A wide-angle photograph of an Antarctic landscape. In the background, there are large, rugged mountains covered in snow and ice. The middle ground shows a vast expanse of blue water with scattered ice floes. In the foreground, a red research ship is visible on the water. The sky is clear and blue.

Evidence that Palmer Station Antarctica Seasonal O₂ and CO₂ Cycles Understate Regional Marine Boundary Layer Means

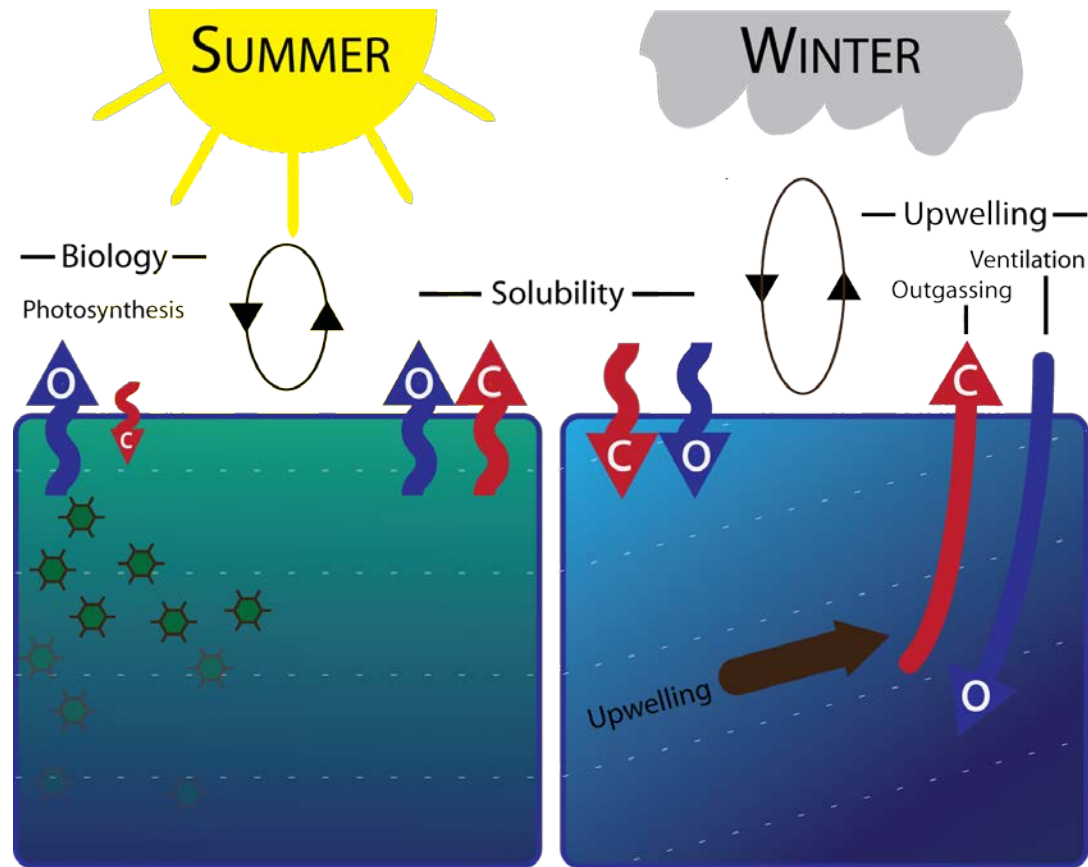
Jonathan Bent

NCAR Earth Observing Laboratory

Contributions from: Britt Stephens, Ralph Keeling, Sara Mikaloff Fletcher, Prabir Patra,
and ocean modelers enumerated later

Atmospheric Potential Oxygen

- $APO \approx O_2 + 1.1 * CO_2$
- Effectively removes land biosphere influence on C cycle
- Reinforcing signals in O_2 especially useful in open-ocean Southern Hemisphere regions
- Reported in “per meg”, equivalent to per mil, but multiplied by 10^6
- 1 ppm is ~ 5 per meg



