Constraints on ocean and atmospheric models with high-resolution airborne observations of the O_2/N_2 ratio

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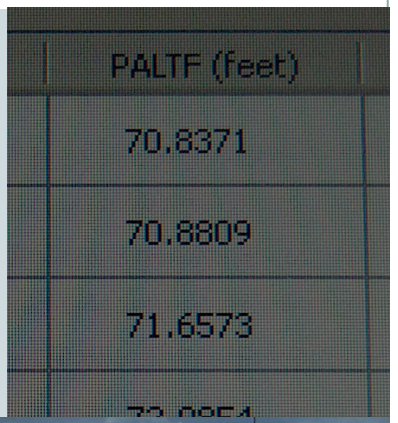


SIO/NCAR Contribution

AO2

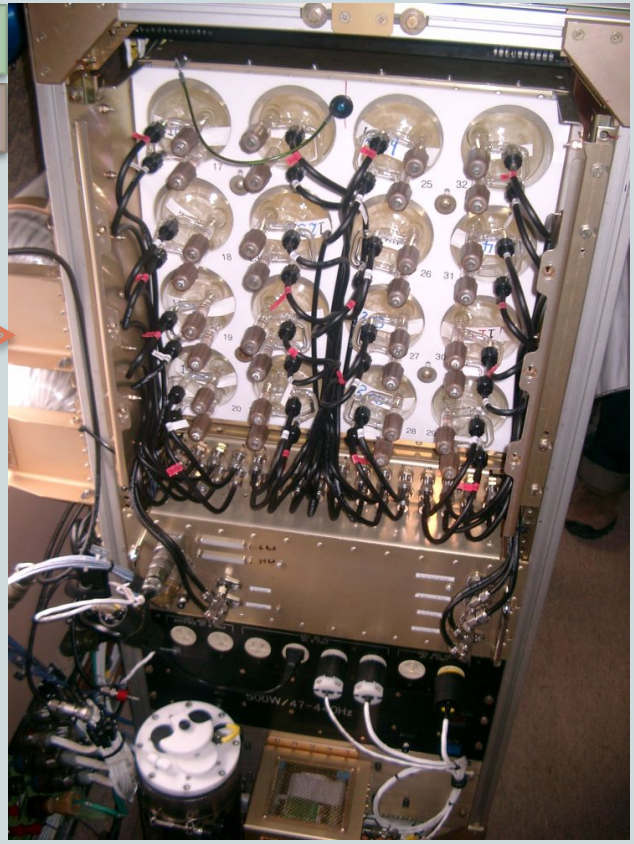
32 Dried Flasks/Flight

