

## **Variations in the width of the Indo-Pacific tropical rain belt over the last millennium: synthesis of stalagmite proxy records and climate model simulations**

Caroline Ummenhofer (1) and Rhawn Denniston (2)

(1) Woods Hole Oceanographic Institution, Physical Oceanography, Woods Hole, USA (cummenhofer@whoi.edu), (2) Department of Geology, Cornell College, Mount Vernon, USA (rdenniston@cornellcollege.edu)

The seasonal north-south migration of the intertropical convergence zone defines the tropical rain belt (TRB), a region of enormous terrestrial biodiversity and home to 40% of the world's population. The TRB is dynamic and has been shown to shift south as a coherent system during periods of Northern Hemisphere cooling. However, recent studies of Indo-Pacific hydroclimate suggest that during the Little Ice Age (AD 1400-1850), the TRB in this region contracted rather than being displaced uniformly southward. This behaviour is not well understood, particularly during climatic fluctuations less pronounced than those of the Little Ice Age, the largest centennial-scale cool period of the last millennium.

Using state-of-the-art climate model simulations conducted as part of the Last Millennium Ensemble with the Community Earth System Model (CESM), we evaluate variations in the width of the Indo-Pacific TRB, as well as movements in the position of its northward and southward edges, across a range of timescales over the pre-Industrial portion of the last millennium (AD 850-1850). The climate model results complement a recent reconstruction of late Holocene variability of the Indo-Pacific TRB, based on a precisely-dated, monsoon-sensitive stalagmite reconstruction from northern Australia (cave KNI-51), located at the southern edge of the TRB and thus highly sensitive to variations at its southern edge. Integrating KNI-51 with a record from Dongge Cave in southern China allows a stalagmite-based TRB reconstruction.

Our results reveal that rather than shifting meridionally, the Indo-Pacific TRB expanded and contracted over multidecadal/centennial time scales during the late Holocene, with symmetric weakening/strengthening of summer monsoons in the Northern and Southern Hemispheres of the Indo-Pacific (the East Asian summer monsoon in China and the Australian summer monsoon in northern Australia). Links to large-scale climatic conditions across the Indo-Pacific region, including its leading modes of variability, are made in the climate model simulations to elucidate the dynamics of TRB variations during periods of expansion and contraction over the last millennium.