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Representation of tropical convection in a near-global convection permitting seasonal simulation with WRF

Kirsten Warrach-Sagi, **Thomas Schwitalla**, and Volker Wulfmeyer
University of Hohenheim, Institute of Physics and Meteorology, Stuttgart, Germany (kirsten.warrach-sagi@uni-hohenheim.de)

Precipitation observations between March to May 2015 show several coherent propagating systems in an area between 10°N and 10°S with a lifetime of 3-4 weeks demonstrating the importance of simulations beyond a month. The eastward propagation speed is typically 1100 km day^{-1}. The main origins of significant amounts of precipitation along this belt are the tropical warm pools in the Western Pacific around 158-174°E and the eastern Indian Ocean around 90°E as well as the tropical rainforest over South America around 69°W.

We investigated the lifetime and propagation of tropical precipitating systems based on observations and a near-global convection permitting seasonal simulation with the Weather Research and Forecasting (WRF). The latitude-belt simulation covers an area between 57°S to 65°N with a grid increment of 0.03° over a period of 5 months forced by sea surface temperature (SST) observations.

Results of this simulation with respect to tropical convection were investigated by means of comparison with satellite-based cloud and precipitation observations and ECMWF operational analysis. Wavenumber-frequency spectra of the tropical convection and the detection of various wave pattern were derived from the 3-h outgoing longwave radiation at the top of the atmosphere (TOA OLR) fields and revealed by Wheeler-Kiladis diagrams. The simulation shows the observed spectral signatures of eastward propagating EIGs and Kelvin waves.

The EOF decomposition of the monthly averaged sea level pressure fields demonstrates that 65 % of the sea surface pressure fluctuations in the ECMWF analyses can be explained by the correlation pattern shown in the 1st EOF. The agreement with the 1st EOF of the WRF simulation is excellent despite a slight underestimation of the strength of the correlations. The spatial structure is very similar and 61 % of the variance are contained in first EOF. The EOF analyses provided strong evidence that the seasonal simulation with a convection permitting horizontal resolution captures the representation of the teleconnection pattern.