Harmonization of hyperspectral and multispectral data sets

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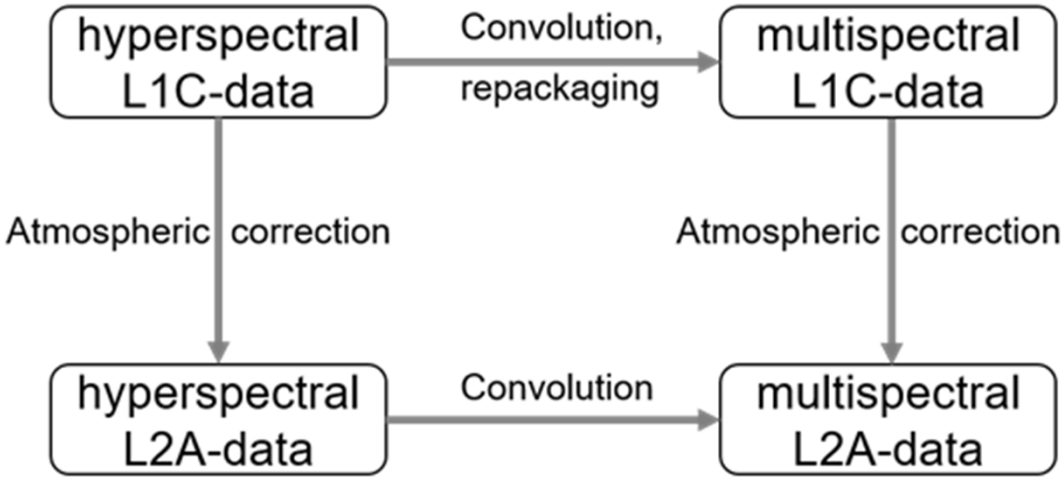
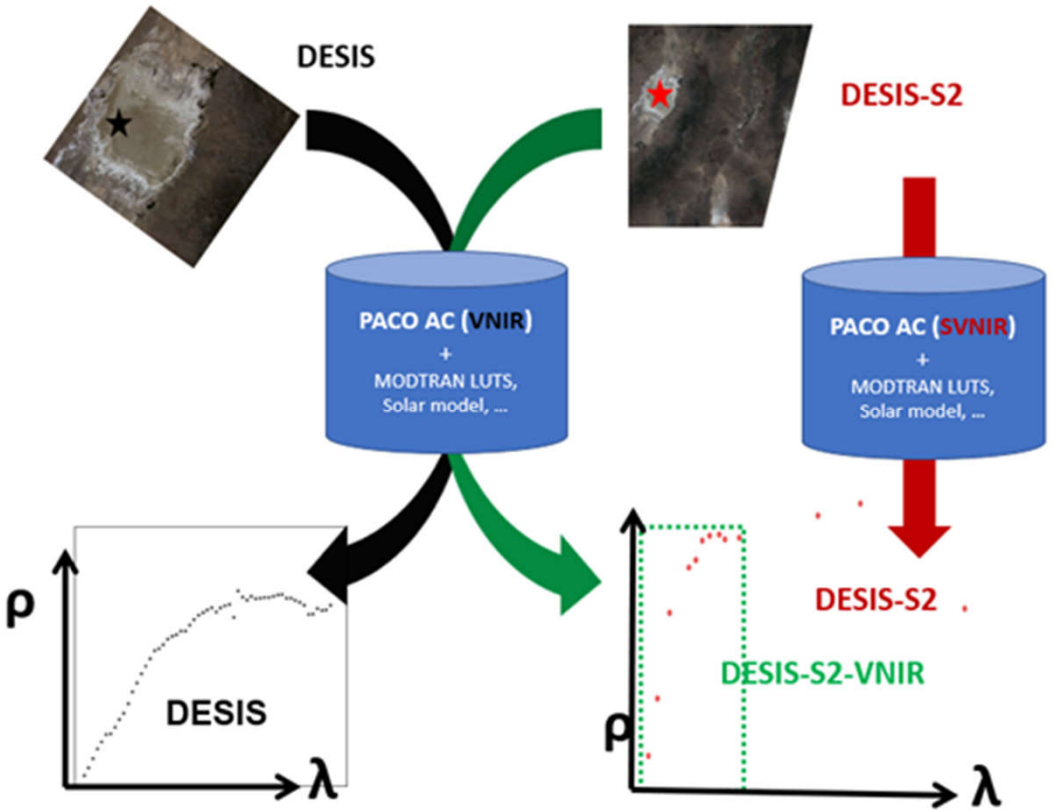
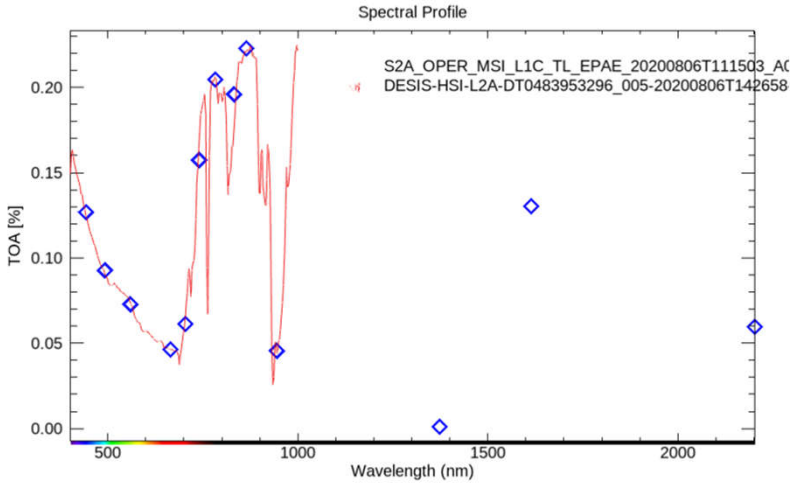
How to implement space borne hyperspectral data into multispectral time series?



