YMC-ARM Science Objectives

Through deploying the ARM AMF-1 and collecting observations, to improve understanding of the connections between *the diurnal cycle in precipitation*, *the MJO*, *the monsoon*, *and mean precipitation in the MC region*, and to support efforts of reducing uncertainties in climate models

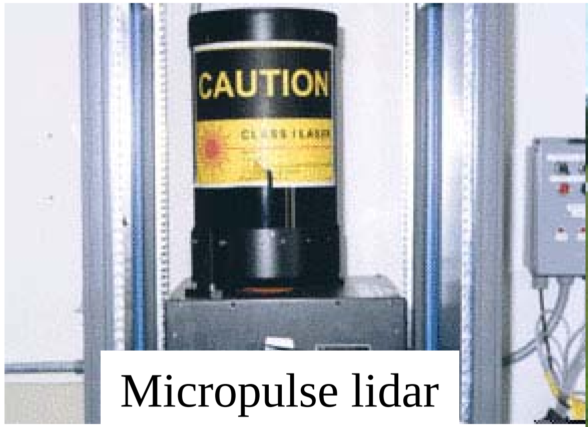
YMC-ARM Hypotheses

- Hypothesis I: Because of the unique geography of the MC, the diurnal cycle in rainfall is governed by convective triggering and convective upscale growth (organization). The triggering is controlled by boundary layer processes, which are different over ocean, land, and mountains; while the upscale growth is also controlled by free tropospheric conditions, which are modulated by the MJO and monsoon.

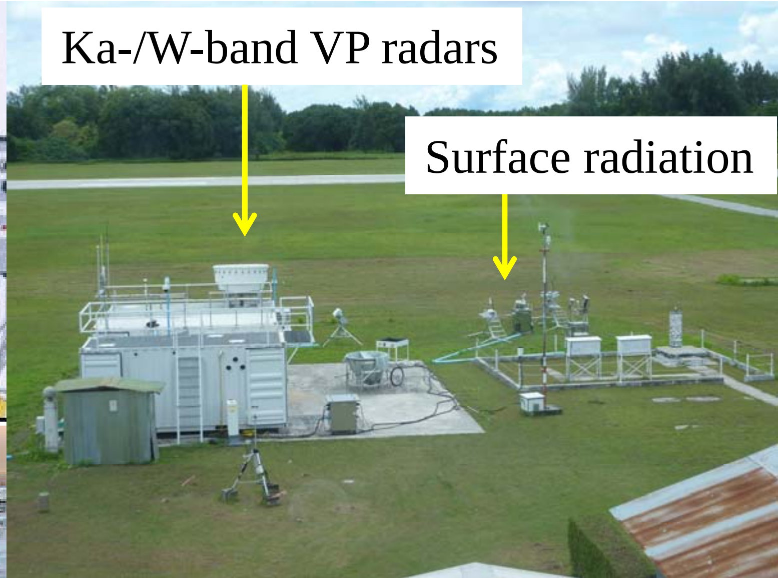
- Hypothesis II: The amplitude of the diurnal cycle in convection over the ocean, especially for MCSs, is maximized during the active periods of the MJO. The observed weakening of the MJO over the MC is partially caused by the islands that limit the ability of MCSs to develop in comparison to the open oceans. The difficulty for the MJO to propagate through the MC in global models is mainly caused by the model failure to correctly represent the diurnally controlled MCSs and their coupling with the large-scale conditions provided by the MJO.

- Hypothesis III: Errors in the diurnal cycle and its multiscale interactions with MJO and monsoons in a model would have aggregate effects on the biases in mean rainfall. Without correct convective organization related to diurnal cycle, rainfall tends to be landlocked, which would lead to wet biases over land, and a lack of MCS development over the ocean, especially its enhancement by active phases of the MJO, leading to dry biases there.

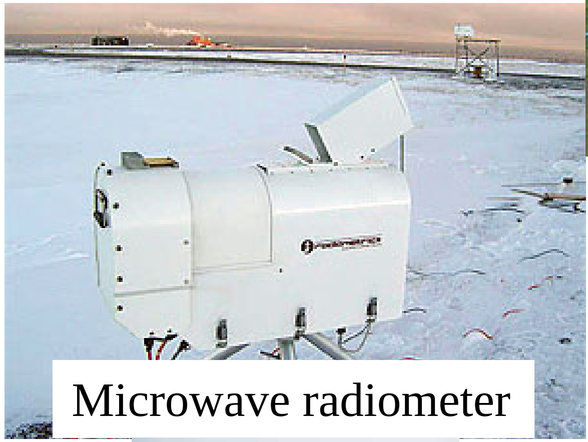
ARM Mobile Facility 1 (AMF-1)



