## Heartbeat of the Climate System Found in Tropical Thunderstorms

Imagine you are sitting on an island beach in the tropical Indian or Western Pacific Ocean. The warm waves lap gently onto the shore, palm trees bask under the sun, and small clouds are scattered across the sky. The pleasant weather lasts for a few weeks. The weather then changes, and the skies darken with thunderstorms that soak your island every day for a few weeks. Following this deluge, fair weather returns. What you have just experienced is a cycle of the Madden-Julian Oscillation (MJO), the most powerful and mysterious of all tropical weather systems. The MJO slowly propagates eastward across thousands of miles over the Indian and Pacific Oceans.

The MJO is important for many practical reasons. It strongly regulates tropical weather patterns, modulates storminess along the west coasts of both North and South America, influences hurricane formation around the planet, and plays a critical role in global climate simulations. Simulation of the MJO is internationally accepted as a key and very challenging test of climate models.

Developing storms over Northern Australia during an episode of the Madden-Julian Oscillation.

Credit: Jim Benedict

Graduate students Jim Benedict and Kate Thayer-Calder of the NSF-sponsored Center for Multiscale Modeling of Atmospheric Processes (CMMAP), headquartered at Colorado State University (PI, David Randall), have made impressive strides in developing a better understanding of physical processes underlying the MJO, and the role of the MJO the Earth's climate. Kate and Jim based their study on a unique approach to climate simulation, in which a high-resolution "cloud-resolving" model is combined with a lower-resolution global atmospheric model. They used this "multiscale" modeling framework to analyze how individual clouds work together to make globe-girdling cloud systems like the MJO. CMMAP's research on the MJO is leading the way to improved predictions of weather and climate.