Introduction

The emissions of greenhouse gases from inland waters (e.g., rivers, streams, reservoirs, lakes, ponds, wetlands) are indeed significant and are comparable in quantity to the net uptake of anthropogenic carbon dioxide emissions by the terrestrial biosphere or the oceans (Bastviken et al., 2011). These emissions, however, do not appear in the “conventional” Carbon Cycle and have been underestimated in the Nitrogen Cycle (e.g., Intergovernmental Panel on Climate Change (IPCC) Assessment Report Four (AR4); Denman et al., 2007).

Emission estimates are not adequately constrained by measurements and as such are often quoted as conservative values, particularly for CH4 and N2O which have received far less attention than CO2 (Bastviken et al., 2011; Battin et al., 2009; Tranvik et al., 2009). Therefore, it is vital that we improve our knowledge of these emissions through both short and long-term measurement campaigns.

Measurement Approach

In situ measurements are the preferred approach as the spatial resolution of remote sensing and inverse modelling is generally too coarse for inland waters. During the Yenisey River Campaign, the flux will be determined through two different methods (see figure below): 1) Estimation of k and measurement of pGaswater and pGasair, and 2) Direct measurement of the flux using floating chambers. The flux and pGaswater, pGasair measurements will then be used to estimate k.

Analysis and Future Directions

The results from the Yenisey campaign will utilised for the following:

- Baseline estimate of Yenisey River GHG exchange. This estimate may be extrapolated in combination with other results to provide regional or global estimate (e.g. Cole et al., 2007; Tranvik et al., 2009).
- Assessment of mechanisms controlling the flux.
- Modelling future GHG exchange in response to climate change feedbacks, change in hydrology, human perturbation of inland waters, etc.
- Biogeochemical assessment of the river, in combination with results of other research groups.

The campaign will also be used to evaluate the measurement technique, and if successful, it will be applied to similar measurement campaigns in the tropical inland waters of northern Australia.

Emissions Unaccounted For

CO2 and CH4: It has been estimated that emissions from inland waters contribute a net CO2 flux of approximately 1.4 Gt C yr−1 to the atmosphere (Tranvik et al., 2009).

Combined with CH4 emissions of 0.65 Gt C (CO2-eq) yr−1, this is equivalent to 79% of uptake by the terrestrial biosphere (2.8 Gt C yr−1) or approximately 20% of all anthropogenic CO2 emissions (Bastviken et al., 2011; Canadell et al., 2007).

N2O: Beaulieu et al. (2011) estimated that rivers and streams alone emit an amount of N2O equivalent to 10% of the global anthropogenic N2O emissions, which is 3 times greater than that estimated by the International Panel on Climate Change.