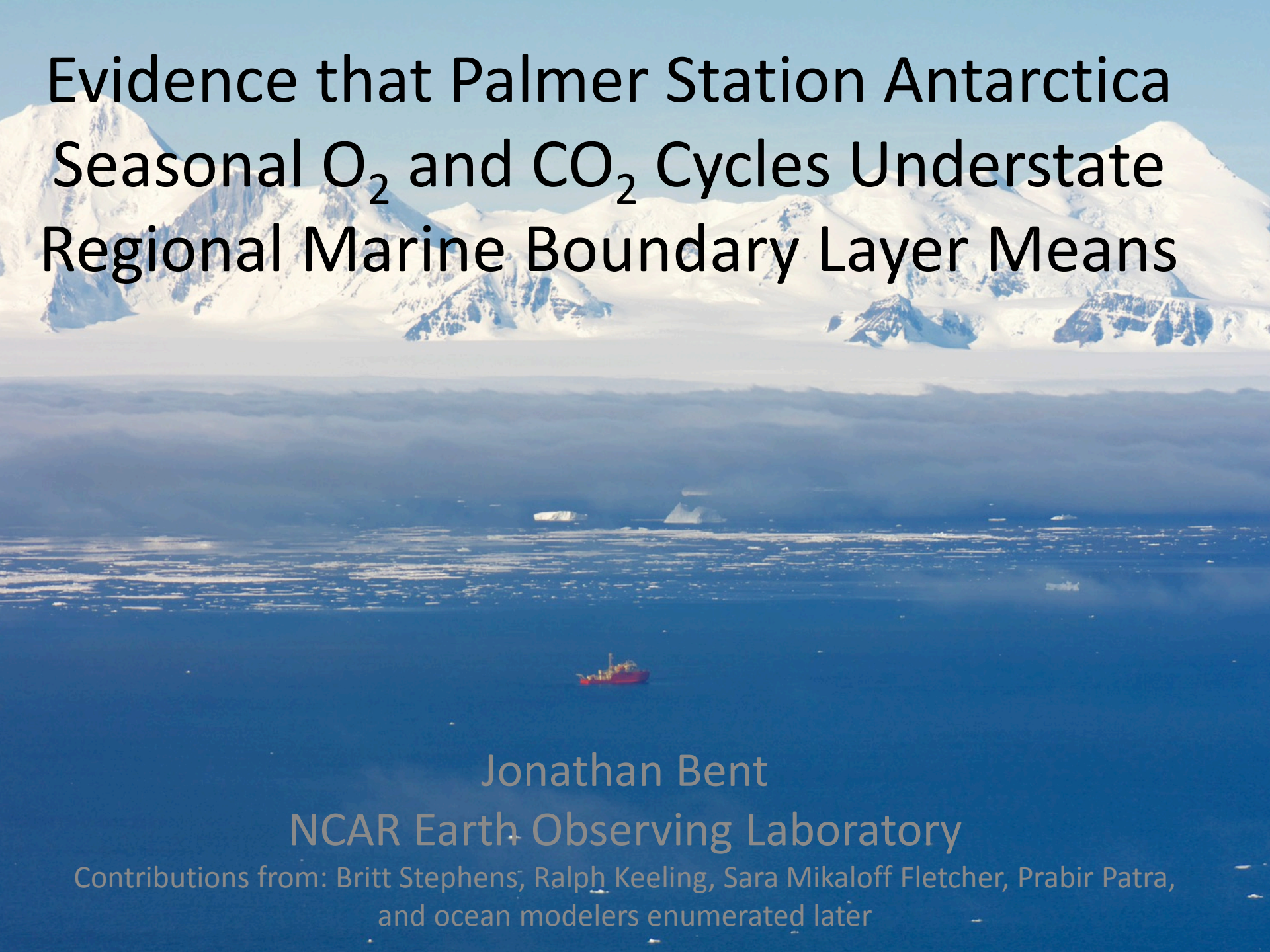
# Evidence that Palmer Station Antarctica Seasonal $O_2$ and $CO_2$ Cycles Understate Regional Marine Boundary Layer Means



