The Colorado State University Sea-Going and Land Deployable Polarimetric (SEA-POL) Radar
Michael M. Bell, V. Chandrasekar, Steven Rutledge, Brenda Dolan, Chelsea Nam, Jim George, Francesc Junyent, EunYeol Kim
Colorado State University

SEA-POL Summary
The Colorado State University (CSU) Sea-Going and Land-Deployable Polarimetric (SEA-POL) radar has recently been supported as a Community Facility available for deployment requests through the National Science Foundation (NSF). The radar is designed to be portable and rugged from a mechanical and electrical perspective, and constructed to be operable in harsh environments. The radar can be deployed on ships and at remote field sites around the world. It offers platform stabilization for oceanic environments while still having high-quality polarimetric capabilities for all-purpose use. The CSU radar has been deployed in SPURS-2 (2017) and PISTON (2018/2019) shipborne campaigns and on an island for PRECIP 2022. The radar is available for future deployments through the NSF Facilities and Instrumentation Request Process (FIRP).

Future SEA-POL Deployments
SEA-POL is available for requests through the NSF FIRP! To request an allocation, please visit: seapol-request@lists.colostate.edu

Past SEA-POL Deployments
• SPURS-2 (October -November 2017), RV Roger Revelle
  • San Diego -> Eastern Pacific -> San Diego
• PISTON (August -September -October 2018), RV Thomas G Thompson
  • Kaohsiung City Taiwan -> Palau -> Kaohsiung Taiwan
• PISTON (September 2019), RV Sally Ride
  • Keelung Taiwan -> Western Pacific -> Keelung Taiwan
• PRECIP (May -August 2022), land-based on Yonganji, Japan

SEA-POL Technical Specifications
The CSU SEA-POL radar measures dual-polarization data over a range in excess of 200 km. The radar operates at C-band (5.65 GHz, 5-cm wavelength) and has a 4.3 m stabilized antenna system. An inertial navigation unit measures ship motion and sends compensation commands to the antenna positioner. Doppler velocity data is also corrected for ship velocity. This permits high quality data to be collected at sea, correcting for ship roll and pitch. The radar operates in simultaneous transmit and receive mode, as well as horizontal-only mode, with a sensitivity of -7 dBZ at 100 km. The radome is designed to handle wind loads up to 115 mph. A variety of pulse widths, pulse repetition frequencies, and scanning strategies are supported. The radar is packaged in three ISO-668 1C containers for transportability and ease of deployment.

Science with SEA-POL
Unique Observations of Large Raindrops during PISTON
SEA-POL frequently measured very large Zdr (>5 dB) => >4.5 mm drops

Can drops grow that large under primarily warm rain conditions?
• Updrafts (~3 m/s) and LWCs (1.5 g/m3) frequent in this warm rain conditions?
  1. Resonance effects at C-band (5 GHz) and warm state and evolution of the atmosphere and ocean during PISTON 2018. J. Climate, 34, 5017-5035.

Publications using SEA-POL

Example data from the Prediction of Rainfall Extremes Campaign in the Pacific (2022)

Example data from the Salinity Processes in the Upper Ocean Regional Study, second field phase (SPURS-2) project
Range-height indicator (RHI) plots of (a) reflectivity, (b) Doppler radial velocity corrected for storm motion, (c) differential reflectivity, (d) co-polar correlation coefficient, (e) specific differential phase, and (f) hydrometeor classification at 1812:54 UTC 28 Oct 2017 facing east (84° azimuth). From Rutledge et al. (2019).

Example analysis from Propagation of Intra-Seasonal Tropical Oscillations (PISTON) 2018 Project
Colored circles in (a) are the evolution of the hourly median reflectivity profile from gridded SEA-POL data. Contoured in black are the relative radial velocities of Typhoon Kong-Rey derived from the thermodynamic profiles exceeding 20 m/s. Vertical dotted lines indicate the times of the corresponding 2-5 km altitude cross sections. The gray shaded region is where SEA-POL was not transmitting and collecting observations, which changes with ship heading. Times where no solar radiation is affecting the polished surface are denoted by a white cross. The correlation coefficient (horizontal-only mode, with a sensitivity of -7 dBZ at 100 km). The radome is designed to handle wind loads up to 115 mph. A variety of pulse widths, pulse repetition frequencies, and scanning strategies are supported. The radar is packaged in three ISO-668 1C containers for transportability and ease of deployment.