



The Inhomogeneous Tropospheric Warming as the Driver of Tropical Sea Level Pressure and Walker Circulation Changes

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In this presentation we follow the idea to split up the global warming signal in a spatial homogeneous warming and in a spatial inhomogeneous warming. In Bayr and Dommenges (2012) the changes of the tropical sea level pressure (SLP) due to inhomogeneous tropospheric warming in climate change, which is mostly the land-sea warming contrast, was investigated in a multi model ensemble. The amplitude of the inhomogeneous tropospheric warming is roughly 10 times smaller than the total warming of the tropical troposphere, but it can explain on average two third of the tropical SLP changes in different climate models. The explained SLP changes are of hydrostatical nature.

As the zonal temperature differences are the main driver of the zonal circulation cells like the Walker Circulation, the inhomogeneous tropospheric warming also changes the zonal circulations. This response is simulated with Atmospheric General Circulation Model and compared with the effect of the homogenous warming on the zonal circulations. The results show that the effect of the inhomogeneous warming can be nearly contrary to the effect of the homogeneous warming, so strengthening of the zonal tropical circulations in the inhomogeneous warming case and a weakening as proposed by Vecchi and Soden (2007) in the homogeneous warming case. As the ratio between the homogeneous and inhomogeneous warming is model dependent, this can partly explain the spread in the response of the zonal circulations of the individual climate models.

References

- Bayr, T., and D. Dommenges, 2012: The Tropospheric Land-Sea Warming Contrast as the Driver of Tropical Sea Level Pressure Changes. *Journal of Climate*, doi:10.1175/JCLI-D-11-00731.1.
- Vecchi, G. A., and B. J. Soden, 2007: Global Warming and the Weakening of the Tropical Circulation. *Journal of Climate*, 20, 4316–4340, doi:10.1175/JCLI4258.1.