Mass Spec, LiCor

CO_2
O_2/N_2

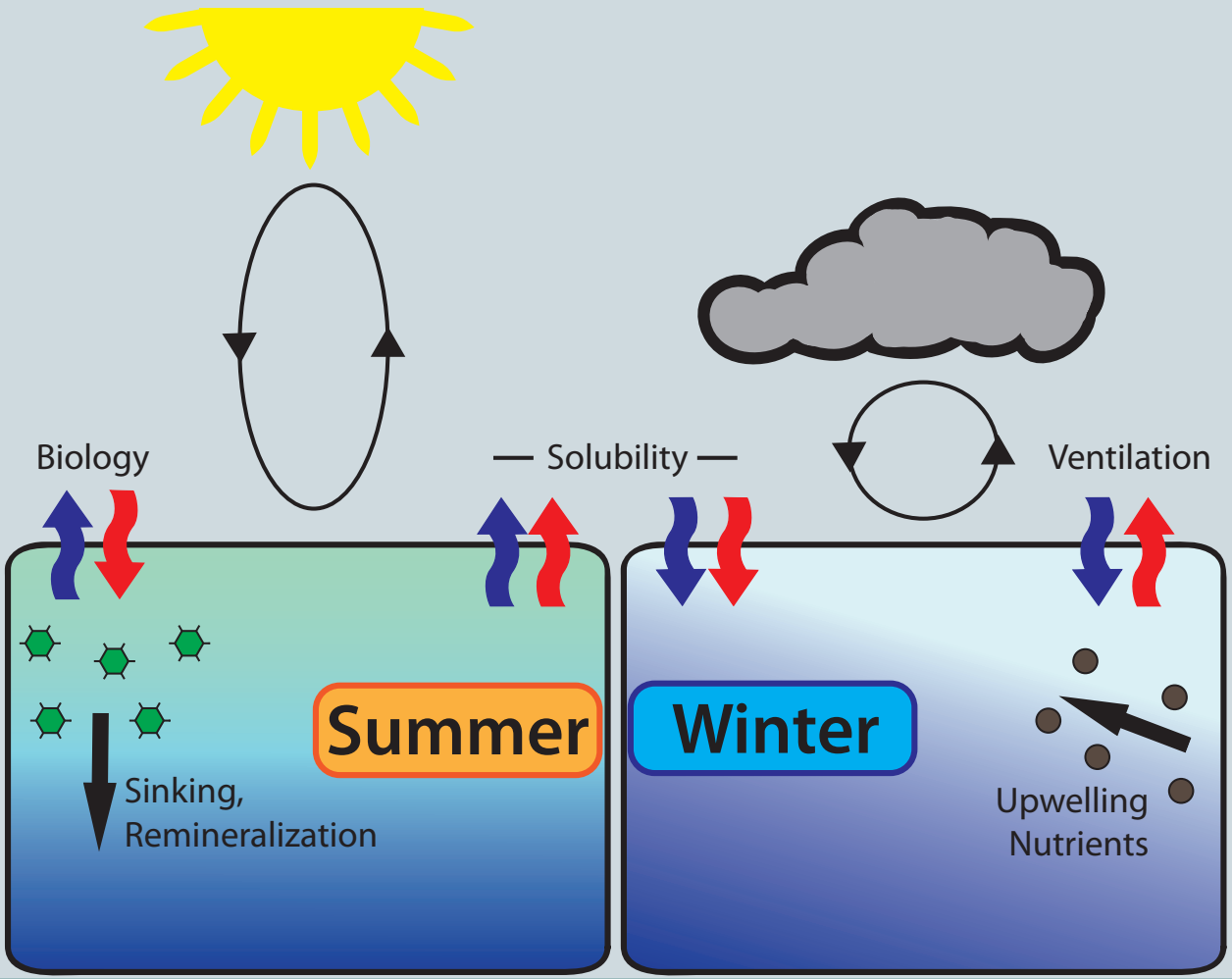
Vacuum UV, LiCor

In Situ: 1 Hz

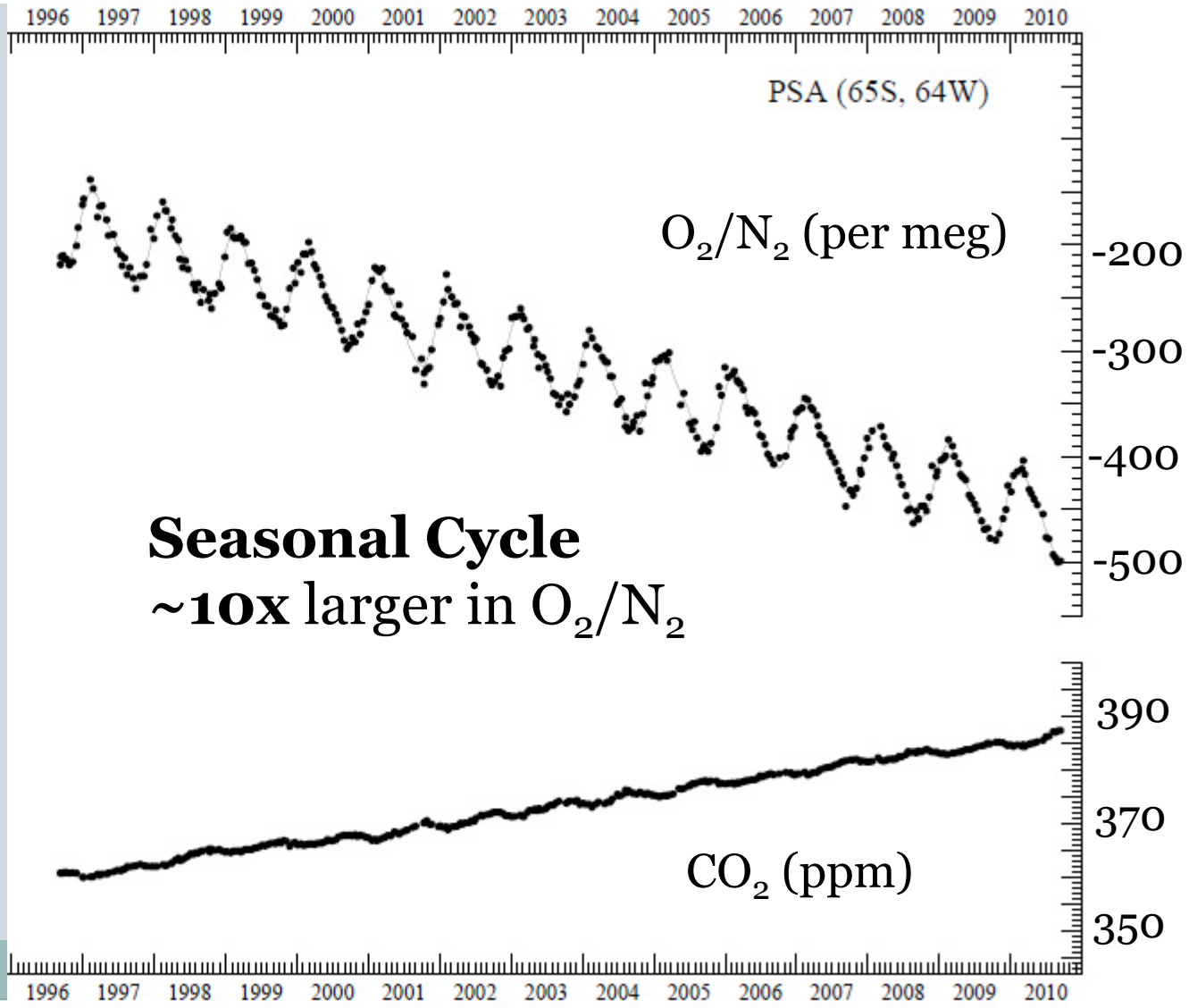


MEDUSA

Southern Ocean CO_2, O_2 Seasonality

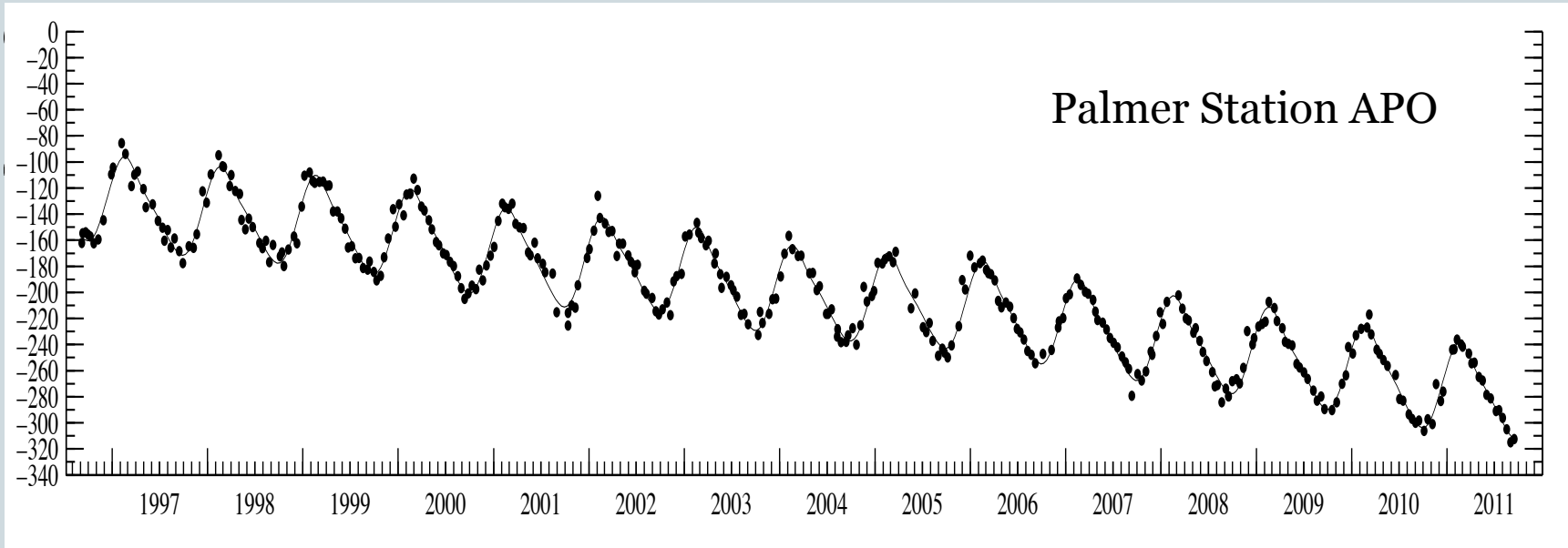


The Southern Ocean: Palmer Station Record



Atmospheric Potential Oxygen

$$APO \approx O_2 + 1.1(CO_2)$$



Recent Method, Conclusion

"We conclude that it is difficult to validate ocean models based on APO because shortcomings in atmospheric transport models and problems with data representivity cannot be distinguished from ocean model deficiencies."

