Abstract:
Conventional understanding suggests that monsoons cannot form over the Sahara. However, when Earth's rotation is reversed (retrograde) in a climate model simulation—while keeping all other boundary conditions constant—a monsoonal Sahara emerges. Traditional explanations based on land–sea thermal contrast and the meridional migration of the Intertropical Convergence Zone (ITCZ), driven by interhemispheric temperature gradients, fail to explain this. In this retrograde simulation, the Atlantic Meridional Overturning Circulation (AMOC) collapses, reducing the interhemispheric temperature contrast across the Atlantic and African sectors. Despite this, the ITCZ over Africa shifts northward, highlighting the role of local processes. Analysis using the energetics framework of monsoons reveals that radiative feedbacks from clouds and water vapor over the Sahara are critical in the transition from arid to monsoonal conditions. This feedback may therefore be a key ingredient in the development of monsoons.