Propagation of Intra-Seasonal Tropical Oscillations (PISTON) Science Plan

Office of Naval Research Departmental Research Initiative

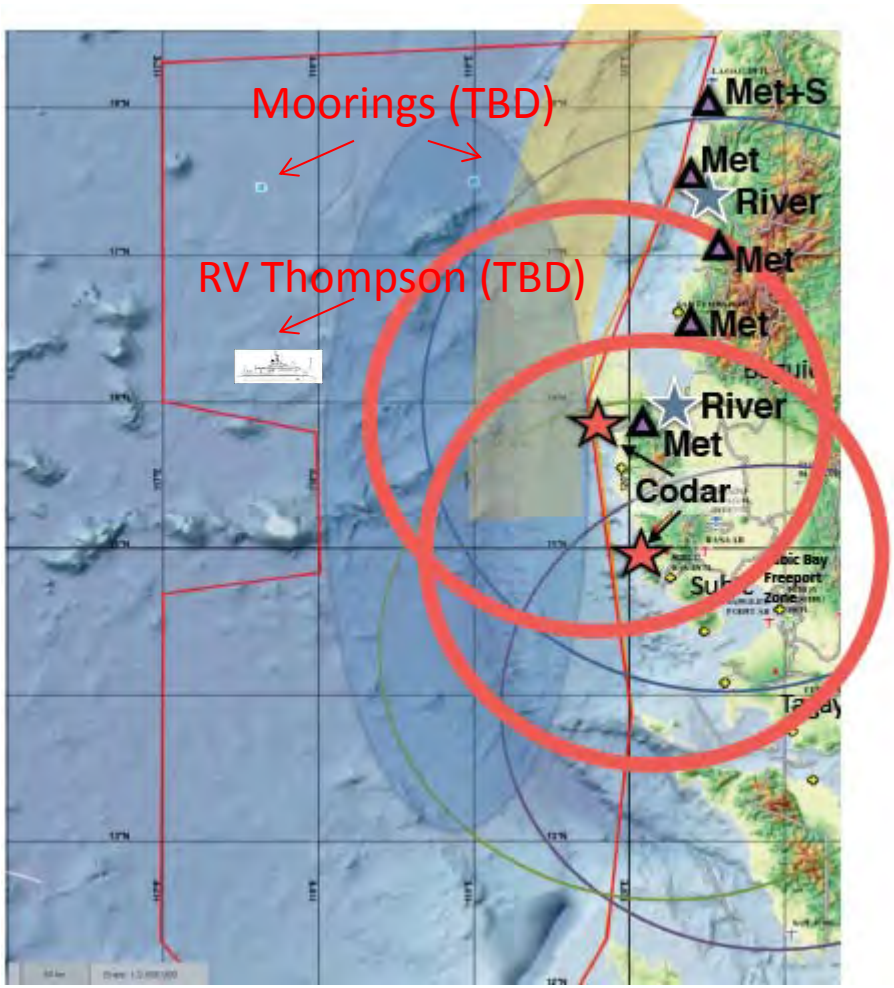
PISTON Science Team

Authors	Affiliation
Alford, Matthew	Scripps Institution of Oceanography
Bell, Michael	Colorado State University
Blake, Brandon	Office of Naval Research
Cabrera, Olivia	University of the Philippines
Chen,Sue	Naval Research Lab, Monterey
de Szoeke, Simon	Oregon State University
Eleuterio, Daniel	Office of Naval Research
Fairall, Chris	NOAA Earth System Research Laboratory
Flatau, Maria	Naval Research Lab, Monterey
Gordon, Arnold	Columbia University
Harper, Scott	Office of Naval Research
Jensen, Tommy	Naval Research Lab, Stennis
Jiang, Xianan	UCLA
Lombardo, Kelly	University of Connecticut
Lucas, Drew	SIO
Maloney, Eric	Colorado State University
Martin, Zane	Columbia University
Moum, Jim	Oregon State University
Narisma, Gemma	Manila Observatory
Pullen, Julie	Stevens Institute of Technology
Ray, Pallav	Floraida Institute of Technology
Reid, Jeff	Naval Research Lab, Monterey
Reynolds, Carolyn	Naval Research Lab, Monterey
Rutledge, Steven	Colorado State University
Rydbeck, Adam	Naval Research Lab, Stennis
Shroyer, Emily	Oregon State University
Skyllingstad, Eric	Oregon State University
Sobel, Adam	Columbia University
Van Den Heever, Sue	Colorado State University
Villanoy, Cesar	University of the Philippines-Diliman
Waliser, Duane	University of California, Los Angeles
Wang, Shuguang	Columbia University
Xu, Weixin	Colorado State University
Zhang, Chidong	NOAA Pacific Marine Environmental Laboratory