-Naegler et al. 2007

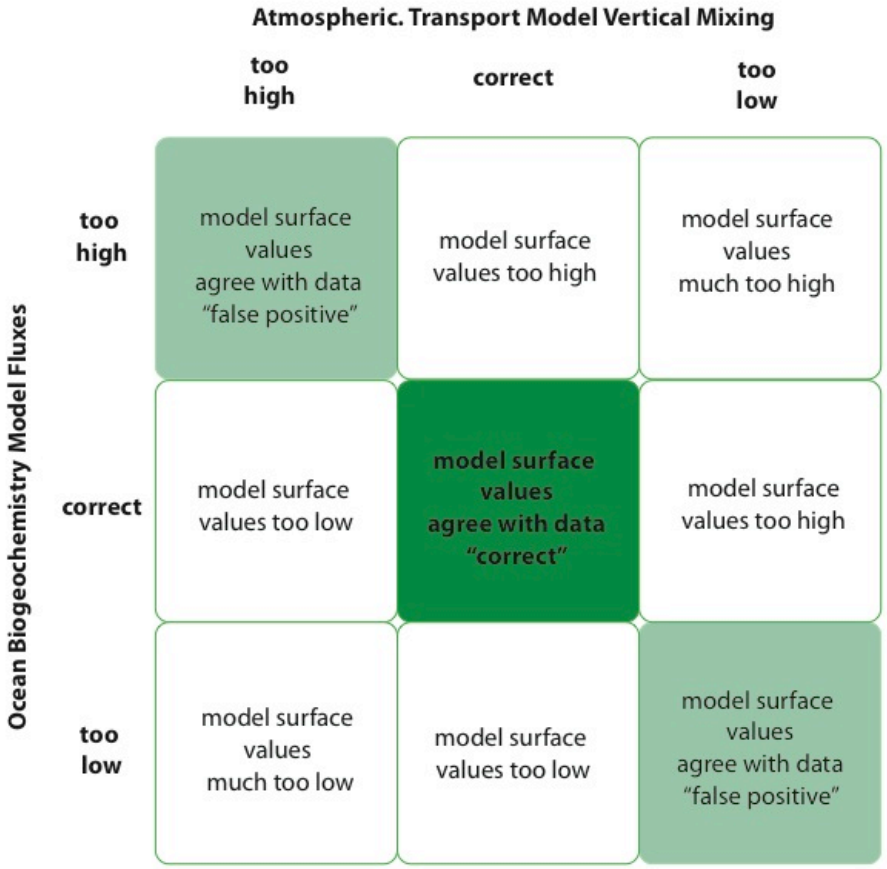
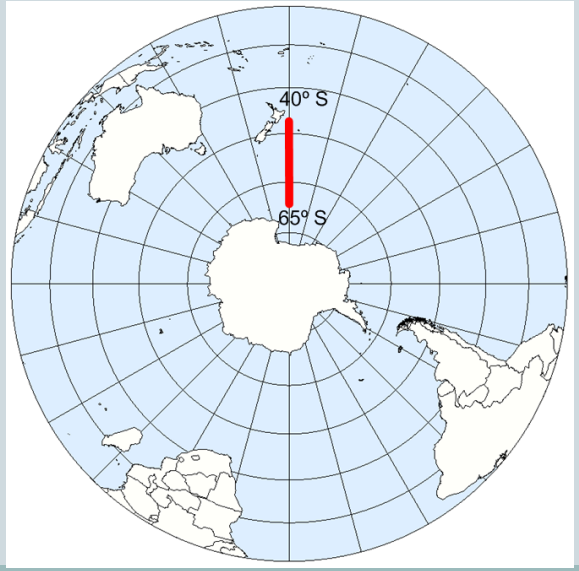
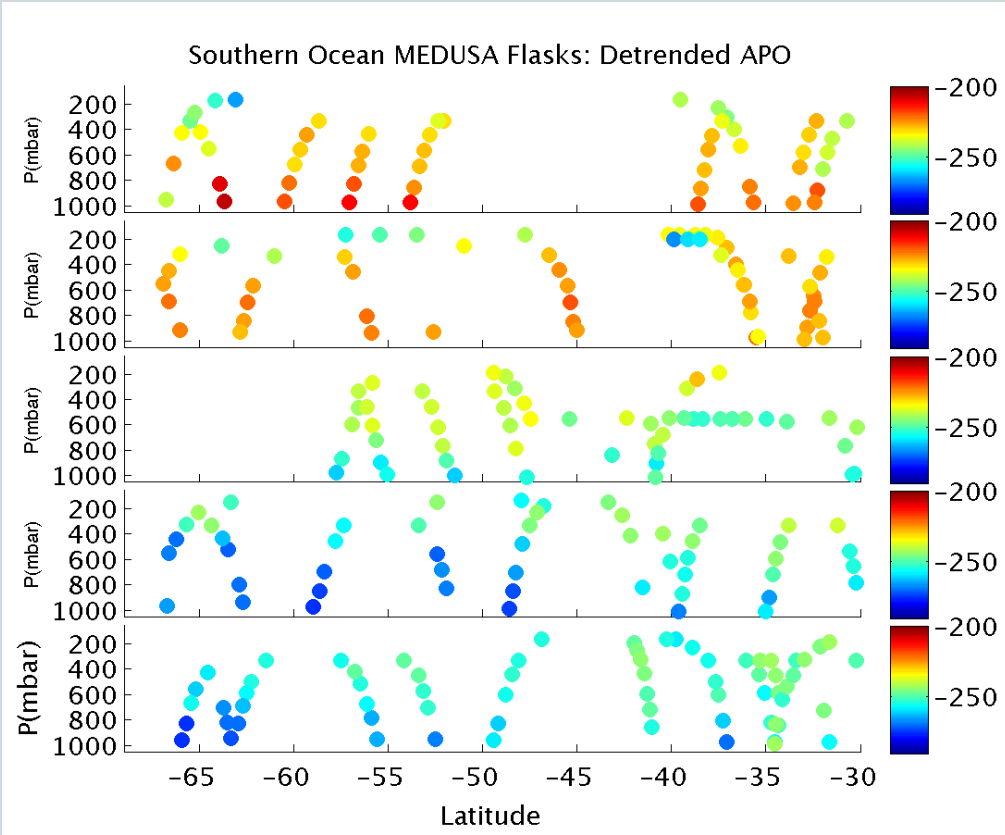


Figure 2. Agreement of model output with data at a theoretical surface station.

