IMAGE PROCESSING FOR SPACE-BORNE WIDE FOV IMAGING POLARIMETERS

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The capabilities of remote sensing instruments to observe aerosols and clouds from space have been continuously pushed as technology and research advances. The measurement of a more complete set of Stokes parameters, for instance, allows obtaining the real part of the refractive index with its link to particle composition and hygroscopicity. Measuring a wide range of scattering angles help constrain particle size, while hyper-angular measurements are necessary to retrieve the full size distribution of both aerosol and cloud droplets. For that reason, the last two Decadal Surveys have made the Aerosol-Clouds-Ecosystems (ACE) mission a priority and recognized the need for a highly accurate multiangle, multiwavelength satellite-borne polarimeter with high spatial resolution.

The Laboratory for Aerosols, Clouds and Optics (LACO) has developed such a sensor, with a very simple but highly effective design with no moving parts. The Hyper Angular Rainbow Polarimeter (HARP) has a wide field-of-view and can simultaneously measure 3 angles of polarization, at 4 different wavelengths, to observe the same target with up to 60 viewing angles. Processing the raw data of any wide-FOV polarimeter is a great challenge per se. Here, we describe our level 1 processing software: the Single-angle Composite Image Processing Pipeline, aka SCIPP. This system is a collection of tightly integrated stand-alone executables, driven by a single script. It accepts as input a range of sequential wide-angle aerial or satellite images, with the associated navigational data. The output is a single HDF5 file containing a series of composite geo-located images at single viewing angles, on a uniform lat-lon grid, corresponding to calibrated stokes parameter data. We will describe the data processing, step-by-step, and present sample level-1 data from the recent LMOS and ACEPOL campaigns.

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