# AN OVERVIEW OF THE ANALYSIS OF MULTI-FREQUENCY POLARIMETRIC SAR DATA.

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## ABSTRACT

Multi-frequency polarimetric SAR data hold the promise of providing valuable information about terrain cover. Many different approaches to model the expected responses have been published, and several papers have described the phenomenology of multi-frequency polarimetric data. This paper gives a brief overview of the different analysis tools and techniques to analyze multi-frequency polarimetric data.

We start with an overview of a number of different ways to view color overlays of multi-parameter SAR data, including polarization color overlays in different bases, as well as multi-frequency overlays. We show overlays using the canonical linear polarization basis, as well as overlays using the Pauli spin matrix basis. This last basis has been introduced because in canonical cases, it provides a simple way to interpret data in terms of scattering matrices. We also discuss how the eigenvalue decomposition introduced by Cloude can be used to interpret polarimetric data. In particular, we look at some of the pitfalls of interpreting the results of these decompositions. For example, we show that if the co-polarization phase difference is not considered in displaying the eigenvalue overlay, one might misinterpret the results in terms of scattering mechanisms. Even if the co-polarization phase difference is considered when displaying the eigenvalues, one still has to be careful when interpreting the results in terms of scattering mechanisms, especially if the co-polarization phase difference is near 90 degrees. This is also true of overlays using the Pauli spin matrix basis.

Next, we look at the concepts of the polarization signature pedestal heights and entropy and the "alpha angle" introduced by Cloude and Pottier. We also show how these parameters are related to the radar thin vegetation index.

All these concepts are illustrated using data from AIRSAR acquired in Australia during the 1996 PACRIM deployment.