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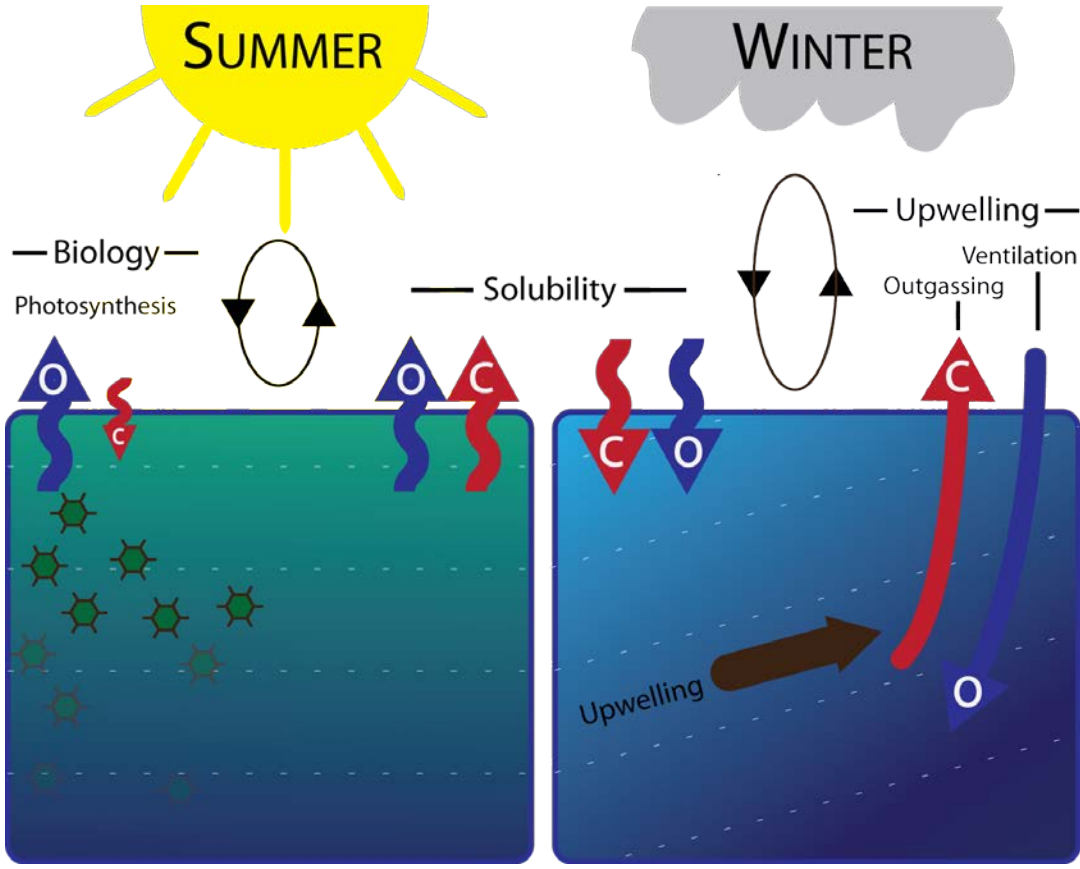
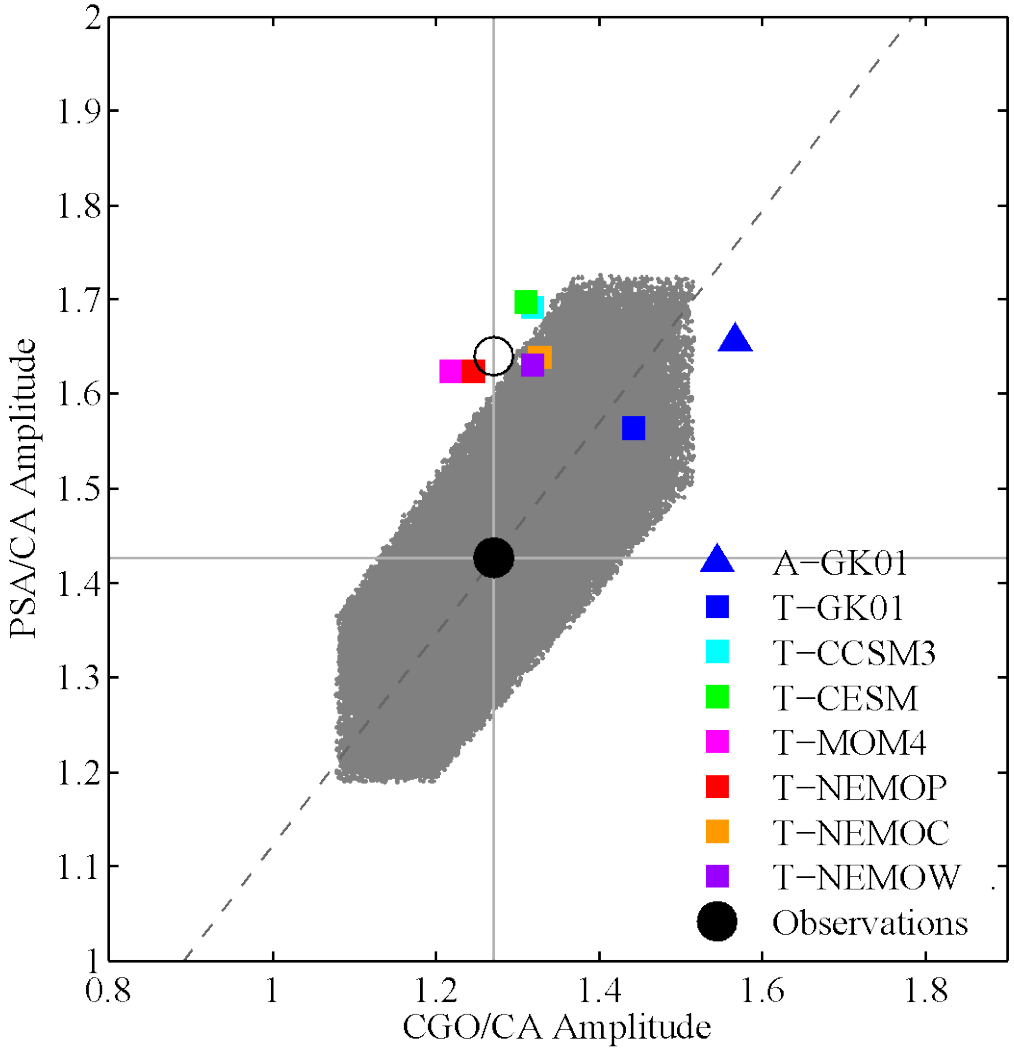
Contributions from: Britt Stephens, Ralph Keeling, Sara Mikaloff Fletcher, Prabir Patra, and ocean modelers enumerated later

# Atmospheric Potential Oxygen

- APO ≈ $O_2 + 1.1{*}CO_2$
- 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