Potential evidence that PSA measurements are not capturing seasonal amplitude

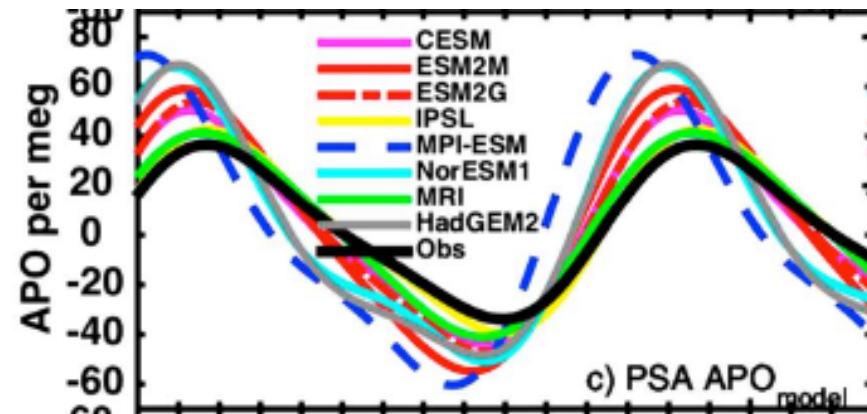
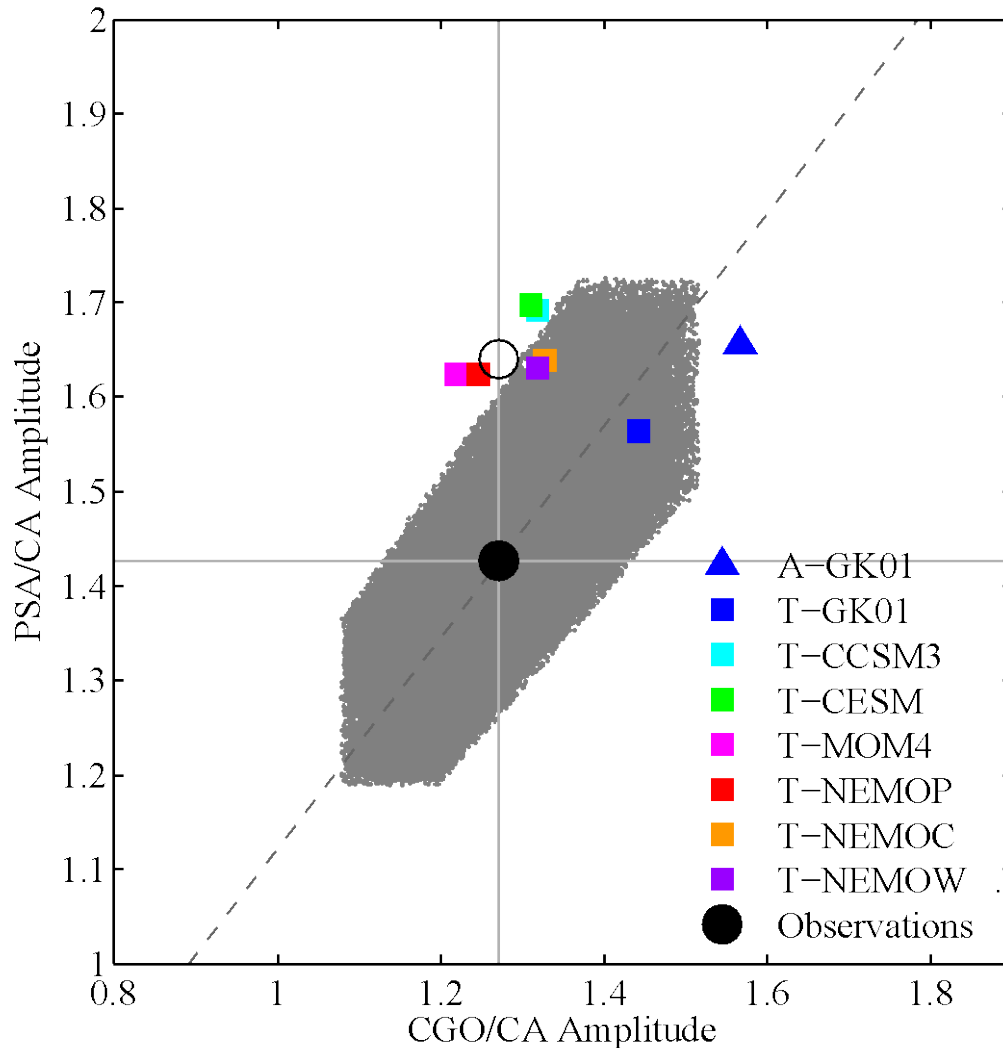
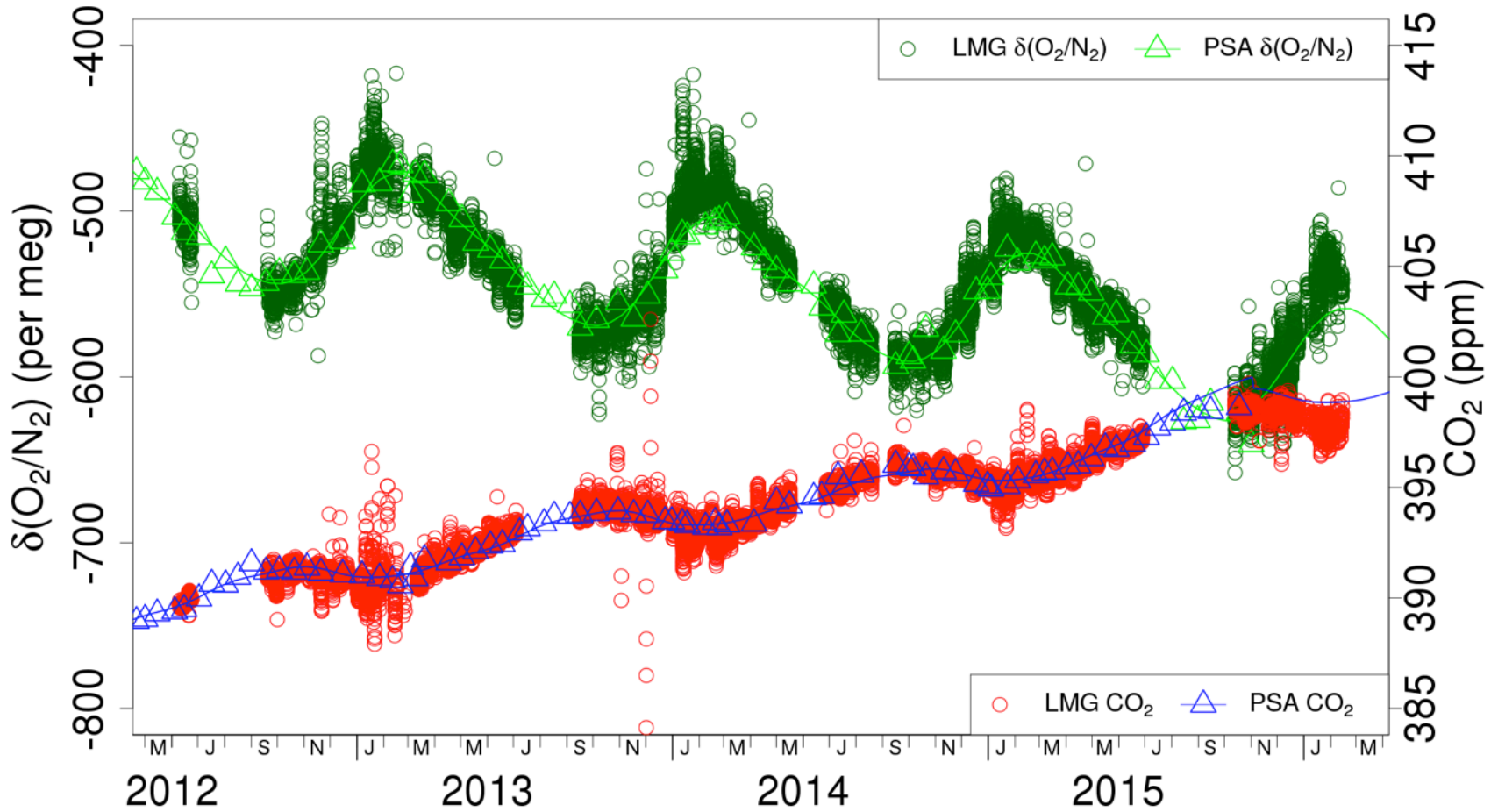