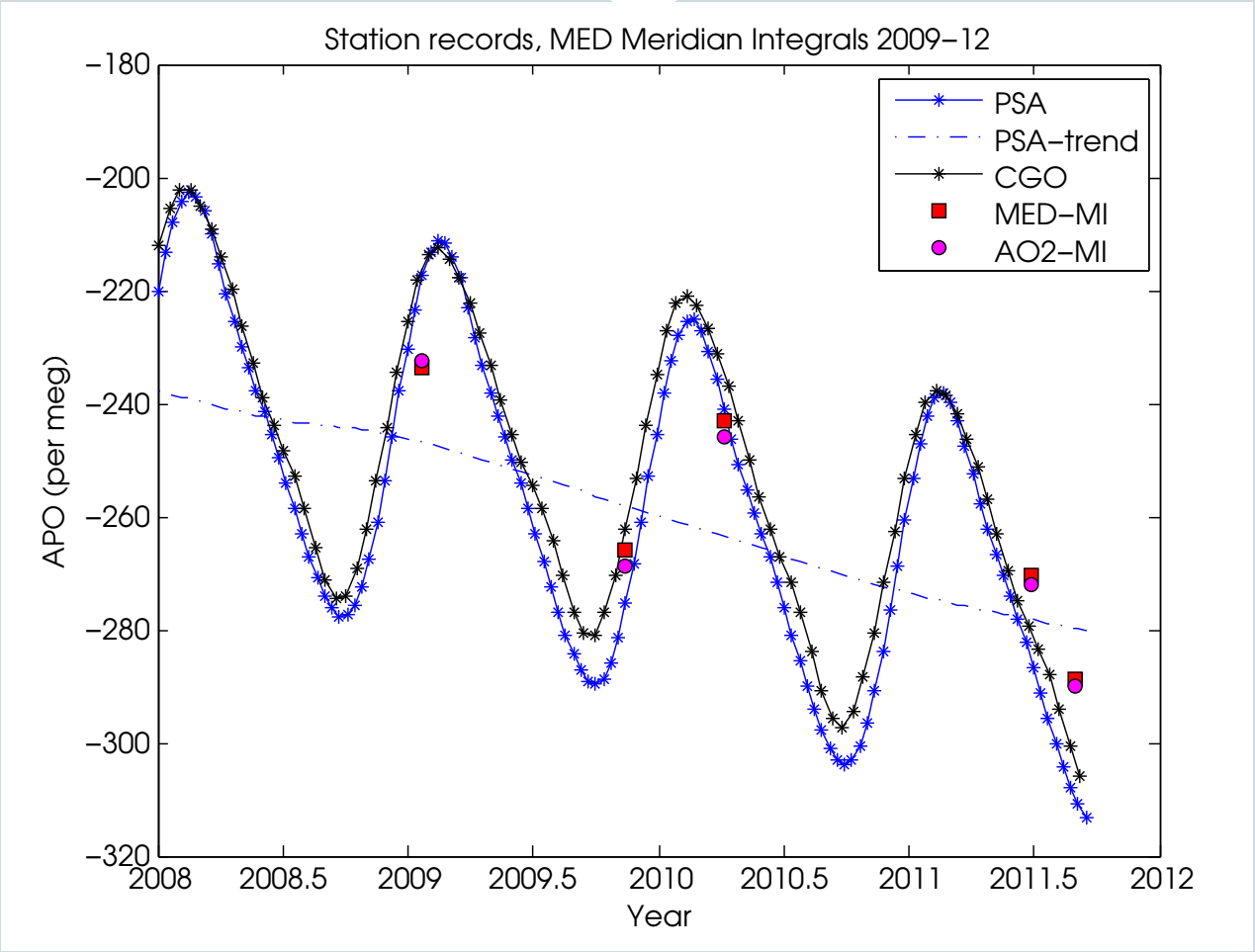
A New Metric: The Meridional Integral

$$MI = \int_{-65^\circ}^{-40^\circ} \int_{1000\,mb}^{0\,mb} C(p,x)\,dp\,dx$$

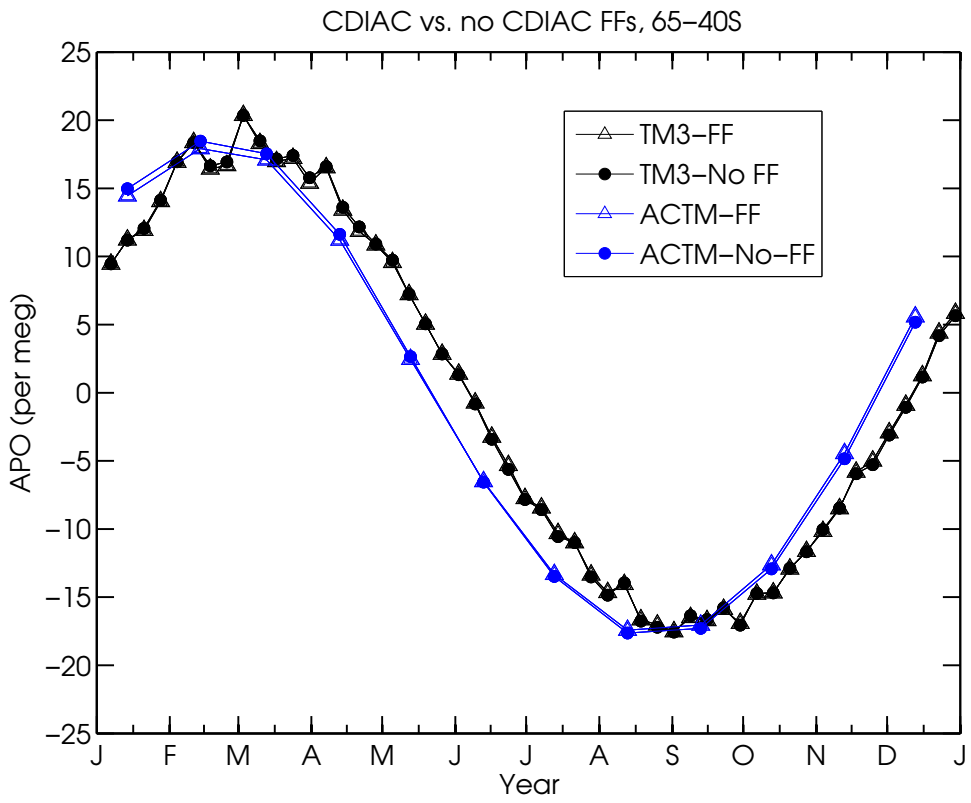




Station Records, Integrals

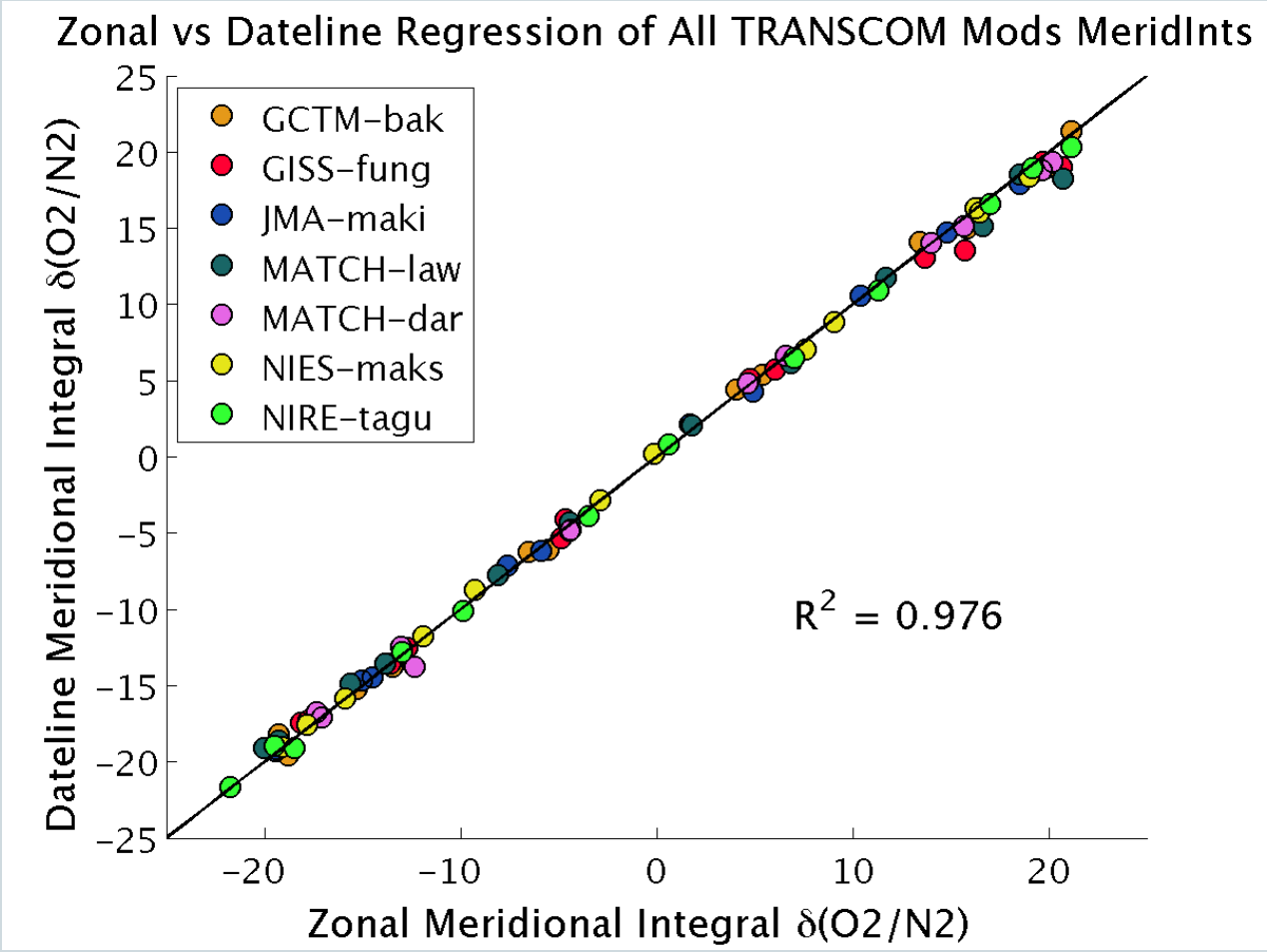


FF contribution to seasonal cycle

