See Reid et al., (2012, 13, & 15) & Wang et al., (2013) for details

7SEAS: The Past and Future In-Situ Aerosol Observations in the Maritime Continent

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Plus a lot of help of 7SEAS members! September, 2016





Getting information that matters to the aerosol problem: The 7 Southeast Asian studies program



Scientist throughout SE Asia and beyond are working in a grass roots manner to expand aerosol observations and prediction capability to answer the question:

How do aerosol particles effect regional weather, climate, and the environment?

The 7SEAS: 1) Aerosol lifecycle and air quality;
2) Tropical meteorology; 3) Radiation and heat balance;
4) Clouds and precipitation; 5) Land processes and fire;
6) Physical and biological oceanography; and
7) Environmental characterization through satellite analyses, model predictions, and verification.



7SEAS Biggest Achievements? We now have systematic in situ and satellite measurements region wide!

Before 7SEAS, there were not many field data sets avaialbe.

Much aerosol work was based on small batches of satellite data, and individual model runs.

Now we have

- AOT and lidar observations region wide
- Real chemistry & microphysics
- Model runs that make sense
- Lots of papers (50+; h=15?)
- And a very large community outside of 7SAES waiting to use it all.

Satellite Composite AOT (550 nm)



This was all possible because of cooperation between the people in this room!



The overly simplistic MC aerosol system: El Nino versus La Nina

2006 Aug-Sept





Potential Meteorological Factors Coupled to Burning and Transport in SE Asia There is still a lot to do!

•To understand aerosol impacts on clouds and precipitation one must know how emissions and transport are related to SE Asia's meteorology.

- •One cannot simply correlate aerosol and weather features and think that the relationship found is causal
- •We have "wired this diagram" for the Maritime Continent. But we ghave a logn way to go on understanding and prediction.

Deceasing Scale



You can observe alot by just watching -Yogi Berra

Cirrus

Land effects

Wind shear

Alto Clouds Squall lines

Himawari 8





NRL Monterey ICAP Multi-Model Ensemble

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Plots Generated Sunday 21 August 2016 11UTC NRL/Monterey Aerosol Modeling

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25

5.0

9.0



Saturday 20 August 2016 00UTC Forecast t+006 Saturday 20 August 2016 06UTC Valid Time SMOKE Aerosol Optical Depth at 550nm





And models are getting at fundamental processes



Field data



- SE Asia is a hard place to figure out. Field data is still the basis of what we know.
- Data here often casts doubt into our preconceived notions as to how things should work.
- This is ok, being wrong is how we advance.
- But... Be good stewards of your instruments and QA.













How About 2012?

Positive ENSO, Weak MJO, variable monsoon flow, slower TC propagation, slightly higher emissions and much higher island AOT



At the smallest scales there is a lot going on

We are challenged with poor data sampling, but high frequency events:

> Monsoon enhancements Land/sea breeze **Squall lines** individual cells









Its been fun. Now what? Things we need to consider.



- The community is not as isolated as it was.
- More data! Between NPP and Himawari-8, we are almost choking on the data streams.
- Moore's law marches on!
- Region wide systems are in development.
- But
 - We are reaching observability and predictability limits.
 - Need to make sure you understand the fundamentals.
 - Ask the right questions.
 - Take ownership of problems
 - Evolve with appropriate teaming.

Years of the Maritime Continent (YMC)

Goal: Observing the weather-climate system of the Earth's largest archipelago to improve understanding and prediction of its local variability and global impact

Period: July 2017 – June 2019

Key Process:

- (1)Ocean-Atmosphere-Land interactions
- (2)Barrier effect on MJO propagation
- (3) Effect of ITF and mixing on SST distribution
- (4) Diurnal cycle
- (5) Monsoons
- (6) Aerosol transport and interaction with cloud/rainfall
- (7) Troposphere-stratosphere interaction and TTL dehydration processes

Potential Participants: Australia, China, France, Germany, Indonesia, Japan, Korea, Malaysia, PNG, Philippines, Singapore, Solomon Islands, Taiwan, UK, USA, Vietnam

Governance: Science Steering Committee

WWRP Endorsement: Working Group on Tropical Meteorological Research (WGTMR), Working Group on Numerical Experimentation (WGNE)/MJO Task Force, Subseasonal to Seasonal Prediction (S2S) Project, Commission for Atmospheric Sciences

Events:

Sept. 5, 2014	YMC Kick-off Meeting, Jakarta (organized by a consortium in Indonesia)
Dec. 15-19, 2014	AGU Fall Meeting (MC session)
Jan. 27-30, 2015	First International YMC Science and Planning Workshop, Singapore
Nov. 24-27, 2015	Second International YMC Science and Planning Workshop, Jakarta
Apr. 11-13, 2016	International workshop on MJO and Maritime Continent
Spring, 2017	Third International YMC Science and Planning Workshop (location TBD)



CAMP²Ex: Return to the field with a NASA P3 A proposed investigation on aerosol impacts on warm and mixed phased tropical clouds.

Overview:

- Lead Agency: NASA
- Proposed Dates: Aug-Sept 2018
- Locations: Philippines, Sulu, Celebes & South China Sea, WestPac
- Platform: NASA P3-4,000 nm range

Scientific Objectives:

- Determine the extent to which aerosol particles are responsible for modulating warm and mixed phase precipitation in tropical environments.
- Investigate if aerosol induced changes in clouds and precipitation feedback into aerosol lifecycle.
- •How do aerosol and cloud radiation covary, relate, and perhaps interact?
- •How does land use change factor into cloud and precipitation change? Is it a confounder for aeroosl impacts?











PISTON: Propagation of IntrarSeaonal Tropical OscillaitoNs

Overview:

- Lead Agency: ONR
- Proposed Dates: Aug-Sept 2018
- Locations: Philippines, Sulu Sea, WestPac
- Platform: R/V Thompson

Motivation

Investigate predictability barrier observed in numerical simulations of the Madden-Julian oscillation and other intra-seasonal tropical oscillations as they propagate across the Maritime Continent.

Scientific Objectives:

- Understand the physics of Interseaonal Tropical Oscillations, such as MJO and BSIRO
- Emphasize air-sea coupling and the near ocean environment.





Closing up? Some good (and old) advice

There is a lifecycle to all things, including aerosol events and programs, think about breaking the mold and do the next big thing. Regional AQ cooperation?

Data in the region is still tricky to deal with, and there is more of it. Make sure you understand what data you use, and where it came from. Improve the processes

Do something personal and important to your country. Sense of self efficacy is important. And be open.





Thanks for the invite! Enjoy two of my favorite days at sea.