Figure 1. APO mean annual cycle for 1997–2004 simulated by GEOS-Chem forced with air-sea fluxes from eight CMIP5 models. Heavy black line shows the SIO mean annual APO cycle, (a, b) South Pole, (c, d) Palmer Station, and (e, f) Cape Grim. Note the different Y axis scale for the middle panels. (Figures 1a, 1c, and 1e) GEOS-Chem forced by CMIP5 O₂, N₂, and CO₂ air-sea fluxes. (Figures 1b, 1d, and 1f) Same as left, except the CMIP5 CO₂ fluxes are replaced with climatological air-sea CO₂ fluxes [Takahashi *et al.*, 2009].

Nevison, 2016 GRL

Gould O2 Data



How Palmer Compares against other latitudes

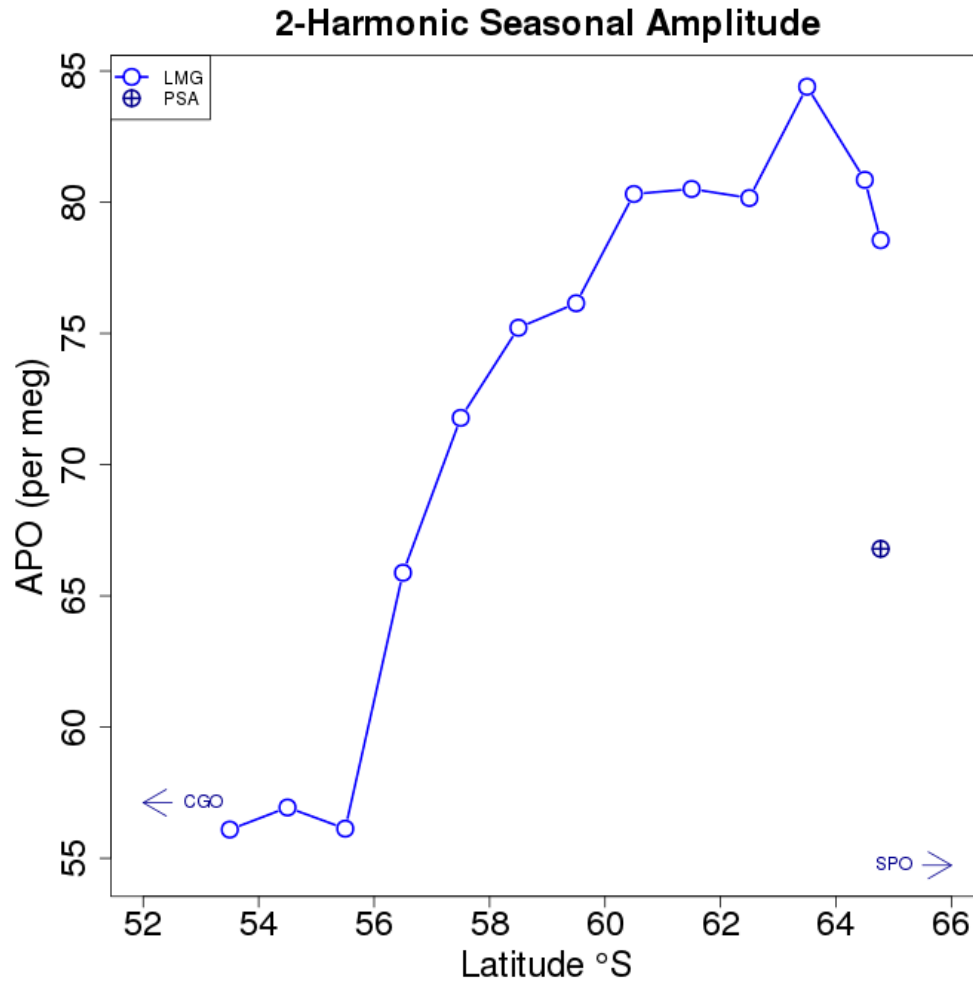
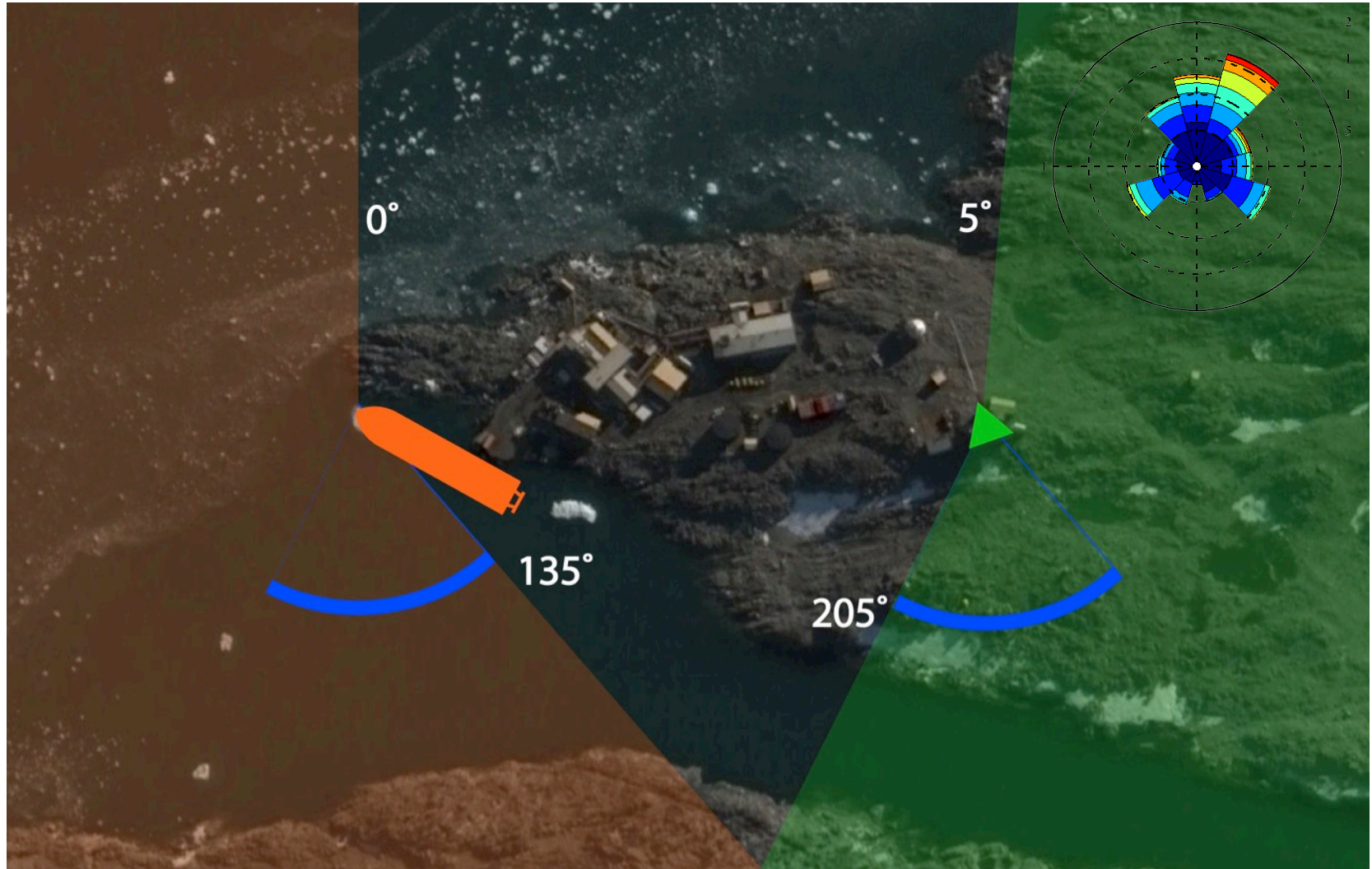
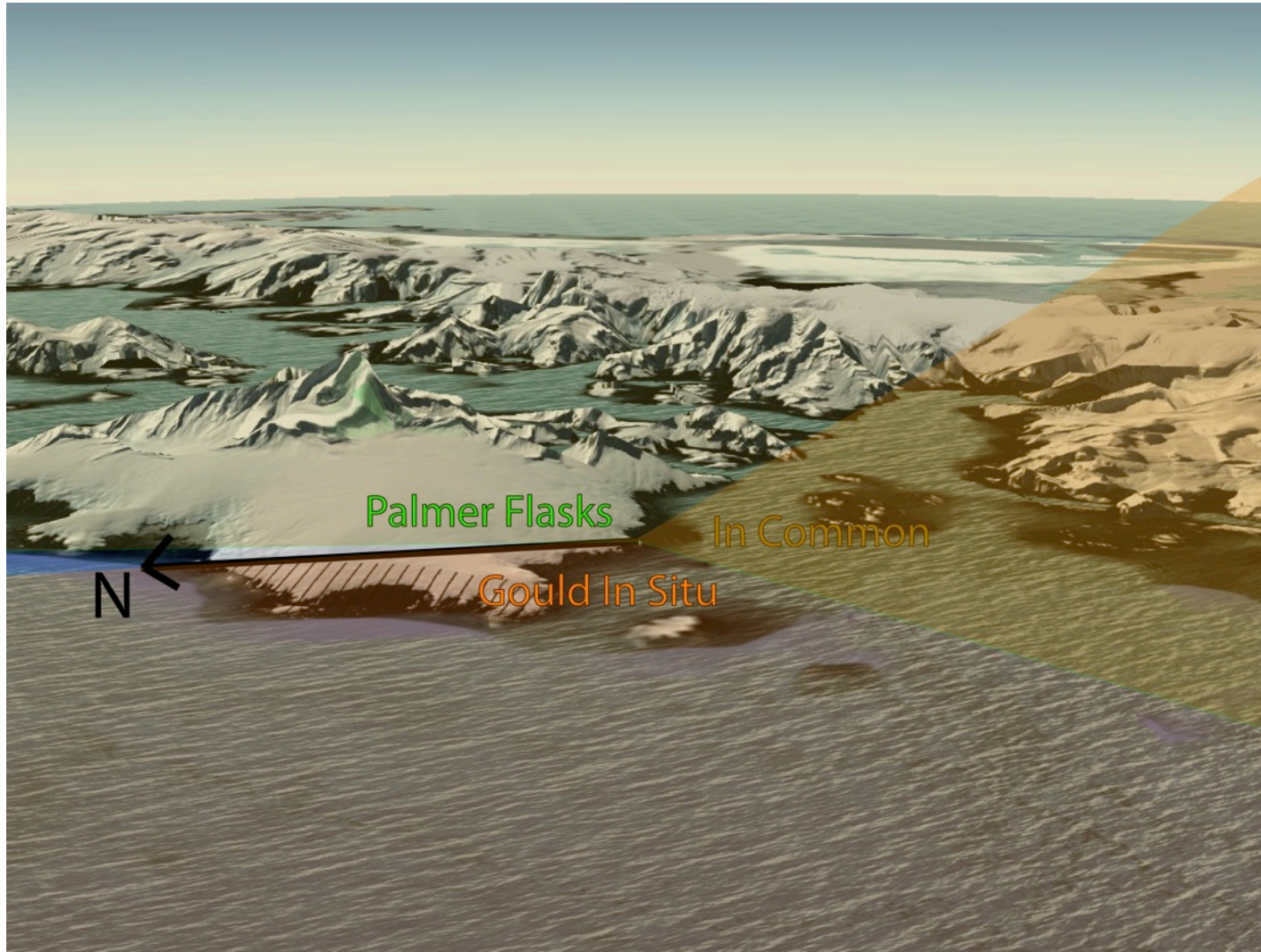


