Constraints on Air-sea Fluxes of Carbon and Heat from Measurements of Atmospheric Potential Oxygen

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Despite its importance to the climate system, the ocean meridional transports of carbon and heat are still poorly quantified. We identify a strong link between the northern hemisphere deficit in atmospheric potential oxygen (APO) and meridional ocean transports using atmospheric data and ocean interior inversions. Novel observations of the HIAPER Pole-to-Pole Observations (HIPPO) aircraft campaign reveal a northern APO deficit in the troposphere of -8 per meg, double the value at the surface and more representative of large-scale air-sea fluxes. We evaluate the hemispheric asymmetry in air-sea fluxes necessary to explain the observed APO. We find that air-sea carbon dioxide fluxes commonly used as priors for atmospheric inversions underestimate the ocean uptake in the north, which could in turn translate into biases in the latitudinal attribution of land sinks.

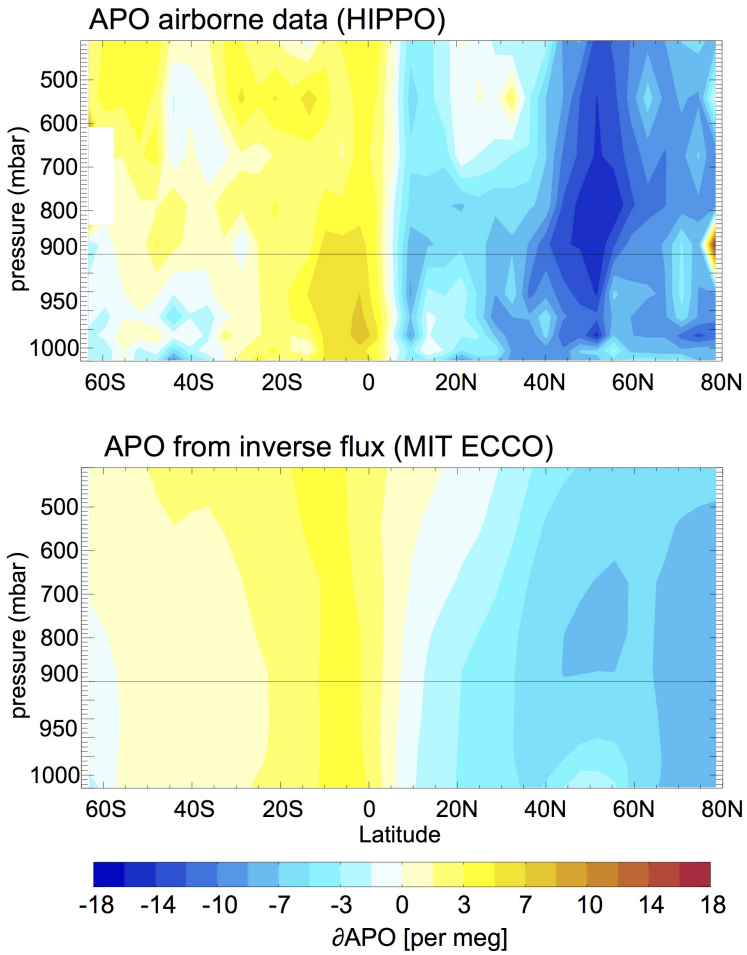

Figure 1. Hemispheric asymmetry in atmospheric potential oxygen in the troposphere as sampled during the HIPPO campaign (top) and predicted with a current ocean prior (bottom). The hemispheric asymmetry is underestimated in the prior, revealing the underlying underestimation of the ocean carbon uptake in the north.