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An MSE budget view on seasonal and CO2-induced ITCZ shifts in the TRAC-MIP model ensemble
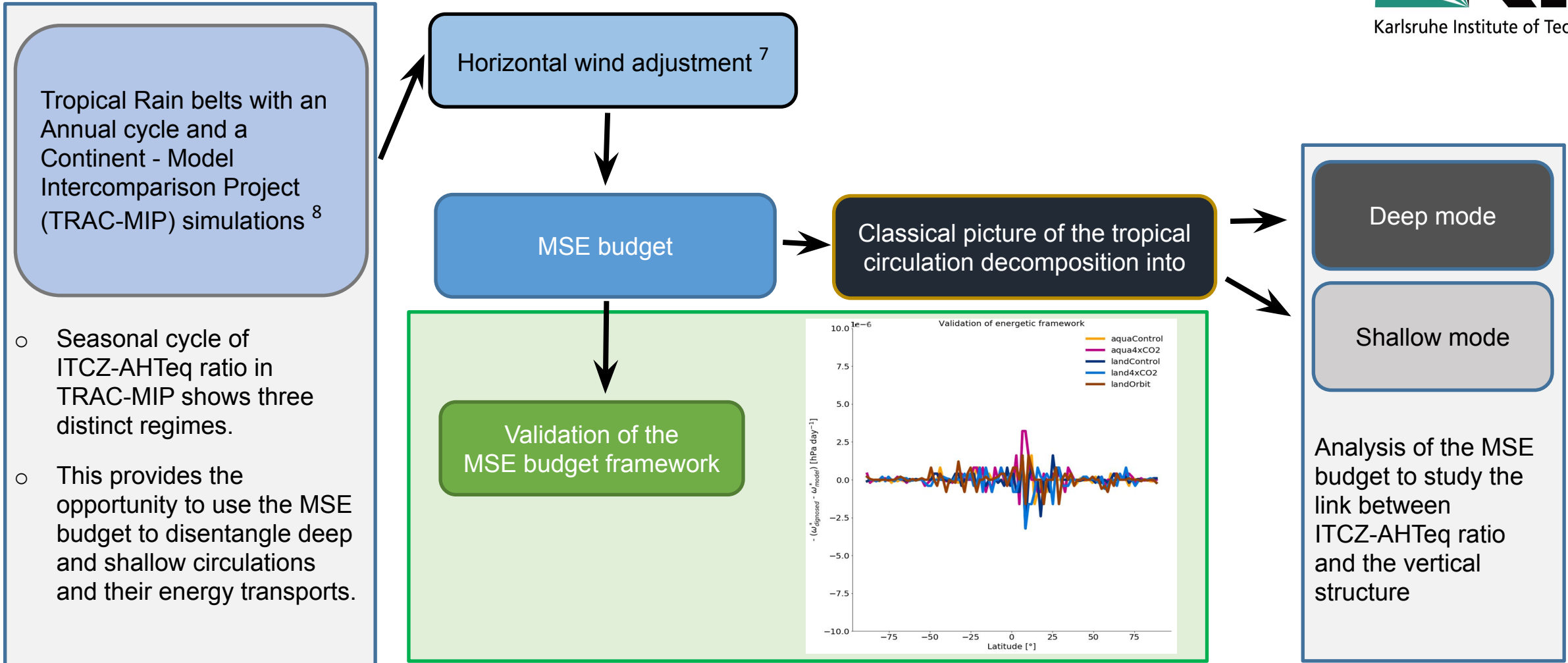
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Motivation and Objectives

- Previous studies showed that there is a linear relationship between the ITCZ and the cross-equatorial atmospheric energy transport (ITCZ-AHTeq ratio)[1,2,3,4,6].

- Such ratio could determine the sensitivity of the ITCZ to external forcings[6].

- Other studies suggested that the ITCZ-AHTeq ratio can greatly differ between models and climate forcings[5].

- In this study, we argue that the vertical structure of the atmosphere, i.e., the profile of large-scale ascent and moist static energy (MSE), is an important factor in setting the ITCZ- AHTeq ratio.

- We use the MSE Budget to study the factors and physical processes that determine the ITCZ- AHTeq ratio.

Tropical Rain belts with an Annual cycle and a Continent - Model Intercomparison Project (TRAC-MIP) simulations [8]

o Seasonal cycle of ITCZ-AHTeq ratio in TRAC-MIP shows three distinct regimes.

o This provides the opportunity to use the MSE budget to disentangle deep and shallow circulations and their energy transports.

Horizontal wind adjustment [7]

MSE budget

Validation of the MSE budget framework

Classical picture of the tropical circulation decomposition into

Deep mode

Shallow mode

Analysis of the MSE budget to study the link between ITCZ-AHTeq ratio and the vertical structure

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