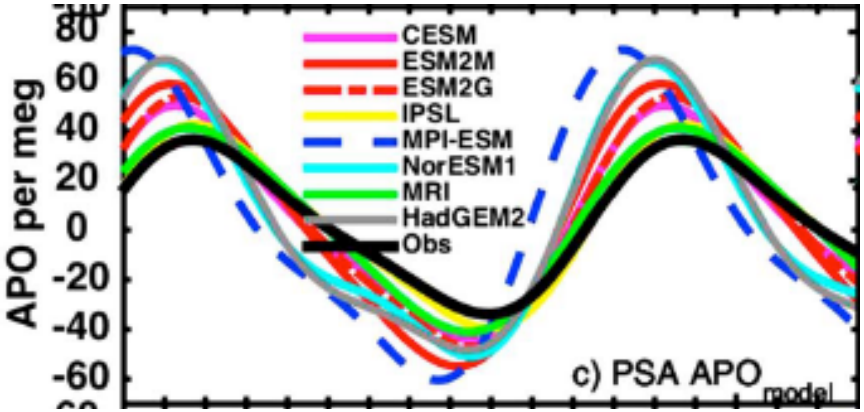
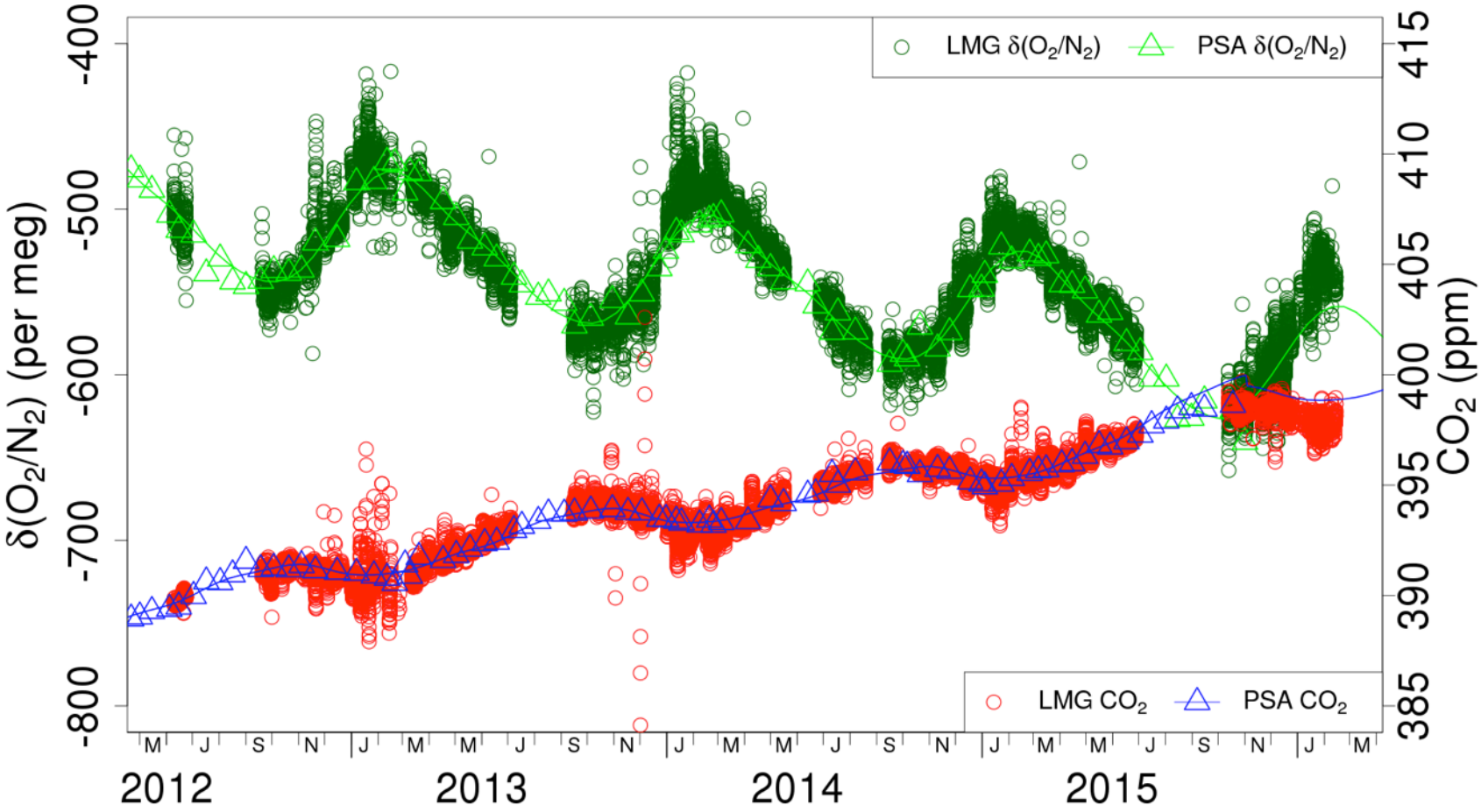




**Figure 1.** APO mean annual cycle for 1997–2004 simulated by GEOS-Chem forced with air-sea fluxes from eight CMIP5 models. Heavy black line shows the SIO mean annual APO cycle, (a, b) South Pole, (c, d) Palmer Station, and (e, f) Cape Grim. Note the different *Y* axis scale for the middle panels. (Figures 1a, 1c, and 1e) GEOS-Chem forced by CMIP5 $O_2$, $N_2$, and $CO_2$ air-sea fluxes. (Figures 1b, 1d, and 1f) Same as left, except the CMIP5 $CO_2$ fluxes are replaced with climatological air-sea $CO_2$ fluxes [*Takahashi et al.*, 2009].