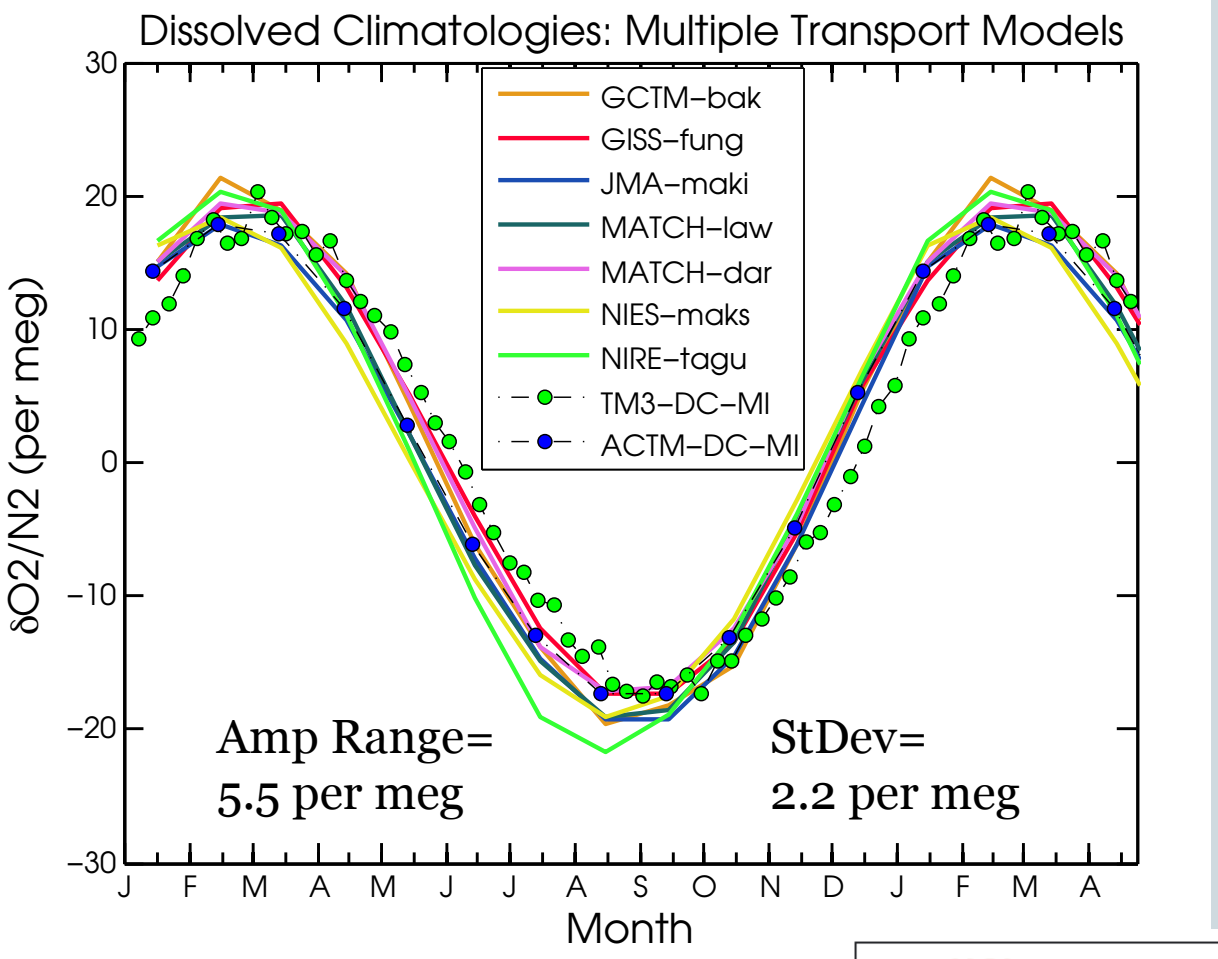


Contribution to seasonal cycle by Fossil Fuels <3%

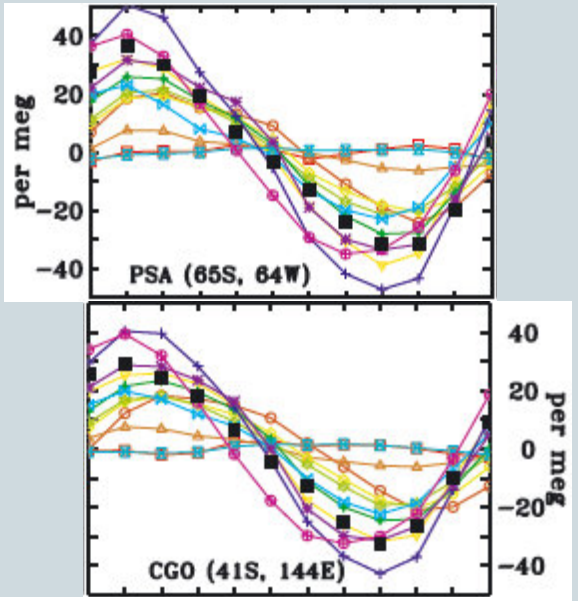
Transcom: Zonal vs. Meridional

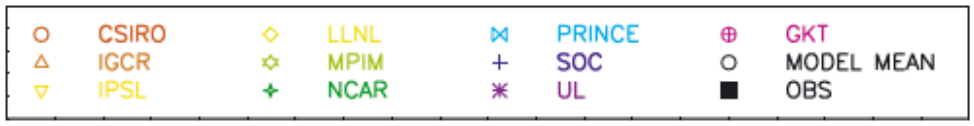


9 ATMs driven with Dissolved Climatologies

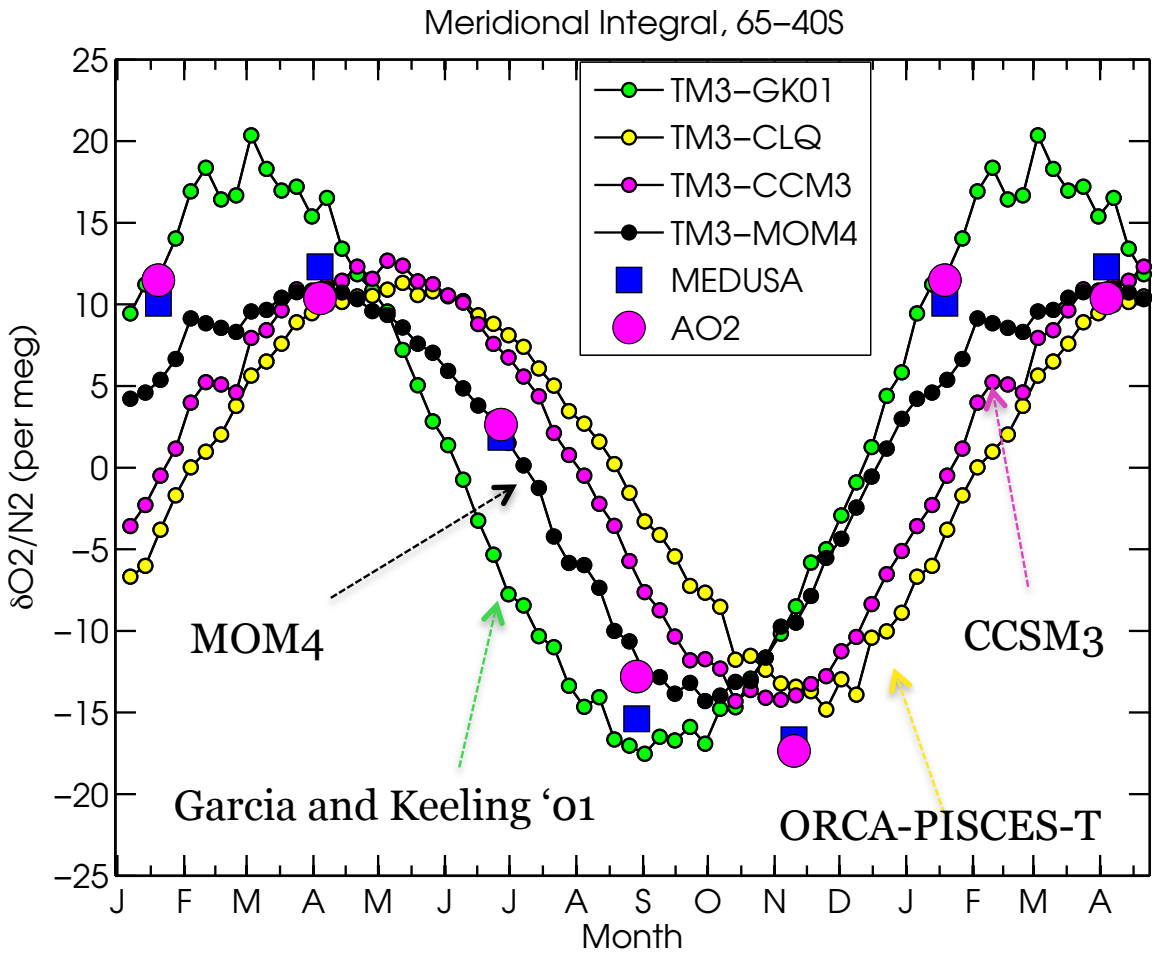


Naegler et al. 2007