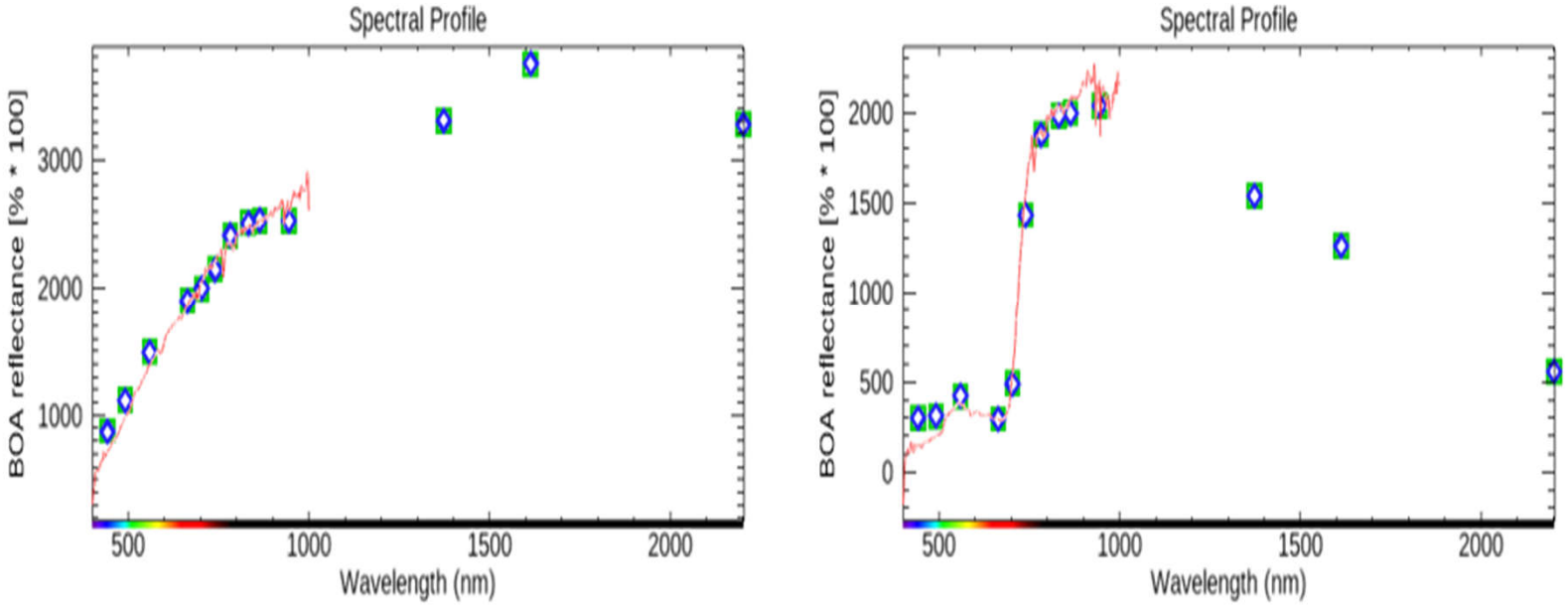
- Two different ways:
    1. Keep at multispectral processing
    2. Go to hyperspectral processing

