Using Observations of SF_6 to Examine Inter-annual Variations in Inter-hemispheric Exchange

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With a long atmospheric lifetime (~850 yr) and no known tropospheric or stratospheric loss processes, sulfur hexafluoride (SF_6) is useful as a tracer of large-scale atmospheric transport. We derive an inter-hemispheric exchange time, τ_{ex}, from surface measurements of SF_6 from two independent sampling networks and a 2-box model. The two sampling networks involve different sampling densities (12 and 38 sites, respectively) and separate analytical systems, linked to the same calibration scale. The mean exchange time derived from the lower-density network observations is ~7% higher than that derived from the higher density network from 2004-2012, and differs substantially in 2003 and 2012 (Figure 1). These differences could be related to sampling density and location, since the lower density network includes four high-altitude sites and the higher density network contains only marine boundary layer sites. Inter-annual variability in τ_{ex} shows some correlation with climate drivers (such as El Niño Southern Oscillation): higher τ_{ex} (slower exchange) during El Niño periods, and lower τ_{ex} (faster exchange) during La Niña. We will explore how differences in sampling networks influence the derived quantity, τ_{ex}.

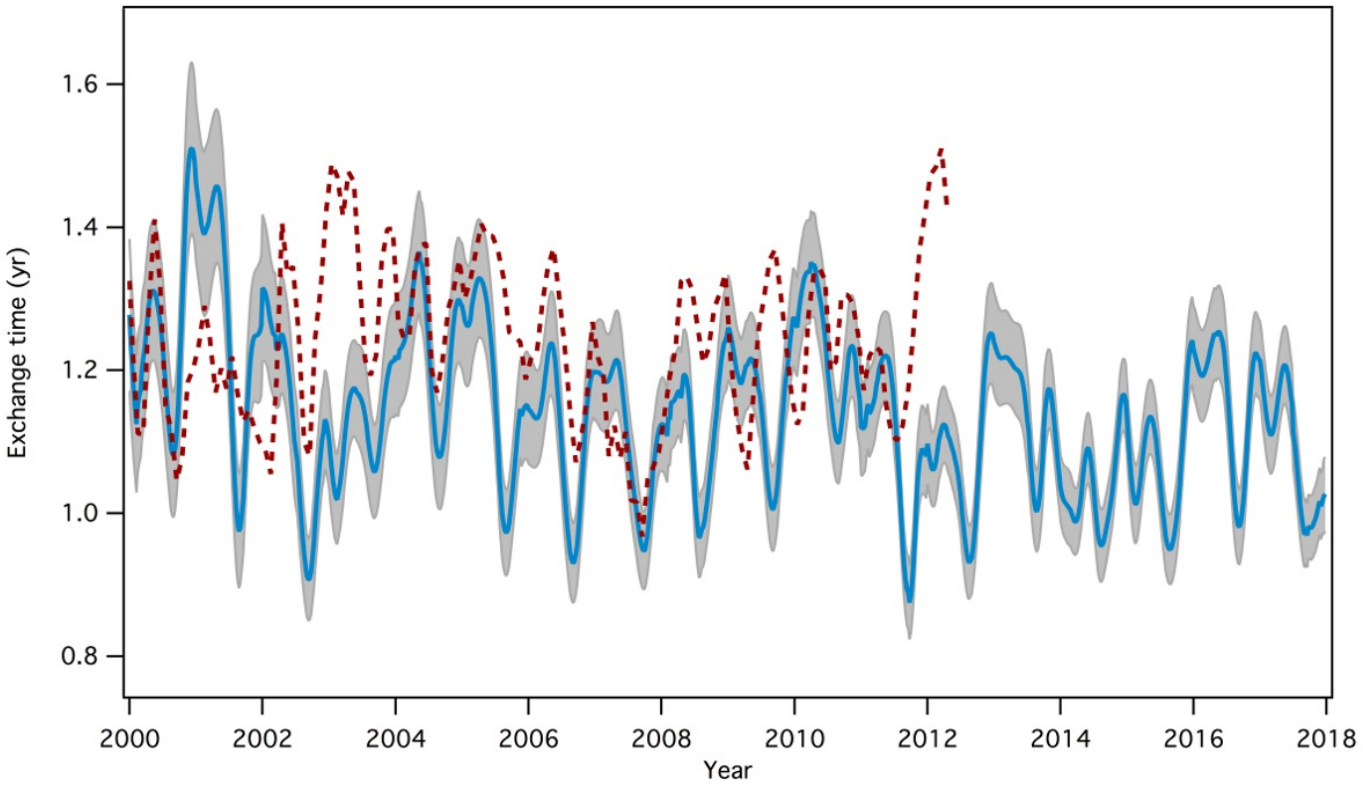

Figure 1. Inter-hemispheric exchange time derived from two independent SF_6 observing networks: 38 marine boundary layer sites (solid line with gray shading, ~1-sigma uncertainty band) and 12 sites (dashed line), assuming a source distribution of 97% Northern Hemisphere, 3% Southern Hemisphere.