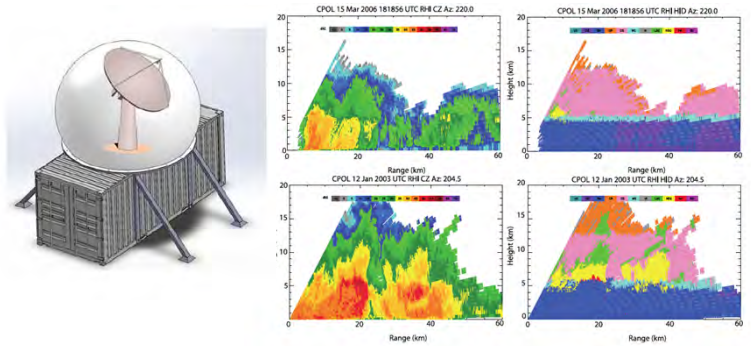
Overview of PISTON Science Plan

- Forge a better understanding of the multiscale, air-sea, and land-atmosphere interaction process that regulate BSISO propagation and intensity
- Use observational dataset and model simulations to address the overarching hypotheses that examine the coupling of large-scale atmosphere and ocean related to the monsoon, BSISO, and convective coupled atmosphere waves with the MC diurnal cycle in the coastal regions and nearby sea to test the following hypotheses:
  1. SST during BSISO events is modulated by a variety of 3D ocean process and these ocean processes provide a feedback between the ocean and atmosphere
     - Breaking internal waves of near-inertial and tidal frequency
     - Shear instability of low-frequency flows
     - Lateral mixed-layer instabilities such as slumping
     - Buoyancy and shear-driven mixing
  2. Local and mesoscale processes related to the presence of land, topography, and ocean influence the development and propagation of the BSISO
     - Land-sea breeze circulation, river discharge to the costal ocean, gravity waves triggering of new convection
     - Diurnal cycle
- Dry run in summer 2017 and field campaign during the late summer of 2018 off the west coast of Luzon

Observation Plan



- Two months of shipboard measurements from RV Tomas G. Thompson
- CPOL Doppler radar (CSU)
- 8 soundings per day (CSU)
- Surface meteorology, radiative, and turbulent flux, lidar, radiometer measurements (OSU, NOAA ESRL)
- Ocean measurements: turbulence, ADCP (OSU)
- Three moorings (SCRIPPS, UCSD)
- Moorings and ship track - TBD



