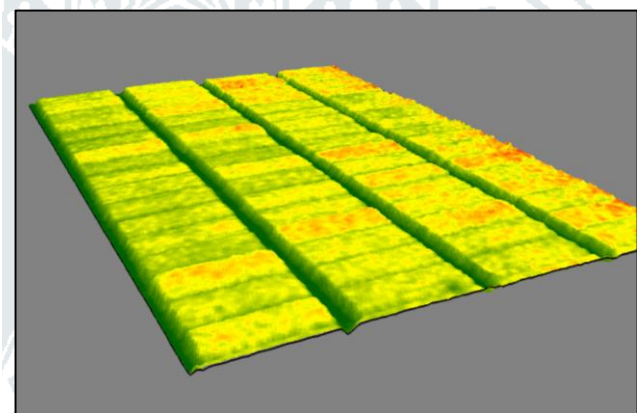
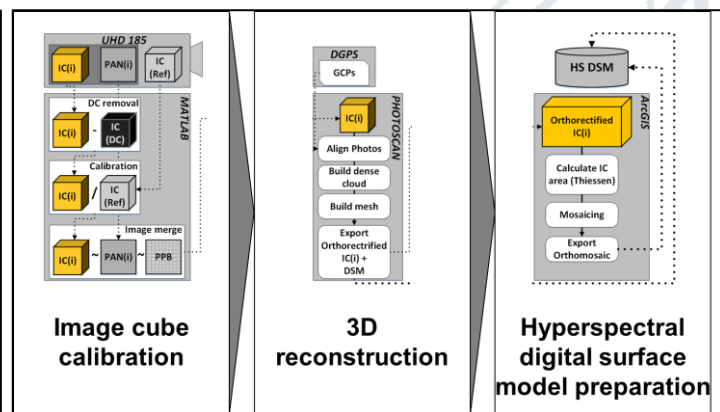




Metadata for (spectral) UAV remote sensing of vegetation

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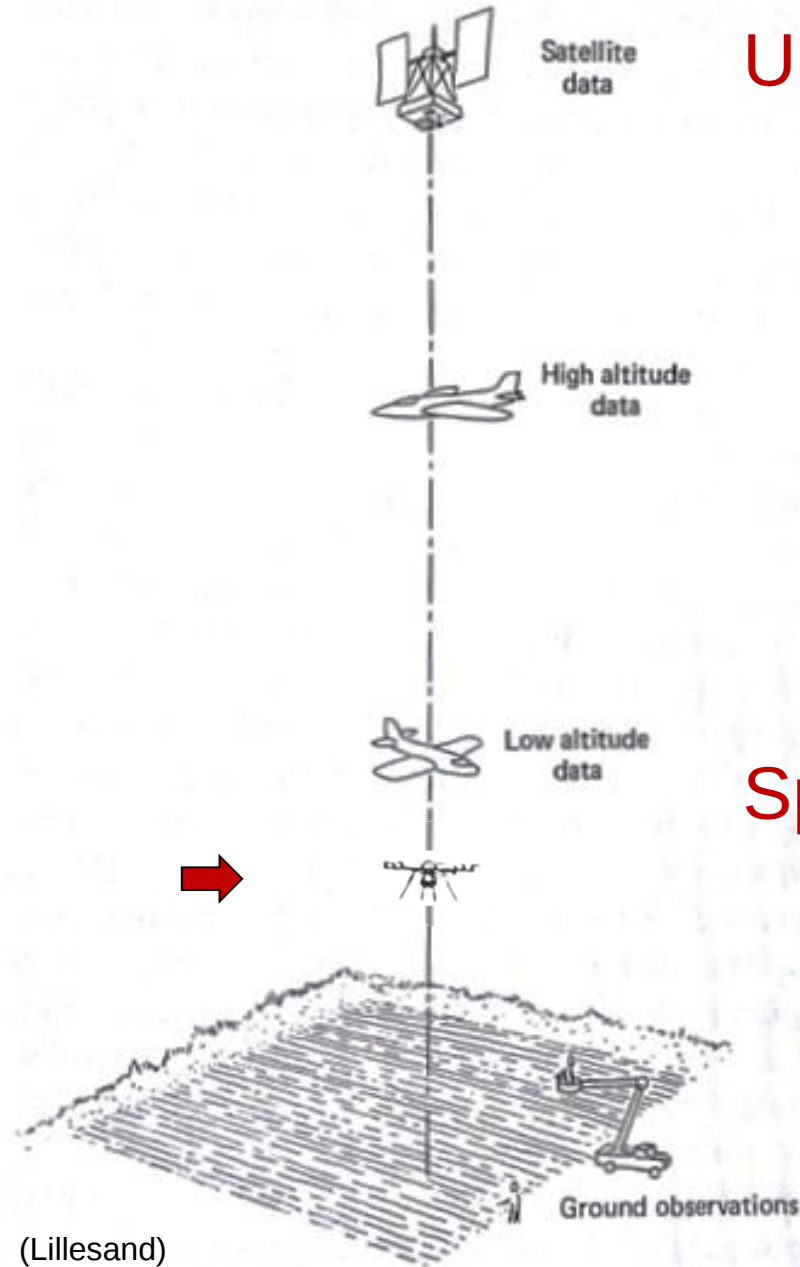