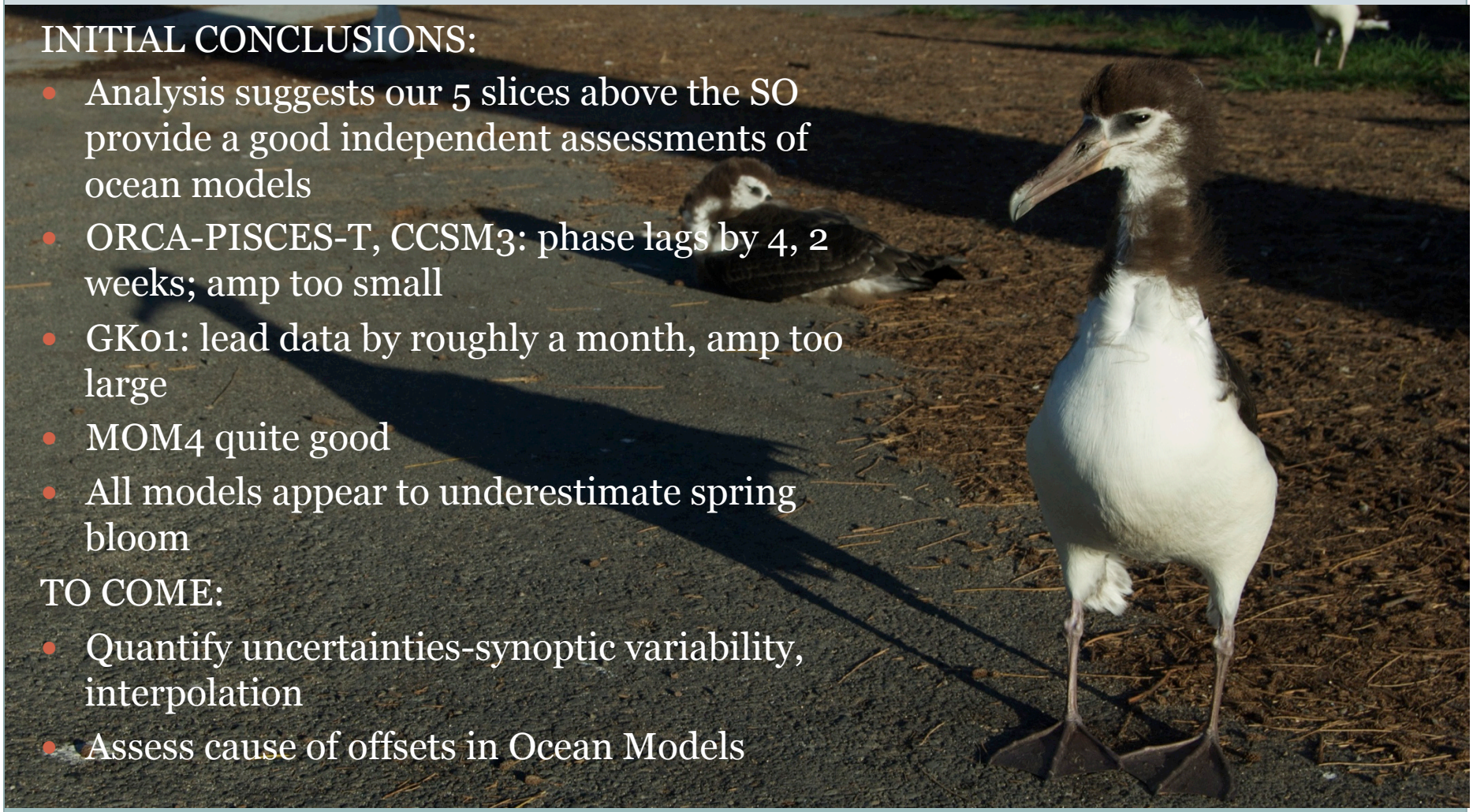




HIPPO Integrated Seasonal Cycles Vs.: (65S-40S@180W Detrended, Normalized)



Conclusions, To Come



INITIAL CONCLUSIONS:

- Analysis suggests our 5 slices above the SO provide a good independent assessments of ocean models
- ORCA-PISCES-T, CCSM3: phase lags by 4, 2 weeks; amp too small
- GK01: lead data by roughly a month, amp too large
- MOM4 quite good
- All models appear to underestimate spring bloom

TO COME:

- Quantify uncertainties-synoptic variability, interpolation
- Assess cause of offsets in Ocean Models

Thanks

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