2024/2025 Master of Science Project

Geoscience and Remote Sensing

Pushing optical Spectro-polarimetry for monitoring agriculture and biodiversity

On February 8, 2024, the Dutch spectro-polarimetric sensor SPEXone was launched into space, opening up a new way of remote sensing by providing multi-angle measurements of spectral radiance and polarization. SPEXone yields advanced aerosol products, but may also provide breakthrough observations for monitoring agricultural crops and biodiversity.

In this recently started project, hosted by both TU Delft and the Netherlands Institute for Space Research (SRON), we are presently exploring how multi-angle polarimetric observations can be exploited for surface observations. In particular, spectro-polarimetry is of high interest as it is the only remote sensing approach that is demonstrated to allow for the direct estimation of canopy leaf angle distributions (LAD). This is the only canopy variable that is both required by detailed radiative transfer models (that couple optical remote sensing observations to biophysical parameters of the surface) and presently not being measured with any traditional satellite remote sensing instrument. Given that vegetation LAD varies between species and alters under heat and drought stress, actually monitoring this variable not only provides a high impact for precision agriculture, but also for monitoring biodiversity. Combining both satellite and airborne observations (executed during the PACE-PAX field-experiment in September 2024 in the US), we will have a unique dataset of polarimetric observations at different levels. By show-casing the dependency of polarimetric observations to different vegetation types, growth stages and stress levels, we intent to define mission requirements for ESHARP, the successor of SPEXone.

Proposed Activities

- Investigate coarse-resolution SPEXone observations over terrestrial vegetated surfaces to identify leaf angle distribution patterns.
- Assess the spatio-temporal dependency of spectro-polarimetric airborne high-resolution observations across different fields.
- Reflect on the present day ESHARP design for monitoring clouds and vegetation.

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University Graduation Topic - MSc CME

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