Unmanned aerial vehicles (UAVs)

- flexible carrier platforms
- fly below clouds
- very high resolution data
- moving (shaking) platform
- limited payload
- small, lightweight, fast sensors req.

Spectral remote sensing

- vegetation monitoring
- non-invasive sampling
- plants are complex
- environmental conditions change



(Lillesand)

Figure 1.21 Multistage remote sensing concept.

Path of information

particle to pixel

Environment

Sensor
system

Data
processing

Data
product

Data modification

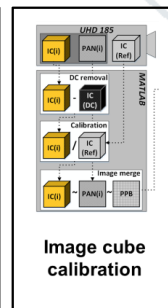
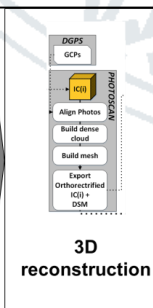
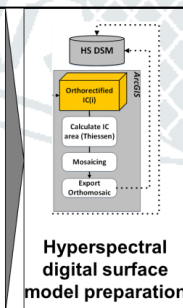


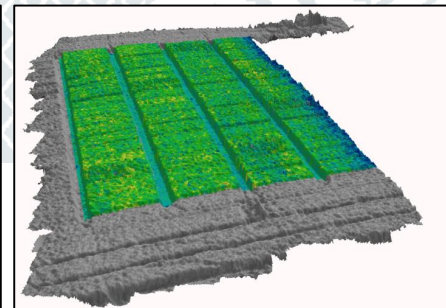
Image cube
calibration



3D
reconstruction

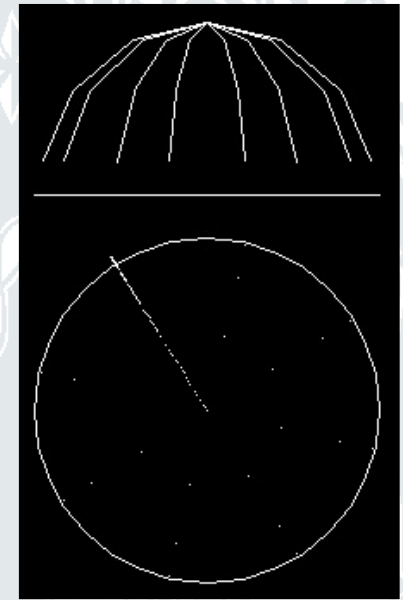
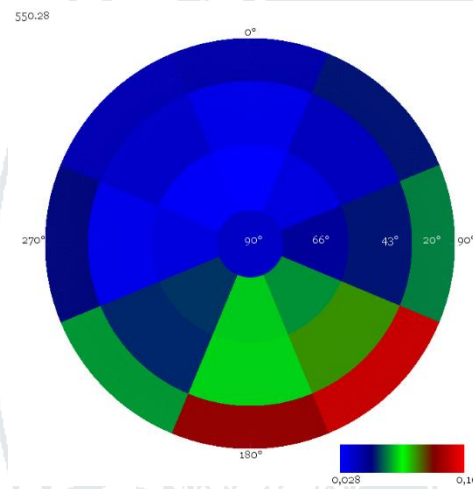


