Atmospheric inversions of greenhouse gas fluxes: A story of uneven development

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Atmospheric inversion is a technique for estimating the fluxes of tracers (here greenhouse gases) given observations and a model of atmospheric transport. The dominant methodology is Bayesian inference in which a model of atmospheric transport is combined with prior information and observations. Bayesian inference describes all input quantities as probability distributions. The methods differ in how they describe their inputs and the technique for constructing the posterior distribution. In this talk I will outline the current state of development of each of these inputs. I will argue that this development has proceeded unevenly. For much of their history inversions were limited by the sparsity of observations. The advent of increasingly accurate and dense satellite measurements has changed this so that the chief weakness is now the atmospheric models. I will sketch some possible remedies for this state of affairs.