Department of Atmospheric Sciences
M.S. Defense Announcement

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M.S. Defense Title:

A Rapid Cold-Front Cyclogenesis over the Central Pacific Ocean

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Time: **9:00 AM**
Location: **Hawaii Institute of Geophysics Building, HIG 309**

Abstract:

A rapidly intensifying wintertime cyclone impacted the Hawaiian Islands from 11 to 15 December 2008. A detailed case study of the evolution of this meteorology "bomb" is conducted using the National Centers for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR) data. The focus is on the dynamic forcing and large-scale settings between the deepening and decaying stages. Model sensitivity simulations are conducted using the Advanced Research Weather Research and Forecasting (WRF-ARW) model to diagnose the roles played by latent heat release on the evolution of the storm.

Feedbacks of latent heat release contribute to the rapid cyclogenesis. Latent heat release enhances vertical motion in the eastern flank of the surface cyclone, which 1) increases the PV advection aloft; 2) causes surface pressure falls underneath with stronger cyclonic flow; 3) strengthens the low-level frontogenesis as cold and warm air are brought into juxtaposition and 4) brings moisture from tropics into the warm sector with increased southerly winds. With a westward tilted, the feedback of latent heat release further increases the upper-level forcing as the enhanced low-level horizontal temperature advection deepens (intensifies) the upper-level trough (ridge). During the decaying stage, latent heat release slows down the cyclolysis with similar processes, but the impact and feedbacks of latent heat release are less significant as compared to the deepening stage due to 1) decreasing moisture and low-level instability as the cyclone moves northwestward, and 2) less significant westward tilted structure. The enhanced rising motion associated with PV advection aloft is in the northeast quadrant of the upper-level low, thus the feedback of latent heat release weakens the upper-level low. Furthermore, without a westward tilt of the trough axis, the enhanced horizontal temperature advection neither deepens (intensifies) the upper-level trough (ridge) nor increases the upper-level forcing.