Role of ICOS atmospheric and ecosystem observations in understanding regional GHG budgets

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Atmospheric greenhouse gas (GHG) observations play an important role not only for understanding the atmospheric composition, but also GHG budgets. Since local GHG flux measurements do not have large enough spatial representability to quantify global to continental or even country scale fluxes, modelling approaches are needed. These approaches include atmospheric inverse models, which are able to estimate GHG sources and sinks from regional to global scales. In these models, information on flux magnitudes, spatial distributions, trends and seasonal cycles are inferred from atmospheric GHG observations.

ICOS has increasing number of measurement stations both for atmospheric concentrations and ecosystem fluxes. Together with atmospheric inverse models, the information from these observations will be essential for understanding regional and global GHG budgets. ICOS Carbon Portal and Norwegian ICOS have implemented the atmospheric inverse models to provide annual updates on CO_2 budgets at European and national scales. Such information can be useful for scientific community, e.g. for evaluation of process models, and also for the political decision makings. Most recent IPCC Refinement addressed the need of independent evaluation of national inventories using atmospheric inverse models.

In this talk, we present an example study of methane (CH_4) budget estimates from the CarbonTracker Europe-CH_4 atmospheric inverse model, where the ICOS atmospheric CH_4 observations, together with global observations, were used to constrain regional and global CH_4 fluxes. Among these, observations from Pallas, Finland, have been used in various global atmospheric inverse models, but other Nordic ICOS sites are relatively new or have not been previously used in such modelling approaches. Therefore, effects of these observations in estimation of the fluxes will be examined by comparing estimates from inversions with and without assimilating these new observations. In addition, the wetland emission estimates for northern Europe will be evaluated using eddy covariance measurements from ICOS ecosystem sites.