Hyperspectral
digital surface
model preparation



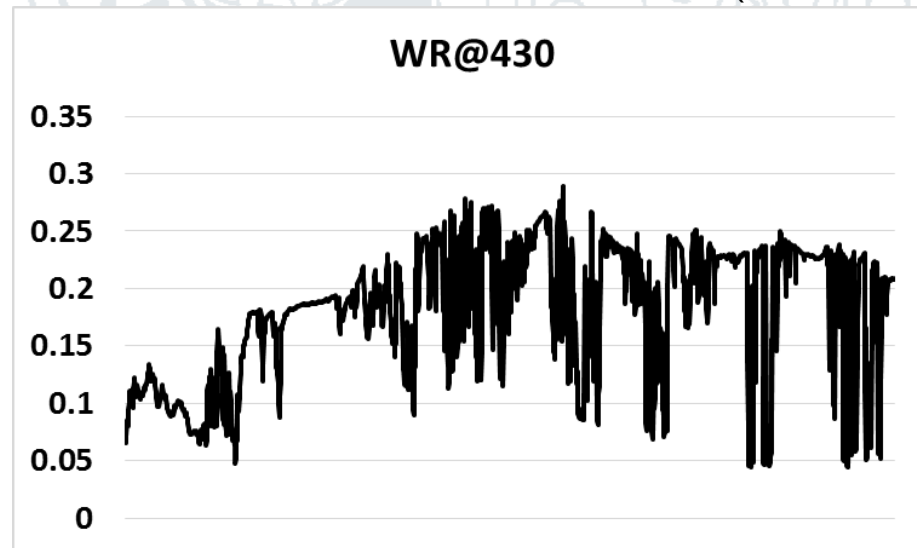
Environmental effects

BRDF



(Burkart et al. 2015)

Irradiance



(A. Burkart, unpublished)



Environmental effects

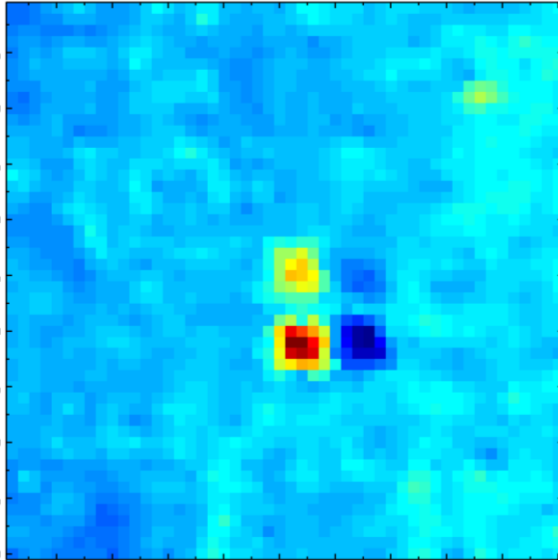
Wind



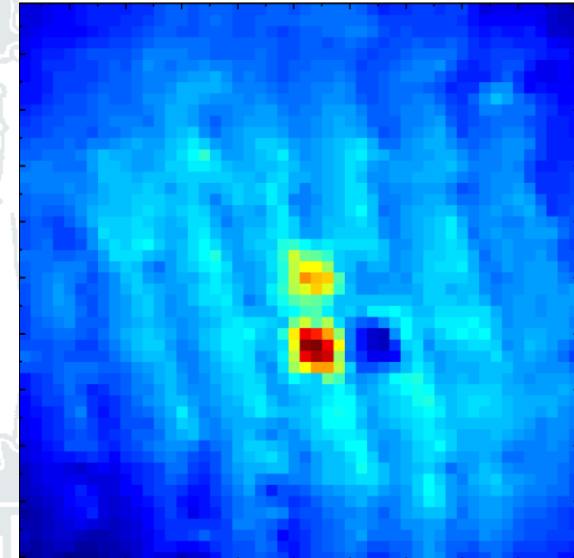
	Per measuremen	Disclose in publication
Environmental metadata • Sun position, UTC time (BRDF) • Irradiance intensity (physical unit transformation) • Wind direction and intensity (leaf inclination) • precipitation and dew point previous to the measurements (are the leafs wetted?)	X X X	g g g

Sensor metadata

“nature”



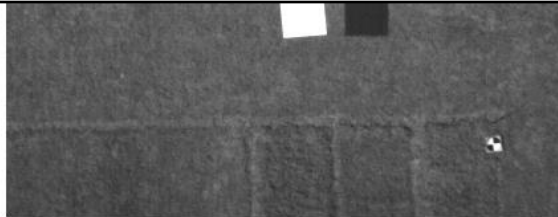
DN



Sensor metadata (physical unit transformation)

- Radiometric response (including optical path effects) per pixel
- Dark current per pixel (function)
- FWHM, band center wavelength, dynamic range