Nevison, 2016 GRL

# Gould O2 Data



# How Palmer Compares against other latitudes

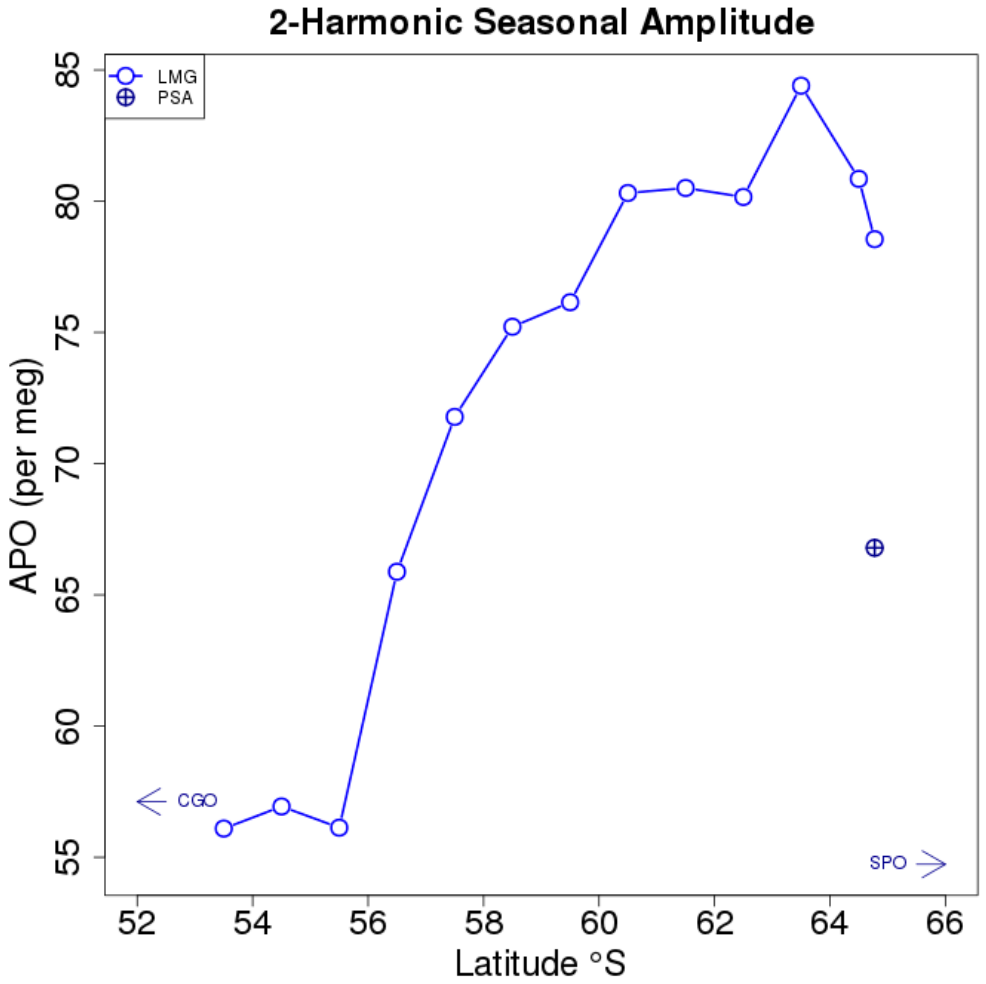