Figure: B. Stephens

Spheres of wind influence

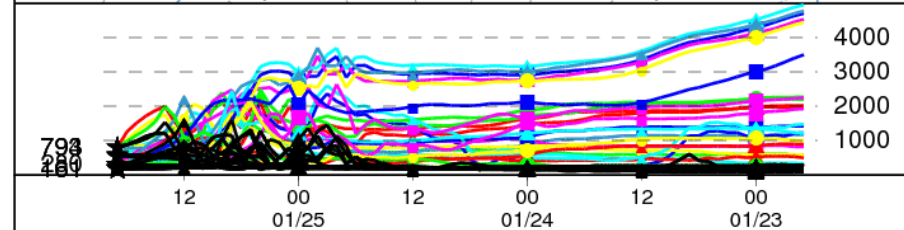
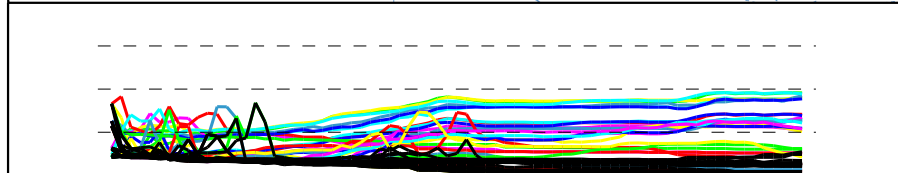
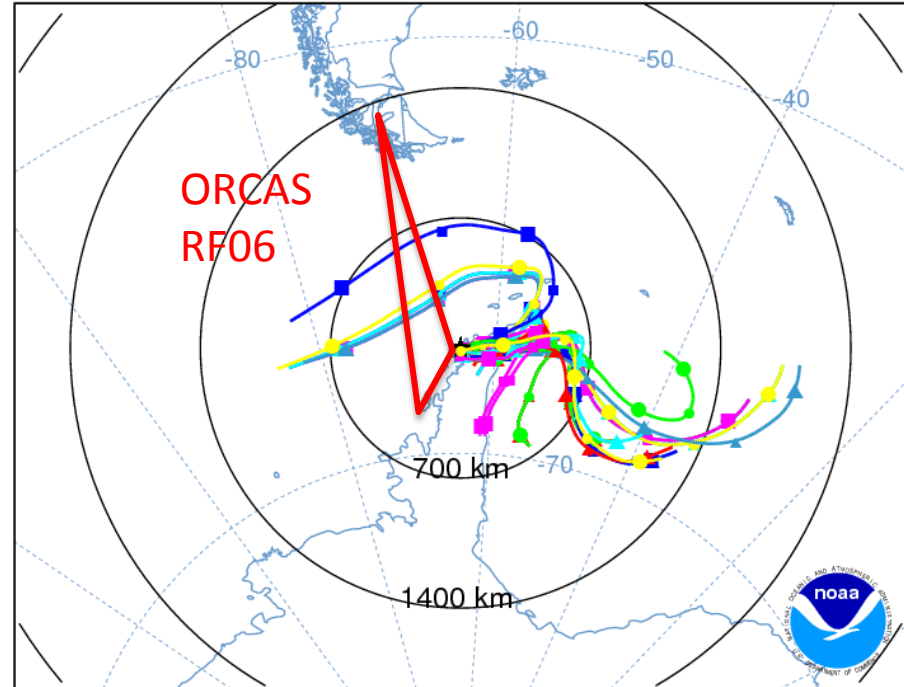
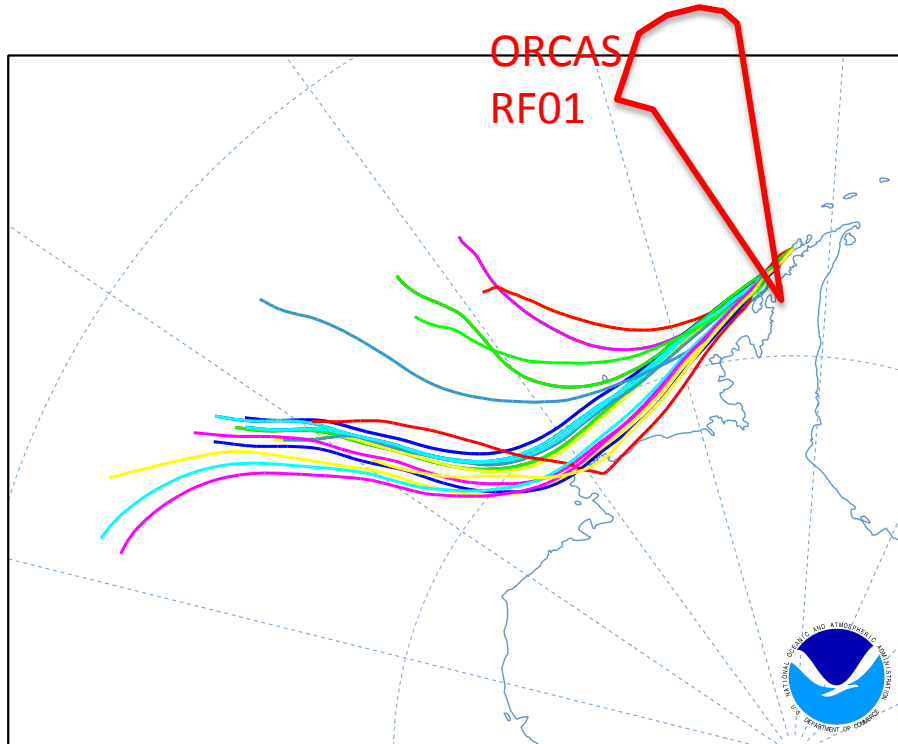


