

EGU2020-9484

<https://doi.org/10.5194/egusphere-egu2020-9484>

EGU General Assembly 2020

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Spatial early warnings of the transition to superrotation: Studying a bifurcation in the general circulation using an idealized GCM

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A superrotating atmosphere, one in which the angular momentum of the atmosphere exceeds the solid body rotation of the planet, occurs on Venus and Titan. However, it may have occurred on the Earth in the hot house climates of the Early Cenozoic and some climate models have transitioned abruptly to a superrotating state under the more extreme global warming scenarios. Applied to the Earth, the transition to superrotation causes the prevailing easterlies at the equator to become westerlies and accompanying large changes in global circulation patterns. Although current thinking is that this scenario is unlikely, it shares features of other global tipping points in that it is a low probability, high risk event.

More than anything though, this tipping point serves as an ideal example to test some spatial early warning methods. I'll show some preliminary results how the critical spatial modes and time scales change through the transition to superrotation using an idealized general circulation model (GCM), Isca.