyl free radical (OH)

$$OH + CH_4 \longrightarrow CH_3 + H_2O$$

- Mean atmospheric lifetime of ~12 years

NAME Model

- NAME is a UK met Office Lagrangian atmospheric dispersion model. The model works by releasing tracer particles into the model atmosphere driven by meteorological data from the UK Met office Unified Model.
- Can run in forwards or backwards mode.

Method

- The forwards modelling approach developed to test the general method is described here forth. The origin of the release was the location of the TCCON site in Park Falls, Wisconsin.

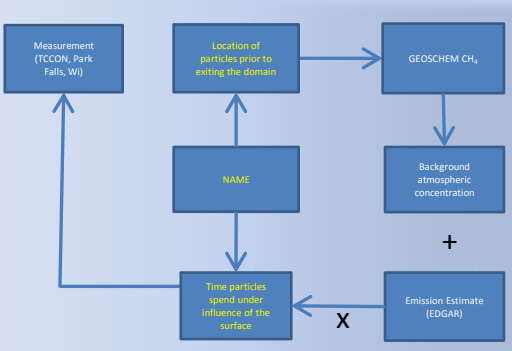
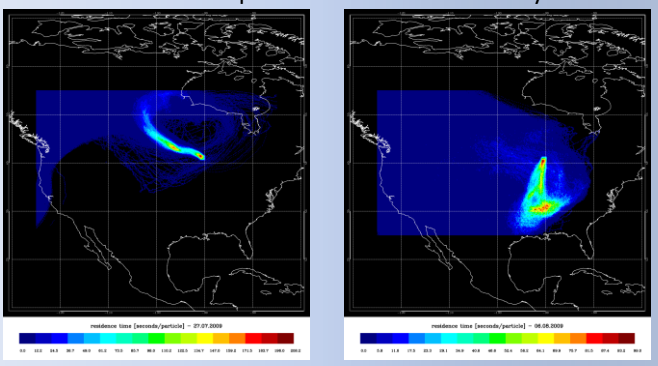
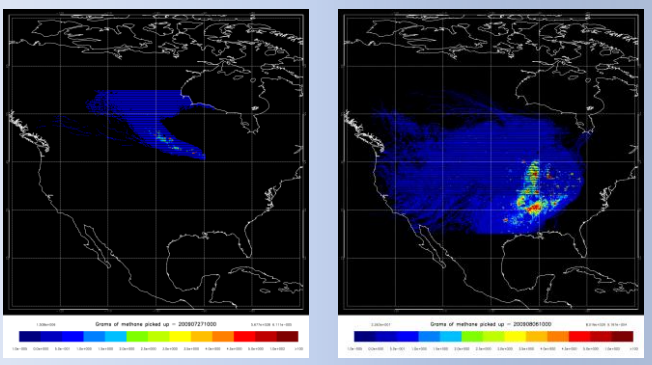


Figure 2 *The outline of the forward modelling approach used here to test the general method of using NAME to model emissions of methane*

1. Name model produces the time that the released particles spend under the influence of the surface. The model was run for 10 days in a backwards mode, for August 2009. The influence plots over the 10 days are shown for releases on 2 separate days to illustrate the different meteorological conditions the tracer particles were influenced by.



2. The surface influence matrix can be multiplied by the emission estimates to work out the mass of methane that would be picked up by the particles.



3. The total mass picked up added to the background can be compared to the measurement at the origin of the release to test the validity of the method. The results are preliminary and the method is still in development.

- This approach tests the NAME model and will lead to the development of an algorithm to invert the surface fluxes of methane in wetland and rice paddy regions.

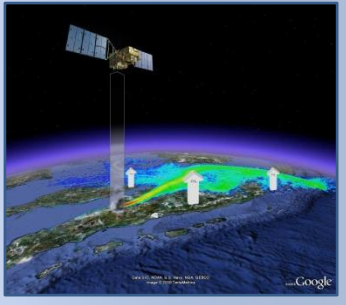


Figure 1 – Source: European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL). Emission Database for Global Atmospheric Research (EDGAR), release version 4.0. http://edgar.jrc.ec.europa.eu, 2009.