

Salar de Uyuni and Lake Titicaca: characterizing two high altitude sites for vicarious calibration of multi-angle polarimeters

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Vicarious calibration sites for on-orbit Earth-viewing satellite sensors are selected for their stable, well-characterized surface properties. Traditionally, “well-characterized” has been limited to angular radiometric characterization. With the proliferation of multiangle polarimeters in space, not only radiometric but polarization characterization becomes necessary. Furthermore, all Earth-view vicarious calibration sites require atmospheric correction to derive surface parameters. This correction introduces uncertainty into what is hoped to be a very accurate and precise comparison of satellite measurements with a known target. The higher the altitude of the vicarious calibration target, the less drastic and more reliable the atmospheric correction becomes. The Altiplano region of Bolivia, at approximately 3,750 m Above Sea Level, offers a unique opportunity for vicarious calibration with minimal atmospheric correction.

The angular spectral polarized reflectance of two Altiplano sites: the Salar de Uyuni, a salt flat covering 10,000 km², and Lake Titicaca are characterized during the ALtiplano Polarimetry Assessment Campaign (ALPACA) in May 2025. For this purpose, an airborne polarimeter is carried by a drone (DroneHARP), measuring in the same four wavelengths using the same stripe filter technology of HARP2 currently aboard NASA’s Plankton, Aerosol, Cloud, ocean Ecosystems (PACE) mission. The drone flight path allows for radiometric and polarimetric measurements of the surface for scattering angles 0 to 180°. DroneHARP has been post-deployment calibrated and its data geolocated. The resulting characterization shows an unexpected angular polarization signal of the salt flat and expected angular polarization through the glint of Lake Titicaca. Drone flights were scheduled to coincide with specific satellite overpasses allowing for intercomparisons between satellite measurements and the results of the characterized surface.

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