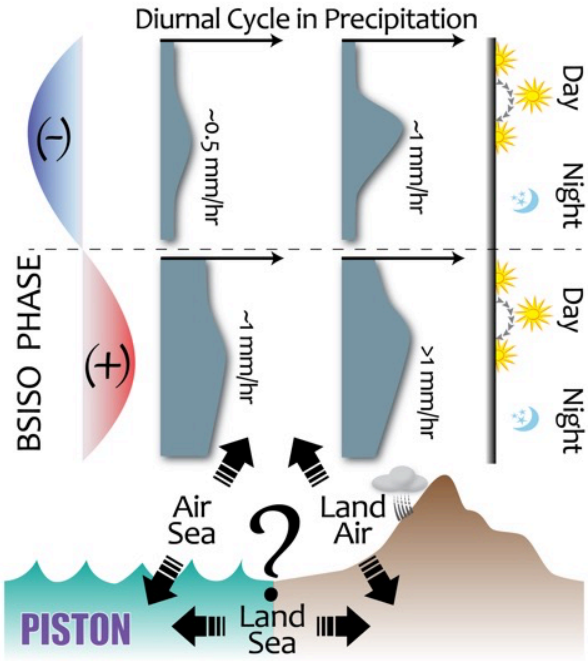
Propagation of Intra-Seasonal Tropical Oscillations (PISTON)

Office of Naval Research Departmental Research Initiative (DRI)

During monsoon season over the South China Sea and Philippines, weather varies on the subseasonal time scale. Disturbances of the "boreal summer intraseasonal oscillation" (BSISO) move north and east across the region over periods of weeks. These disturbances, comprised of synoptic- and mesoscale convective systems, are strongly conditioned by the complex geography of the region. The diurnal cycle in convection over islands and adjacent coastal seas is strong. Air-sea interaction is modulated by ocean stratification and local circulation patterns that are themselves complex and diurnally varying. The multiple pathways and space-time scales in the regional ocean-atmosphere-land system make prediction on subseasonal to seasonal (S2S) time scales challenging. The PISTON field experiment aims to address these challenges.

The PISTON field campaign targets the west coast of Luzon in August/September 2018. Shipboard measurements will be made on the R/V Thomas G. Thompson, working closely with colleagues on BRP Gregorio Velasquez through the Philippine SALICA program (Sea Air Land Interactions in the Context of Archipelagos). Measurements will span the coastal ocean to 220 nm offshore and include polarimetric and Doppler radar, atmospheric soundings, fluxes and aerosols as well as detailed upper ocean measurements. Ship-based observations will be augmented by measurements from oceanographic moorings, land based soundings, radar and rain gauge stations. PISTON is timed to interact with the aircraft-based, NASA-funded CAMP^{2}EX campaign (Cloud and Aerosol Monsoonal Processes-Philippines Experiment). The PISTON observational effort will be closely complemented by a modeling program including global and regional atmosphere, ocean and coupled models. The modeling component includes process-oriented research as well as the use and validation of operational systems.



The diurnal cycle and its interaction with the BSISO are primary targets for PISTON. Key questions include how heat is stored and released in the upper ocean on intraseasonal time scales, how that heat storage interacts with atmospheric convection, and what role it plays in BSISO maintenance and propagation. Key processes include land-sea breezes, orographic influence on convection, river discharge to coastal oceans, gravity waves, diurnal warm layers, internal tides, and a buoyancy-driven northward coastal current. As intraseasonal disturbances approach the region, the presence of islands, with their low surface heat capacity, mountains, inhomogeneous distribution of urban/vegetation/soil, and strong diurnal cycle disrupts the air-sea heat exchange that likely sustains the BSISO over the ocean, confounding prediction models in which these processes are inadequately represented. Along with upscale influences, PISTON will seek to advance our understanding of how *large scale atmospheric circulation variability over the South China Sea, related to the monsoon, BSISO, and convectively coupled waves, modifies the local diurnal cycle, synoptic systems, and air sea interaction in coastal regions and nearby open seas.* PISTON's coordinated observing and modeling program will attempt to unravel this complex web of interactions in the service of improved S2S prediction.