Model Plan

Pre-field phase

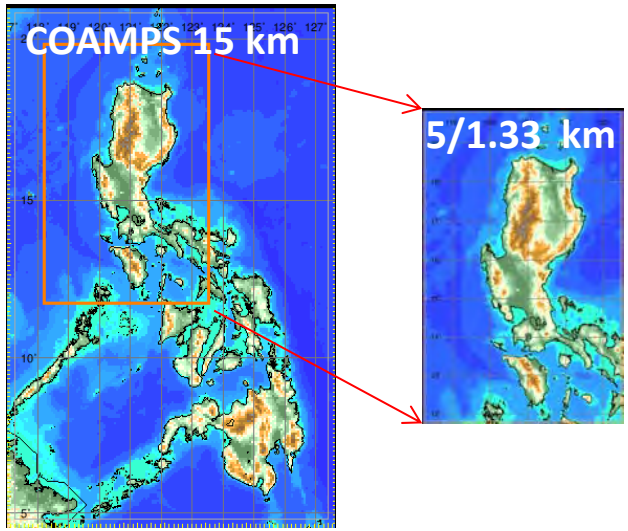
- Preliminary cases will be identified based on existing observations to undertake targeted process-level model experimentation, and further refine the field stage where possible.
- Limited preliminary control simulations will inform the sampling strategy of the field campaign.
- Differences between realizations from similar model configurations will identify areas of uncertainty.
- A few idealized experiments can highlight processes of particular scientific interest that require observational constraint.
- Will take advantage of the multi-model GASS-YOTC (e.g. Jiang et al. 2015) and S2S Project databases
- Dry run in 2017

Field campaign

- COAMPS (two-way coupled air-ocean-wave)
- provides realtime 3-day forecast twice/day
- On-demand RAMS high-resolution forecast

Post-field phase

- Model validation
- PISTON hypotheses validation



Model Hypotheses Testing

Hypotheses	Large-scale Control	Convective Process Studies	Ocean Diurnal Warm Layers	3-D Ocean Processes	Atmo-Ocean-Land Interactions
Models	COAMPS-NCOM, NAVGEM-HYCOM, WRF-HYCOM, GASS-YOTC, S2S	COAMPS-NCOM, RAMS, WRF-ARW, ALEMC, GASS-YOTC	RAMS, COAMPS-NCOM	COAMPS-NCOM, WRF-HYCOM	COAMPS-NCOM, NAVGEM-HYCOM, WRF-ARW, WRF-HYCOM, GASS-YOTC
Observations	Raobs, surface fluxes, upper ocean profiles, air and sea surface temp, humidity, wind	Raobs, radar, surface fluxes, upper ocean profiles, air & sea surface temp, humidity, wind, aerosol, cloud, microphysics	Raobs, surface fluxes, upper ocean profiles, air and sea surface temp, humidity, wind	Raobs, surface fluxes, upper ocean profiles, air and sea surface temp, humidity, wind	Raobs, radar, surface fluxes, upper ocean profiles, air and sea surface temp, humidity, wind, near-surface winds and temp over land, precipitation
Modeling Groups	NRLMRY, Columbia, JPL Personnel: Chen, Flatau, Reynolds, Sobel, Wang, Waliser, Jiang	CSU, UCONN, JPL, NRLMRY Personnel: Lombardo, Maloney, Riley Dellaripa, Posselt, van den Heever, Chen, Flatau, Reynolds, Skyllingstad, De Szoeke, Waliser, Jiang	CSU, OSU, NRLMRY, NRLSSC Personnel: Maloney, Riley Dellaripa, Flatau, Chen, Reynolds, Jensen, Skyllingstad, De Szoeke	Columbia, NRLSSC, NRL MRY Personnel: Sobel, Wang Jensen, Chen, Flatau, Reynolds,	NRLMRY, OSU, Stevens, Florida Tech, USNA, Columbia Personnel: Sobel, Wang, Flatau, Chen, Reynolds, Pullen, Ray, Barrett, Waliser, Jiang

Synergy with Other Projects

Observation

- YMC
- CAMP^{2}Ex (NASA clouds, aerosol, monsoon processes experiment; P3)
- Proposed platform for Philippine field activities under SALICA in summer 2018 (TBD, University of Philippines - Cesar Villanoy & Olivia Cabrera)

Models

- WRF/WRF-HYCOM (Manila Observatory - Gemma Narisma; University of Philippines - Cesar Villanoy & Olivia Cabrera)
- S2S, GASS-YOTC Multi-Model Simulations
- NICAM