

Modeling Venus-like Worlds Through Time: The habitable zone, and the evolution of Venus' atmosphere.

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Using a modern three-dimensional general circulation coupled atmosphere/ocean model [1] we recently demonstrated [2] that climatic conditions may have permitted liquid water on Venus' surface for ~2 billion years in its early history. Similar such conditions on Earth are believed amenable to the rise of life. Several assumptions were made based on what little data we have for early Venus such as; the type of solar spectrum extant at that time, orbital parameters, estimates of a shallow ocean from Pioneer Venus D/H ratios, and topography from the Magellan Mission. We also assumed that it would have had an atmosphere similar to modern day Earth: 1 bar N₂, 400ppmv CO₂, 1ppmv CH₄. I will discuss the motivations behind these assumptions and additional parameter space studies with direct relevance to hypothetical exoplanetary Venus-like worlds found at the inner edge of the liquid water habitable zone. Finally, I will show how our studies demonstrate that the reason for Venus' present climatic state is unlikely to be related to the gradual warming of our sun over the past 4Gyr as is commonly believed

[1] Way, M.J. et al. (2017) *Astroph Journ Suppl*, 231, 1

[2] Way, M. J., et al. (2016) *Geophy Res Lett*, 43, 8376-838

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