Geophysical Research Abstracts
Vol. 20, EGU2018-5441, 2018
EGU General Assembly 2018

Bifurcated tropical convergence zones in Matsuno-Gill-type models

Ori Adam
Hebrew University, Institute of Earth Sciences, Climate dynamics, Israel (ori.adam@mail.huji.ac.il)

In the present climate, tropical rain bands exhibit a bifurcated pattern, continuously forming along single intertropical convergence zones (ITCZs) in some regions, and along double ITCZs that straddle the equator in other regions. Since the tropical overturning circulations in regions dominated by single and double ITCZs are inextricably linked, a theory of the zonally varying tropical rain belt requires consideration of the bifurcated pattern as a whole.
In this study, a Matsuno—Gill-type model with idealized ocean-atmospheric coupling is used to study bifurcated ITCZs. Two ITCZ bifurcation mechanisms are identified. First, equatorial ocean upwelling increases equatorial surface pressure, which can lead to precipitation peaks that straddle the equator in regions of equatorial ascent. Second, in the viscous limit ITCZs form along negative anomalies of the local Rossby number near the surface. Negative anomalies of the local Rossby number tend to occur along the equator for equatorial low pressure and off the equator for equatorial high pressure, leading to a single ITCZ in the rising branch of zonal overturning circulations and a double ITCZ that straddles the equator in the descending branch. When the northern hemisphere is differentially heated in the idealized model, a pronounced ITCZ forms north of the equator and a less elongated ITCZ forms south of the equator, mimicking annual-mean Pacific ITCZs. Changes in the zonal orientation of ITCZs are modulated in the idealized model by the strength of the ocean-atmosphere coupling, in a manner consistent with observed seasonal variations.