

# The Colorado State University Sea-Going and Land Deployable Polarimetric (Sea-Pol) Radar



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## CSU Sea-Pol Summary

The Colorado State University (CSU) Sea-Going and Land-Deployable Polarimetric (Sea-Pol) radar is 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 or 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 radar is available for future deployment requests through the NSF Facilities and Instrumentation Request Process (FIRP).



## Sea-Pol Deployments



### Ship deployments:

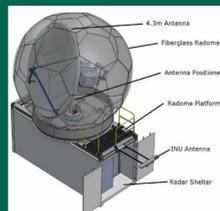
- **SPURS-2** (October - November 2017), *R/V Roger Revelle*  
San Diego -> Eastern Pacific -> San Diego
- **PISTON** (August -September - October 2018), *R/V Thomas G Thompson*  
Kaohsiung City Taiwan -> Palau -> Kaohsiung Taiwan
- **PISTON** (September 2019), *R/V Sally Ride*  
Keelung Taiwan -> Western Pacific -> Keelung Taiwan
- **PICCOLO** (August - September 2024), *R/V Meteor*  
Mindelo Cape Verde-> Atlantic-> Bridgetown Barbados

### Land deployments:

- **PRECIP** (May - August 2022), Yonaguni, Japan
- **S2noCliME** (December 2024 – April 2025), Steamboat Springs, Colorado

## Technical Specifications

The CSU Sea-Pol radar measures dual-polarization data over a range >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. This permits high quality data to be collected at sea, correcting for ship roll and pitch. Doppler velocity data is also corrected for ship velocity. 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 20-foot containers for transportability and ease of deployment.

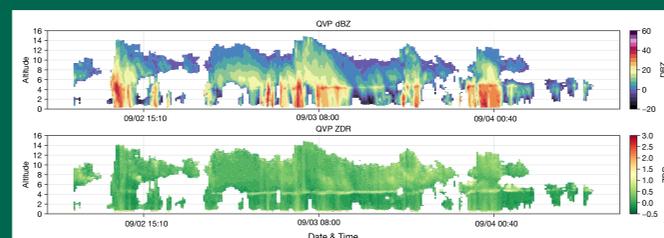


## Publications using Sea-Pol Data

- Bingham, F. M., and Z. Li, 2020: Spatial Scales of Sea Surface Salinity Subfootprint Variability in the SPURS Regions. *Remote Sensing* 12.23, 3996.
- Chudler, K. and S. A. Rutledge, 2021: The coupling between convective variability and large-scale flow patterns observed during PISTON 2018–19. *J. Climate* 34.17, 7199-7218.
- Chudler, K., S. A. Rutledge, and B. Dolan, 2022: Unique radar observations of large raindrops in tropical warm rain during PISTON. *Mon. Wea. Rev.* 150 (10), 2719-1736.
- Mishra, K. V., M. Thurai, and V. N. Bringi, 2024: The decade of renaissance in weather radar research. *Advances in Weather Radar: Precipitation Sensing Platforms, Volume 1*.
- Nam, C. C. and M. M. Bell, 2026: The Climatology and Structure of Elongated Rainbands of Tropical Cyclones in the Western North Pacific Monsoon Region. *J. Climate*, in press.
- Reverdin, G., A. Supply, K. Drushka, E. J. Thompson, W. E. Asher, and A. Lourenço, 2020: Intense and small freshwater pools from rainfall investigated during SPURS-2 on 9 November 2017 in the eastern tropical Pacific. *J. Geophys. Res.: Oceans*, 125, no. 2, e2019JC015558.
- Serra, Y. L., S. A. Rutledge, K. Chudler, and C. Zhang, 2023: Rainfall and Convection in ERA5 and MERRA-2 over the Northern Equatorial Western Pacific during PISTON. *J. Climate*, 36(3), 845-863.
- Trabling, B. C., and M. M. Bell, 2021: Observations of Diurnal Variability under the Cirrus Canopy of Typhoon Kong-rey (2018). *Mon. Wea. Rev.*, 149, 2945-2964.

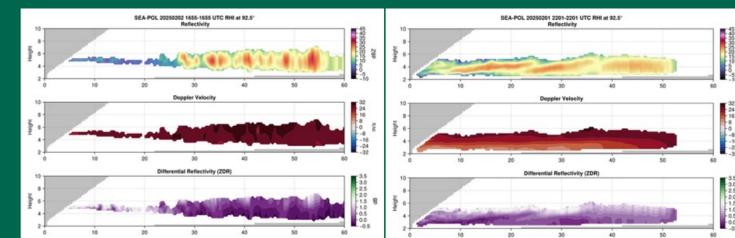
## Sea-Pol: Enabling Science

### From Tropical Convective Organization in PICCOLO



Quasi-vertical profile (QVP) at 45° of reflectivity (top) and differential reflectivity  $Z_{dr}$  (bottom) during a rainy period from 2 - 4 September 2024 in the Process Investigation of Clouds and Convective Organization of the atLantic Ocean (PICCOLO). The *R/V Meteor* ship deployment was part of the larger ORCESTRa campaign to understand mesoscale organization of tropical clouds and validate satellite remote sensing and high-resolution storm resolving models. Sea-Pol data provides important observations of the storm scales and organization near the ship and out to 240 km range.

### To Snow Microphysics in S2noCliME



Vertical RHI scans of reflectivity, differential reflectivity, and radial velocity from two different snow regimes from the Snow Sensitivity to Clouds in a Mountain Environment (S2noCliME) campaign. This project around Steamboat Springs, CO seeks to understand the long range transport of water vapor and its interaction with complex terrain and cloud microphysics. The left RHI shows heterogeneous convective cells on 2 February 2025. The right RHI is an example from a widespread case of heavy snowfall, with layers of high reflectivity as the system encounters terrain. Sea-Pol provides the large-scale context as well as microphysical information about these winter clouds.

**Sea-Pol is available for requests through the NSF FIRP!**

- Track 1 (Education)
- Track 2 (Single facility)
- Track 3 (Field Campaign)



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Email us at [seapol-request@lists.colostate.edu](mailto:seapol-request@lists.colostate.edu)

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## Sea-Pol References

- Chandrasekar, V., J. George, S. Rutledge and F. Junyent, 2019: The CSU Sea-Pol Ship-Board Radar, *2019 URSI Asia-Pacific Radio Science Conference (AP-RASC)*, New Delhi, India, pp. 1-1
- George, J. V. Chandrasekar; F. Junyent; S. A. Rutledge; A. Morin; R. Bowie; P. Kennedy, 2018: Salient features of the CSU sea-pol radar, *2018 IEEE Radar Conference (RadarConf18)*, Oklahoma City, OK, USA, 2018, pp. 1307-1310.
- Rutledge, S. A., V. Chandrasekar, B. Fuchs, J. George, F. Junyent, B. Dolan, P. C. Kennedy, and K. Drushka, 2019: Sea-Pol goes to sea. *Bull. Amer. Meteor. Soc.*, 100, 2285–2301.
- Rutledge, S. A., V. Chandrasekar, B. Fuchs, J. George, F. Junyent, P. Kennedy, and B. Dolan, 2019: Deployment of the Sea-Pol C-band polarimetric radar to SPURS-2. *Oceanography*, 32, 50–57.

