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The CSU Sea-Pol Ship-Board Radar

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Sea-Pol is ship- and land-deployable dual-polarization meterological radar system developed at Colorado State University. It is designed for operation aboard Global-class research ships operated by the US oceanographic community. The radar operates at C-band (5.65 GHz) and has a 4.3 meter stabilized antenna system. An inertial navigation unit (INU) is used to measure and compensate for ship platform motion. The radar can operate in simultaneous-transmit, simultaneous-receive (STSR) mode, as well as horizontal-transmit, simultaneous-receive mode. The radar uses a 250 kW coaxial magnetron transmitter capable of a variety of pulse widths and PRFs within a 0.12% duty cycle limit. The radar has a sensitivity of -7 dBZ at 100 km range. The radar is designed to be easily transported by virtue of being packaged in standard ISO-668 1C containers. Special care was taken to make Sea-Pol rapidly deployable and able to withstand the harsh environmental conditions aboard research ships on the open ocean.

The radar completed its second deployment cruise aboard the R/V Thomas G. Thompson in the Philippine Sea between August and October 2017. This was part of the Propagation of Intra-Seasonal Tropical Oscillations (PISTON) field campaign [1], designed to observe the Boreal Summer Intraseasonal Oscillation. Sea-pol provided high quality dual-polarization measurements to a range of 120 km around the ship. The radar also performed dual-doppler measurements to extract 2D wind vectors in conjunction with the radar on board the Japanese R/V Mirai.

The paper presents an engineering overview of the radar, including its salient features that make it a world-class instrument. The dynamic stabilization system performance is shown. We then present example cases of data recorded during the PISTON campaign. We also present preliminary results from the spectral classification method used to identify and suppress sea clutter.

In summary, the Sea-Pol radar was developed and successfully deployed in a marine environment. Measurements taken while at sea demonstrated very good dual-polarization performance, and showed that the platform stabilization system suppressed platform motion to within 0.1°.

1. About the PISTON field campaign, https://onrpiston.colostate.edu/about.html