

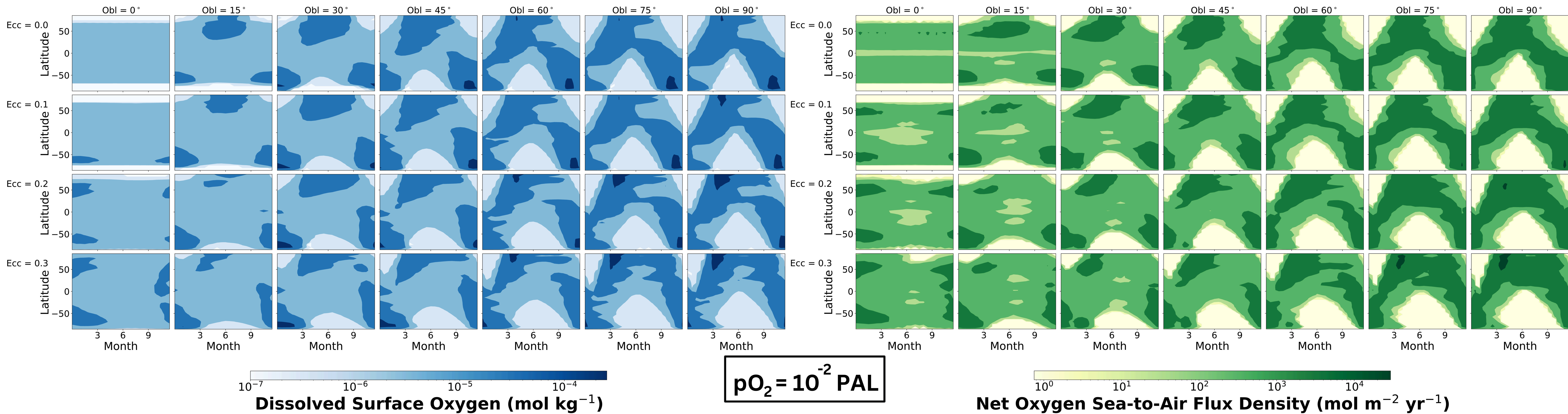
# Modeling Oxygen Seasonality on Earth-like Exoplanets



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We use **cGENIE-PlaSim** to model seasonality on a Proterozoic Earth-like exoplanet under a range of planetary orbital configurations (0 – 90° obliquity and 0 – 0.3 eccentricity) [1]. Under  $pO_2 = \sim 10^{-2}$  PAL conditions, both dissolved surface ocean  $O_2$  (left) and  $O_2$  sea-air fluxes (right) display strong seasonal patterns due to spatiotemporally variable rates of primary productivity [2].



Intermittent oxygen and nutrient limitations driven by seasonality would occur in the marine biosphere, which may affect the rise of more complex life (e.g., animals) on highly seasonal Earth-like exoplanets [2].

**Next Steps:** How does extreme  $O_2$  seasonality impact exo-animal viability?

Seasonally variable fluxes of  $O_2$  between the marine biosphere and the troposphere may impact remote detections of atmospheric  $O_2$  as a biosignature.

**Next Steps:** Can we observe  $O_2$  (and/or  $O_3$ ) seasonality on Earth-like exoplanets orbiting Sun-like stars using HWO?



This work is supported by funding from the NASA Exobiology, NASA Habitable Worlds, and NASA ICAR programs.

For more information, please email me ([elafléch@purdue.edu](mailto:elafléch@purdue.edu)) or scan the QR code!

## References:

- [1] Holden, P. B., et al. (2016) *Geoscientific Model Development*, 9(9), 3347–3361.
- [2] Reinhard, C. T., et al. (2016). *PNAS*, 113(32), 8933–8938.
- [3] Olson, S. L., et al. (2018) *ApJ*, 858(2), L14.