Why does it matter if air is coming from E or W? Topography



HYSPLIT back trajectories

NOAA HYSPLIT MODEL
 Backward trajectories ending at 1900 UTC 25 Jan 16
 GFSG Meteorological Data



Job ID: 13734 Job Start: Mon Mar 28 16:33:13 UTC 2016
 Source 1 lat.: -64.774300 lon.: -64.052900 height: 5 m AMSL

Trajectory Direction: Backward Duration: 72 hrs
 Vertical Motion Calculation Method: Model Vertical Velocity
 Meteorology: 0000Z 25 Jan 2016 - GDAS0p5

Gould O2 Data

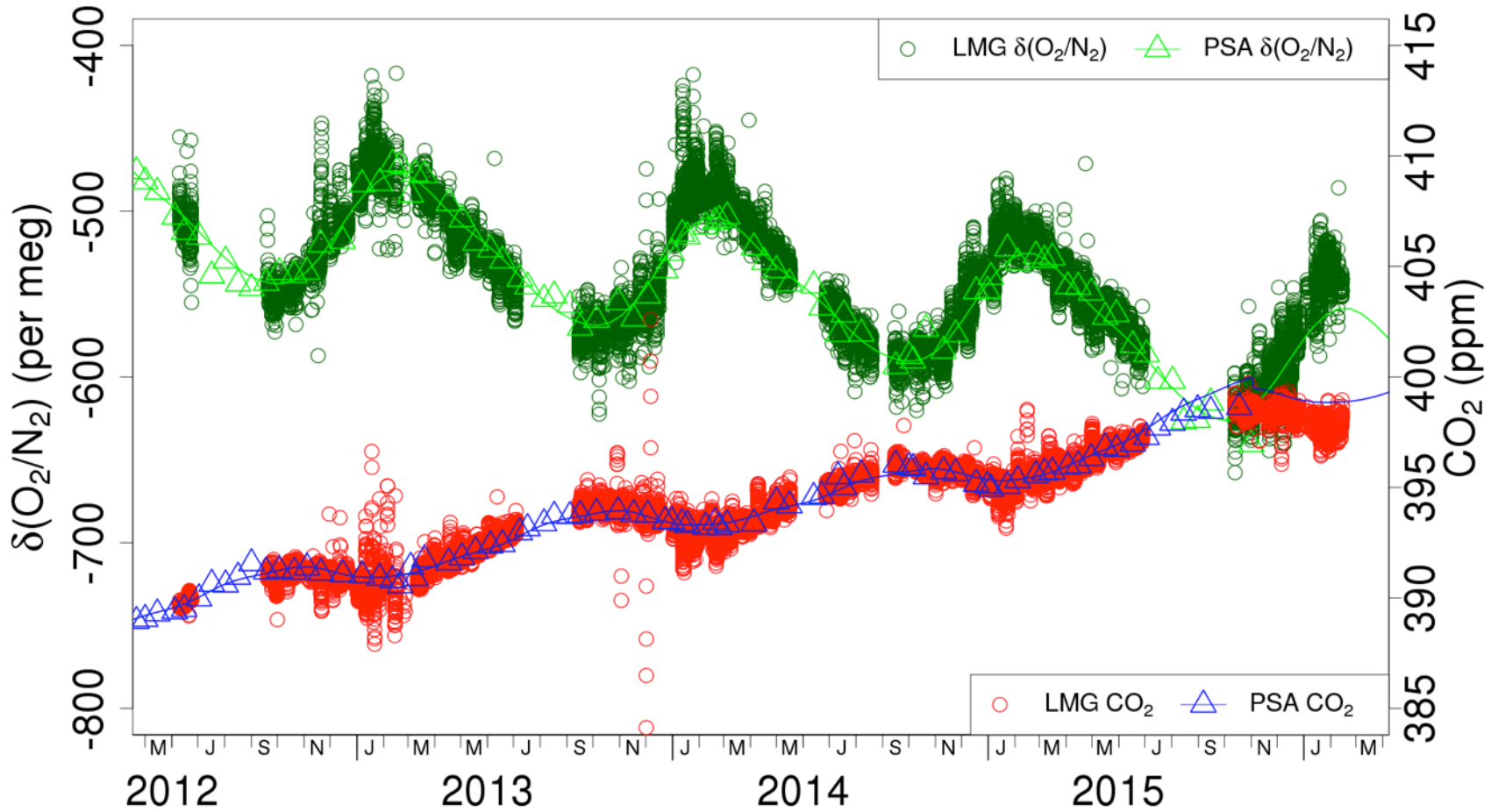
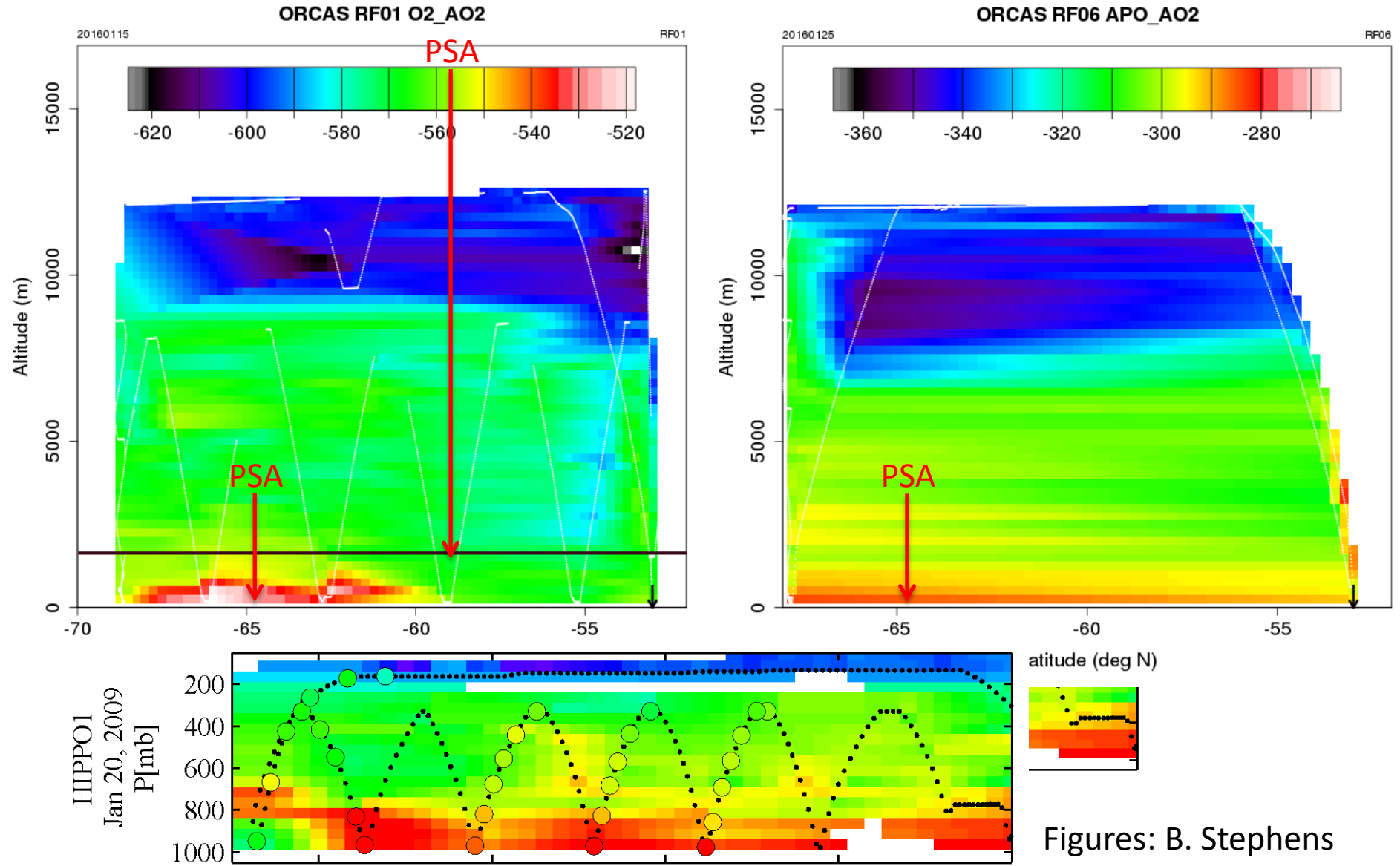


Figure: B. Stephens

SO Seasonal Atmospheric Vertical Mixing



Figures: B. Stephens

Future steps with PSA

- Comparisons of CESM output at source regions for Gould and flask data
- STILT simulations for Influence Functions
- Determining how to adjust methods or measurements to make models and data comparable

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