A Zonally Averaged Global Transport model for Long-lived Trace Gases

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Quantifying global emissions of non-CO_2 greenhouse gases and ozone depleting substances using atmospheric measurements of their abundance is important to understand the environmental impacts of these gases and to monitor compliance with international protocols. The large number of gases of interest – for example clorofluorocarbons (CFC), hydrofluorocarbons (HFC), perfluorocarbons (PFC) – requires atmospheric modelling that is faster and more simplified compared to that of the three major greenhouse gases. Currently, emissions are mainly quantified using simplified box models of atmospheric transport, which neglect the interannual variability in atmospheric large-scale dynamics that is known to impact emissions estimates. Here we propose a two-dimensional model of atmospheric transport, which considers transport variability on a monthly timescale, to improve measurement-derived estimates of emissions. These estimates could lead to more accurate emissions reporting, for example through the Scientific Assessment of Ozone Depletion.

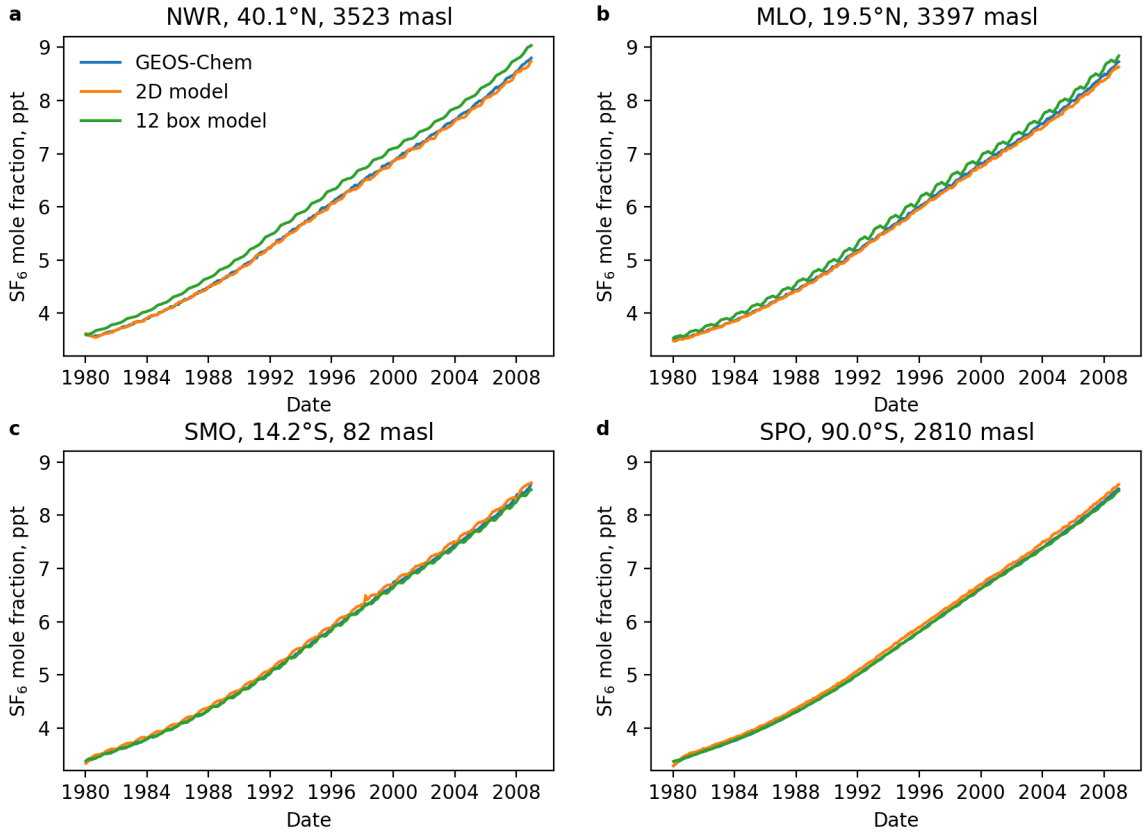

Figure 1. A comparison of the model output of sulfur hexafluoride (SF_6) mole fraction from the 3D transport GEOS-Chem, the new 2D model and a 12-box model at four NOAA site locations.