Comparison of both ways with DESIS and S2 data





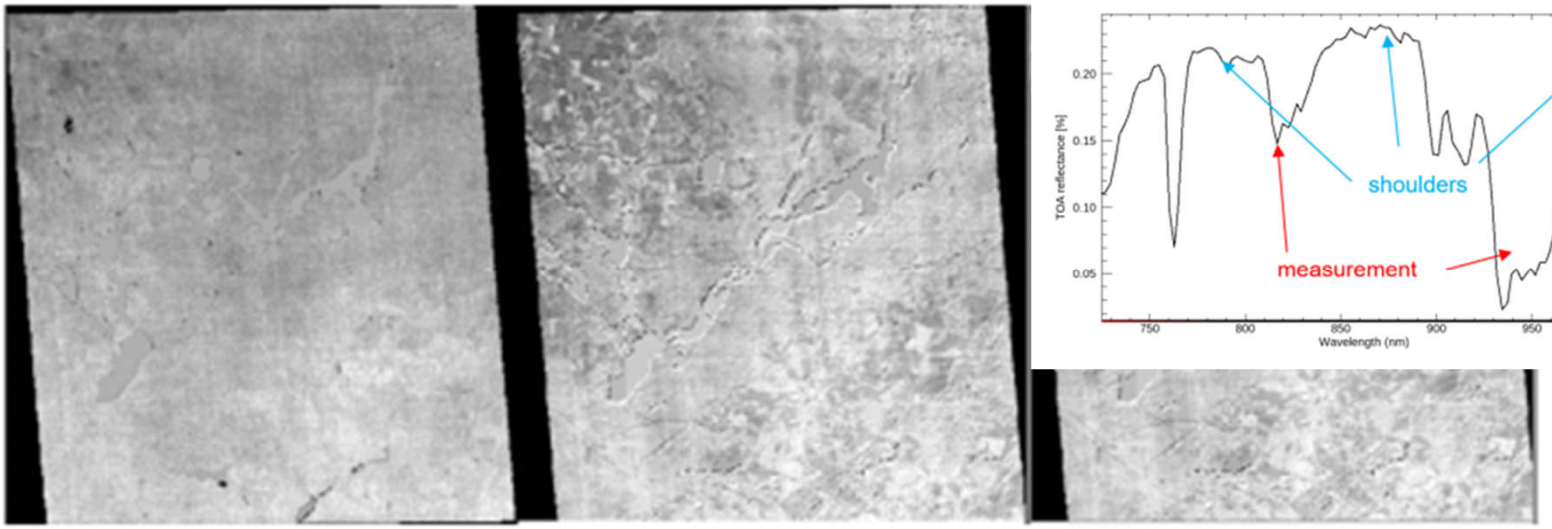
Difference for Surface Reflectance



DESIS (red line); DESIS-S2-VNIR (blue diamond); DESIS-S2 (green square)

- Differences smaller than uncertainties of reference measurements
  - Difference in blue region: due to scale path radiance
  - Similarity of DESIS-S2-VNIR and DESIS-S2
  - Difference between hyperspectral – multispectral at S2 B09 (940 nm) for soil

Difference for Water vapour estimation



DESIS DESIS-S2-VNIR DESIS-S2

- Difference between multi-spectral and hyper-spectral (± 0.3 cm at some pixels)
- Different bands used for WV estimation
  - Hyperspectral: 820 nm, with shoulders in the 765 nm and 845 nm range
  - Multispectral: 940 nm, with one shoulder at 865 nm only.
- Mean WV = 2.2 cm for land pixels for all three processing chains

Conclusions for harmonization of hyperspectral and multispectral data sets

- If L2A hyper-spectral processing is available, also a multispectral (convolved) data set can be created at any time.
- L2A spectra are smoother than L1C;
  Convolution of L1C spectra might lead to more errors than the convolution of smoother L2A.

➢ **Implementation of space borne hyperspectral missions into multispectral time series by convolution at L2A-level**

Sen2Like experience on data format to ease harmonization and fusion

- Same reference grid / cartographic projection (UTM)
- Unified approach for flagging of cloud, snow, water, shadow
- Same structure for Sun/Viewing - Zenith/Azimuth angles ((per channel / detectors)
- Spectral response reported in a similar way
  (sampling, Central Wavelengths (CW), FWHM, uncertainties)
- Hyperspectral Format includes CW and FWHM for any bands