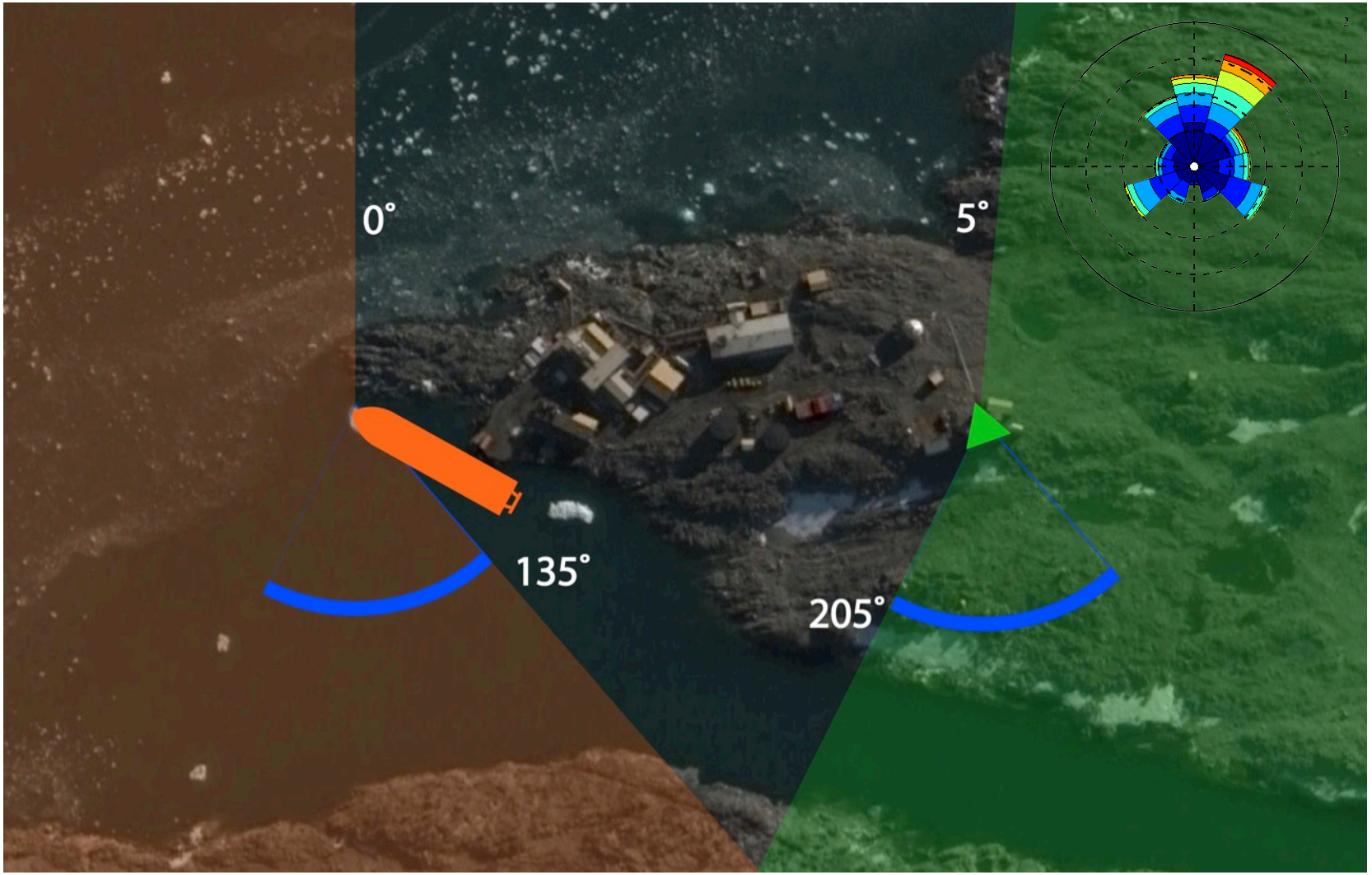
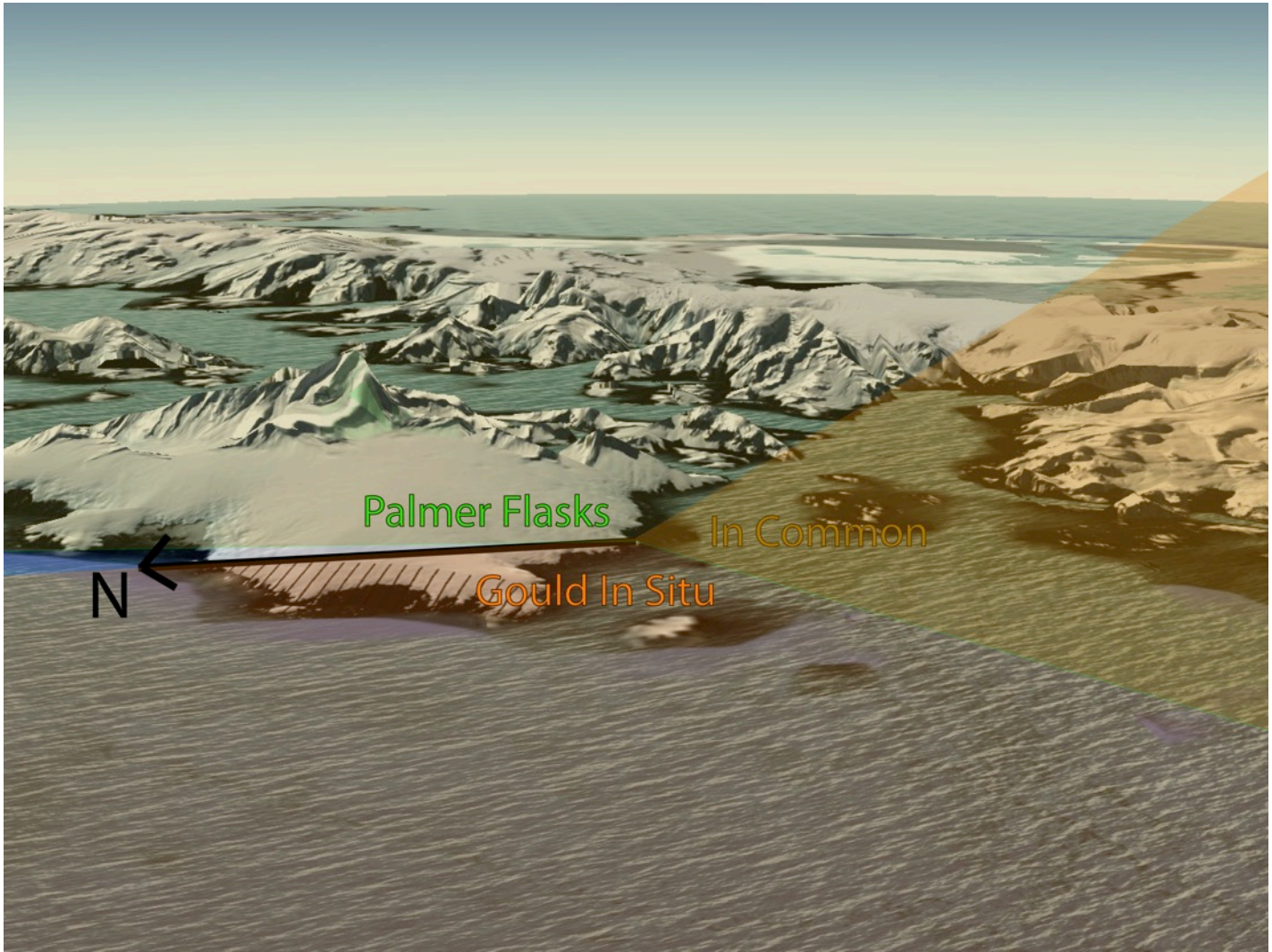



