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Tracer correlations and PDFs as touchstones for CCM validation

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Chemistry-climate models (CCMs) require verification against observations. A model performing well in its climatology of the recent past provides us with some confidence applying the same model for climate projections. Unfortunately many observational records of trace gases are still relatively short, inhomogeneous and spatially biased. This creates a challenge for the amalgamation of model and observational data. Two possible solutions already exist. To run a CCM with observational constrains over the observational period, or to extract statistical information describing an underlying process that is only weakly influenced by day-to-day variability which might differ between a free running model and observations. Focusing on the latter we will briefly discuss tracer-tracer correlations and in more detail the potential of tracer probability density functions (PDFs). In particular we will demonstrate how height resolved N2O PDFs can be used to reveal many aspects of observed and modelled transport and how they can help to guide further CCM development.