Micropulse lidar



Ka-/W-band scanning radars



Microwave radiometer

Cimel Sunphotometer

NOAA S-band Doppler Profilter

C-band scanning radars

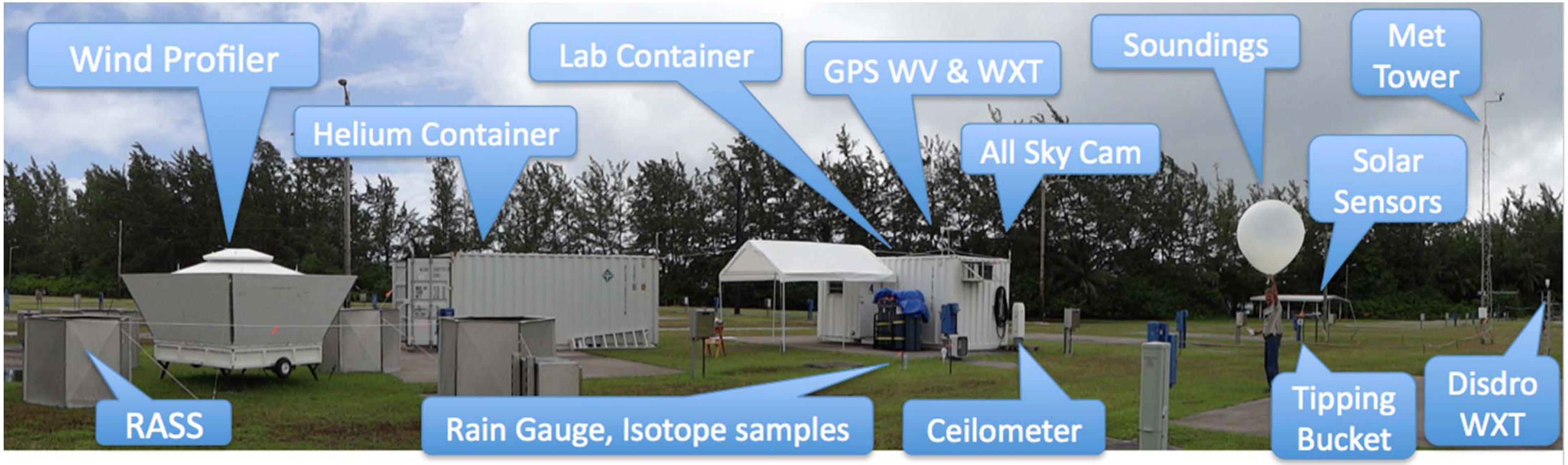
YMC-NCAR_G Science Objectives

- Diurnal precipitation: What are the prime diurnal cycle mechanisms over the MC (e.g., land/sea contrasts, topography, or convective dynamics/microphysics)? How important is representing the diurnal cycle in model simulations to obtain correct large-scale precipitation?
- MJO propagation: How does the character of the MJO and its propagation mechanisms change as it goes across the MC? What is the interaction with the diurnal cycle? Why do some models fail to propagate the MJO across this region?
- UTLS humidity: What is the role of convection in determining the humidity of the UTLS in the main upward branch of the Brewer-Dobson circulation? How do convective interactions with the UTLS vary diurnally and by MJO phase?

S-Pol

- Dual-polarimetric, Doppler S-band (10-cm wavelength)
- Precipitation, 3-D hydrometeor ID
- Scans alternating for large-scale view of convective organization and detailed upper level view of cloud microphysics in UTLS

Integrated Sounding System (ISS)



- Surface met and vertical profiles of wind, T, and RH
- High time resolution at surface and for BL profiling instruments
- 3-hr launches of new RS41 sondes for better humidity observations at high altitudes

Doppler on Wheels (DOWs)

- Dual-polarimetric, Doppler truck-mounted X-band (3-cm wavelength)
- Dual-Doppler 3-D wind retrieval
- Request for DOW6 and/or DOW7 depending on site conditions and other radar availability

YMC-ARM/YMC-NCAR_G Timeline

YMC-ARM:

- 1 year deployment, tentatively September 2018-August 2019
- Three IOP with 8/day soundings

YMC-NCAR_G:

- 2 month deployment, between October 2018 - March 2019

Location: TBD

YMC-NCAR_G/YMC-ARM Deployment

<u>S-Pol</u>: Stand alone or build a “super site” at AMF1 main site; **convective intensity, organization, and microphysical properties**

<u>ISS</u>: Sounding array with AMF1 main site and Indonesian operational sites; **environmental T, humidity, winds, heat and moisture budgets**

<u>DOWs</u>: Dual-Doppler (possibly with ARM C-band radar); **storm kinematics**