Figure: B. Stephens

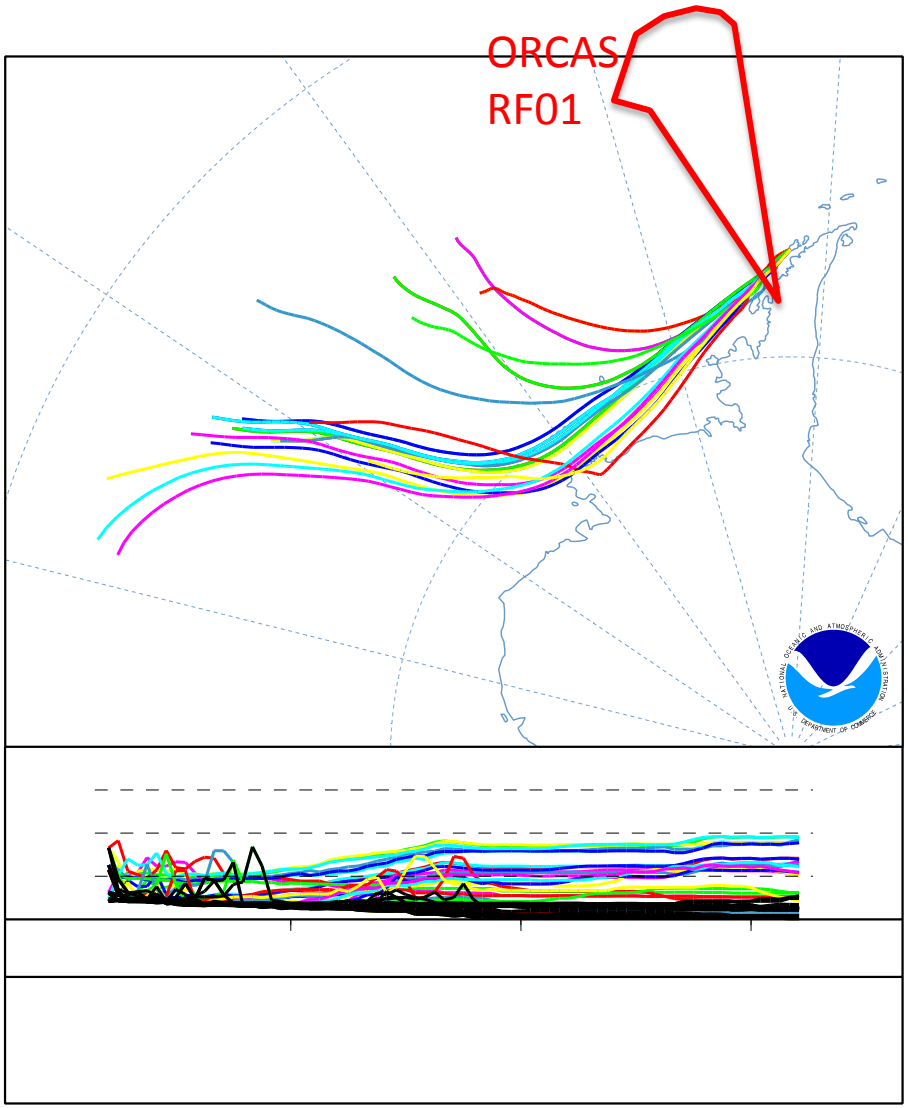
# Spheres of wind influence

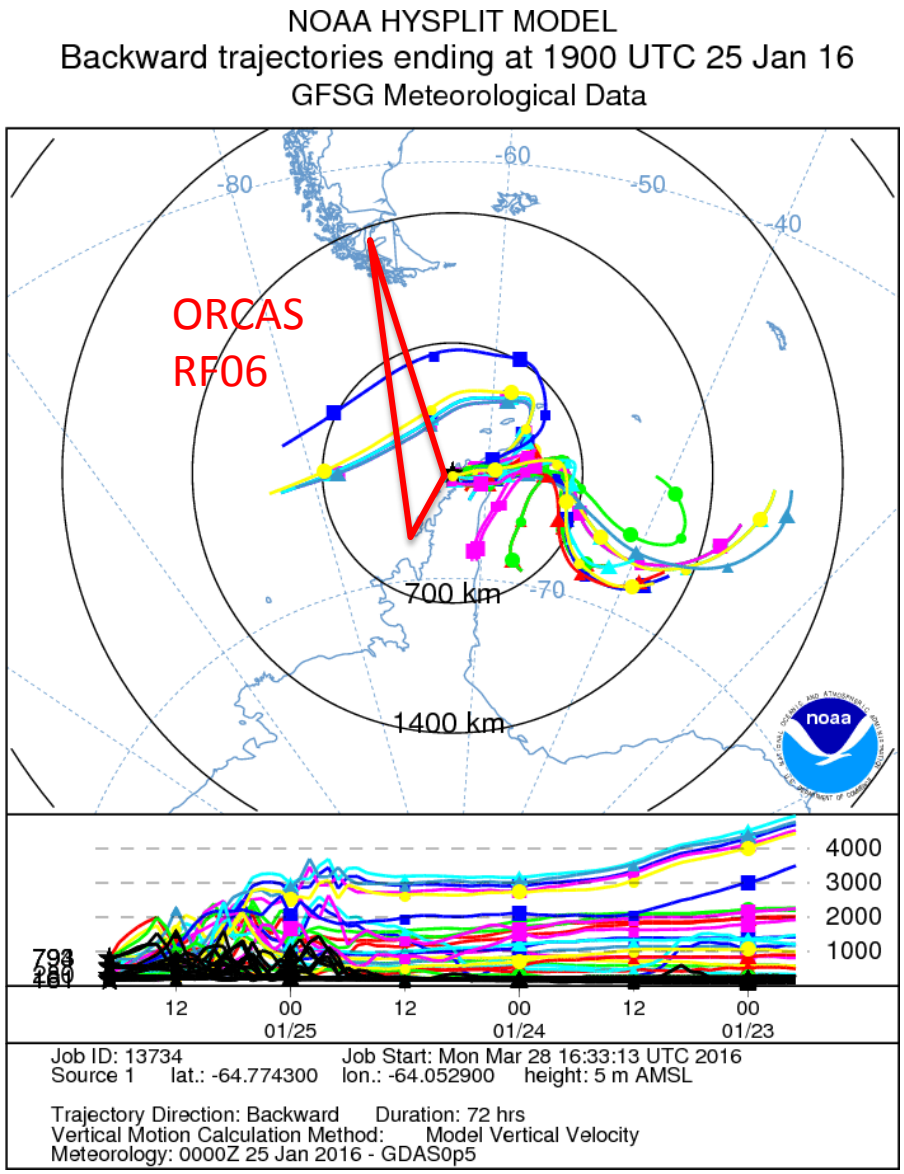


# Why does it matter if air is coming from E or W? Topography



# HYSPLIT back trajectories



# Gould O2 Data

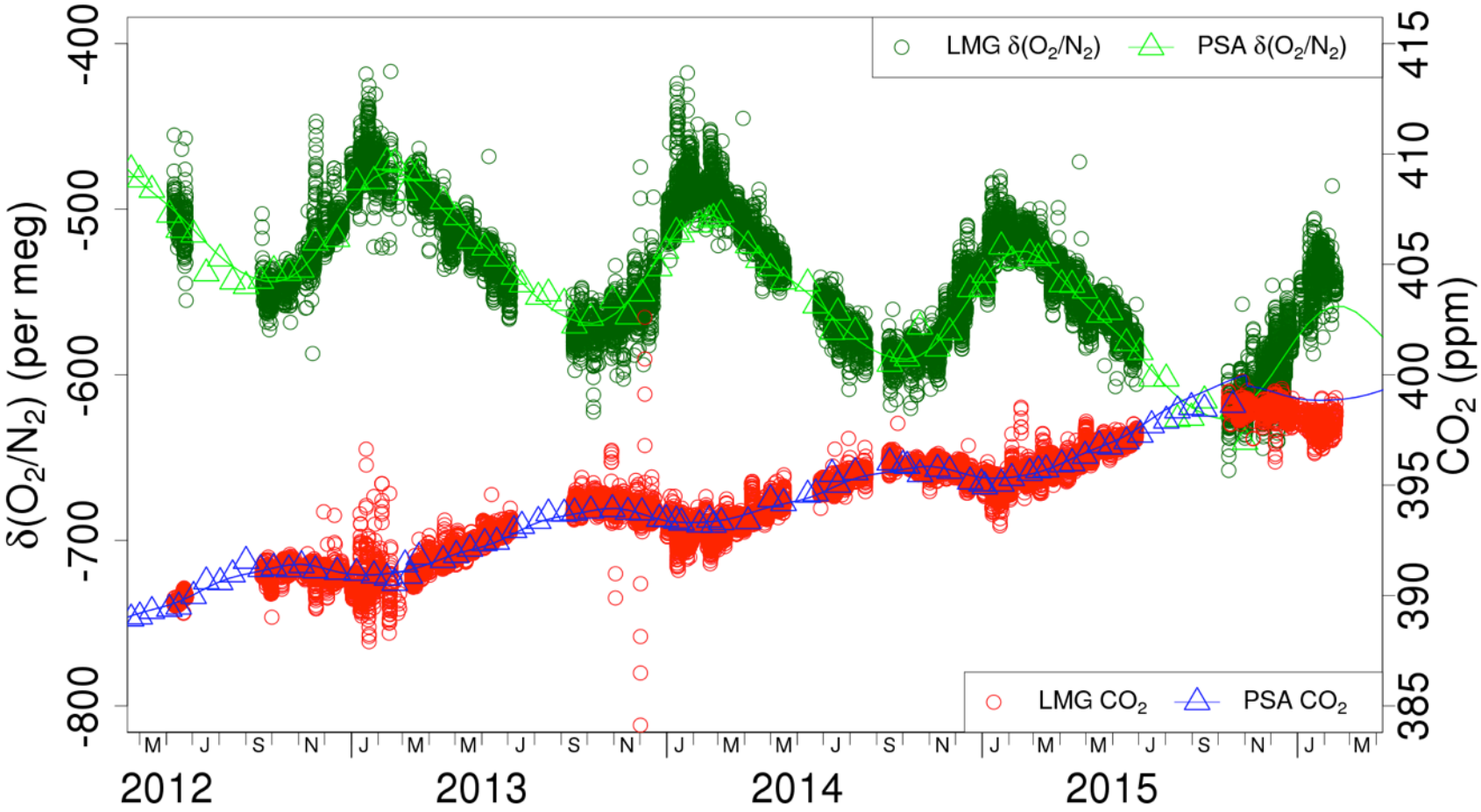
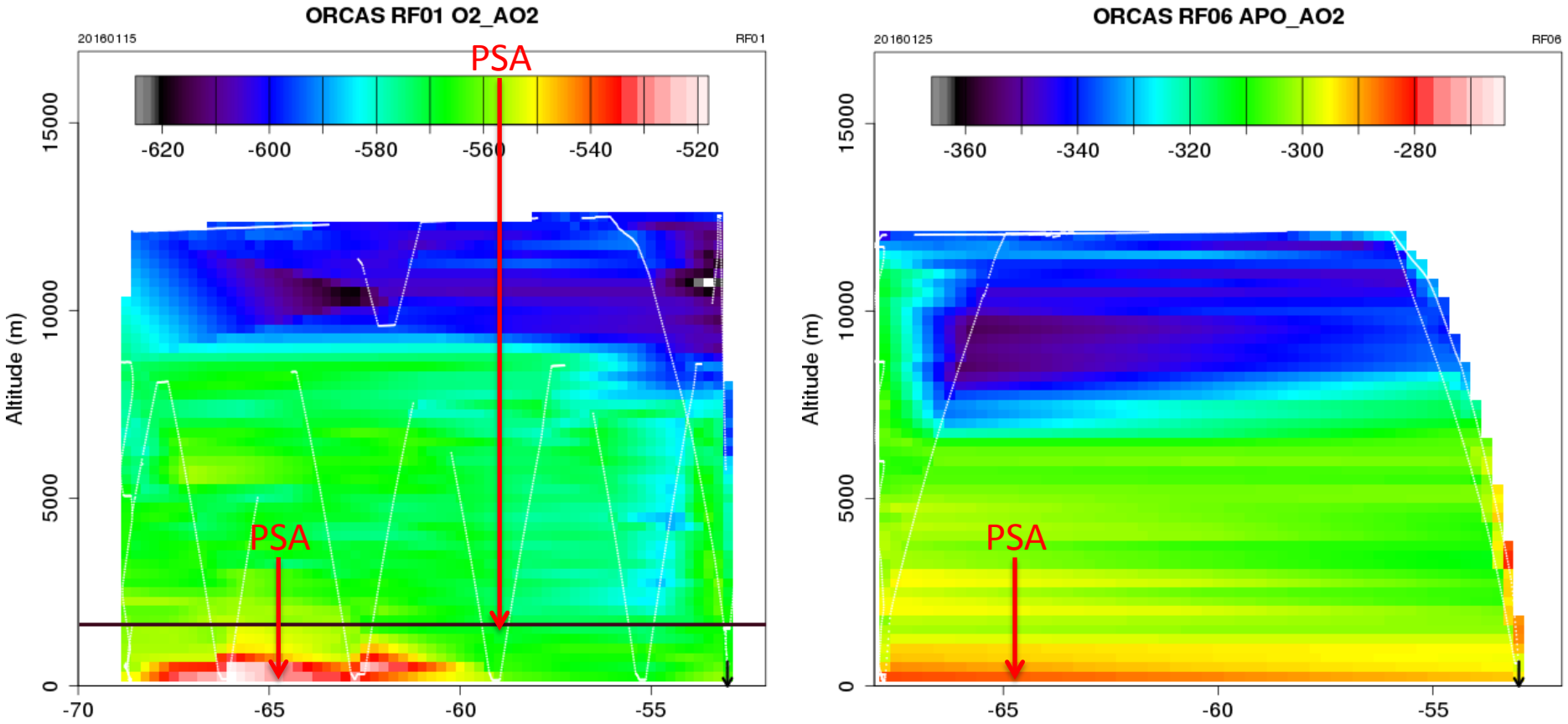
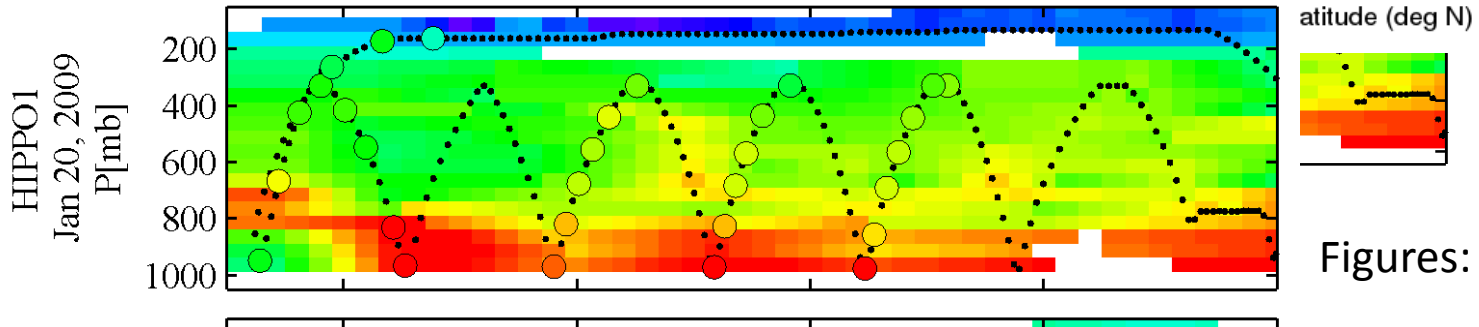



Figure: B. Stephens

# 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

# Acknowledgements


- Britt Stephens and Ralph Keeling (co-advisors, collaborators)
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