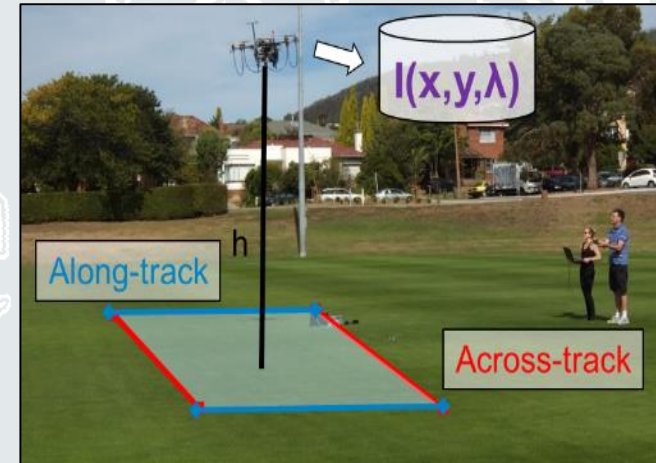
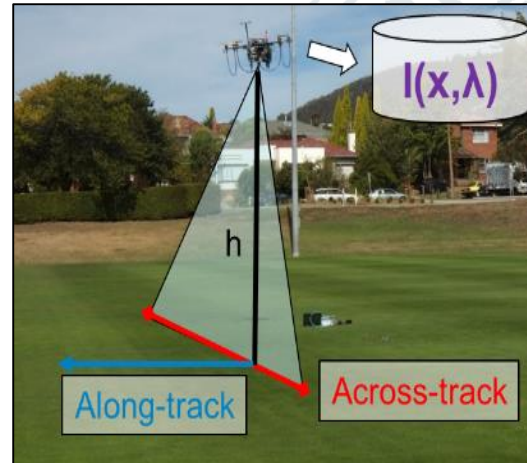
5



DN



Measurement metadata



Flying spectrometer

Line scanner

Image-frame camera

Data complexity

Orientation and positioning metadata requirements

Measurement metadata

- Sensor temperature (physical unit transformation)
- Integration time (physical unit transformation)
- Orientation and position (orthorectification, BRDF per pixel)

x

Processing metadata

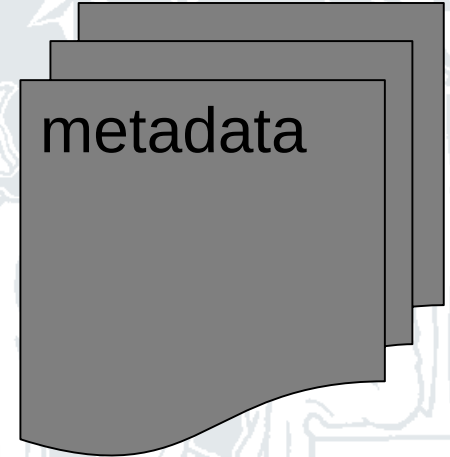
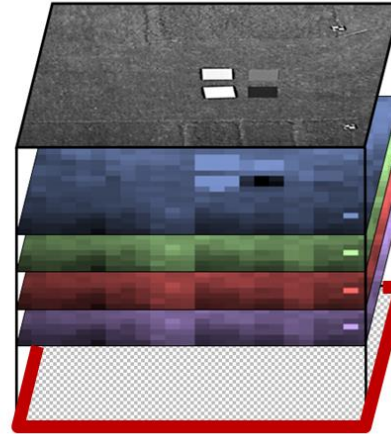
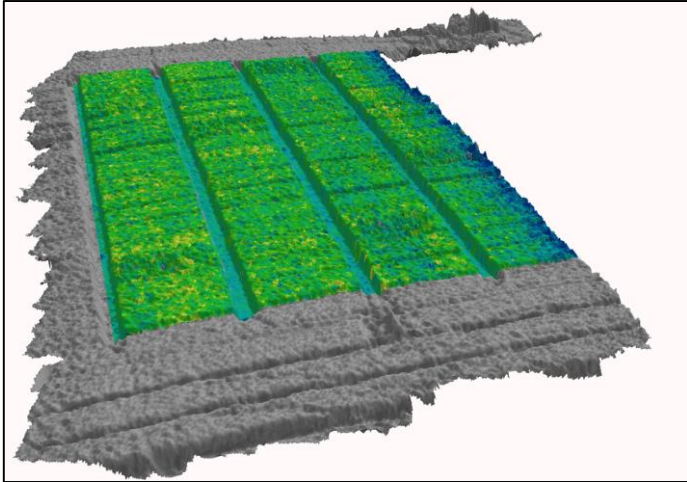
Data processing metadata

- Software & version
- Processing chain
- Processing parameters

		X
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Data product metadata



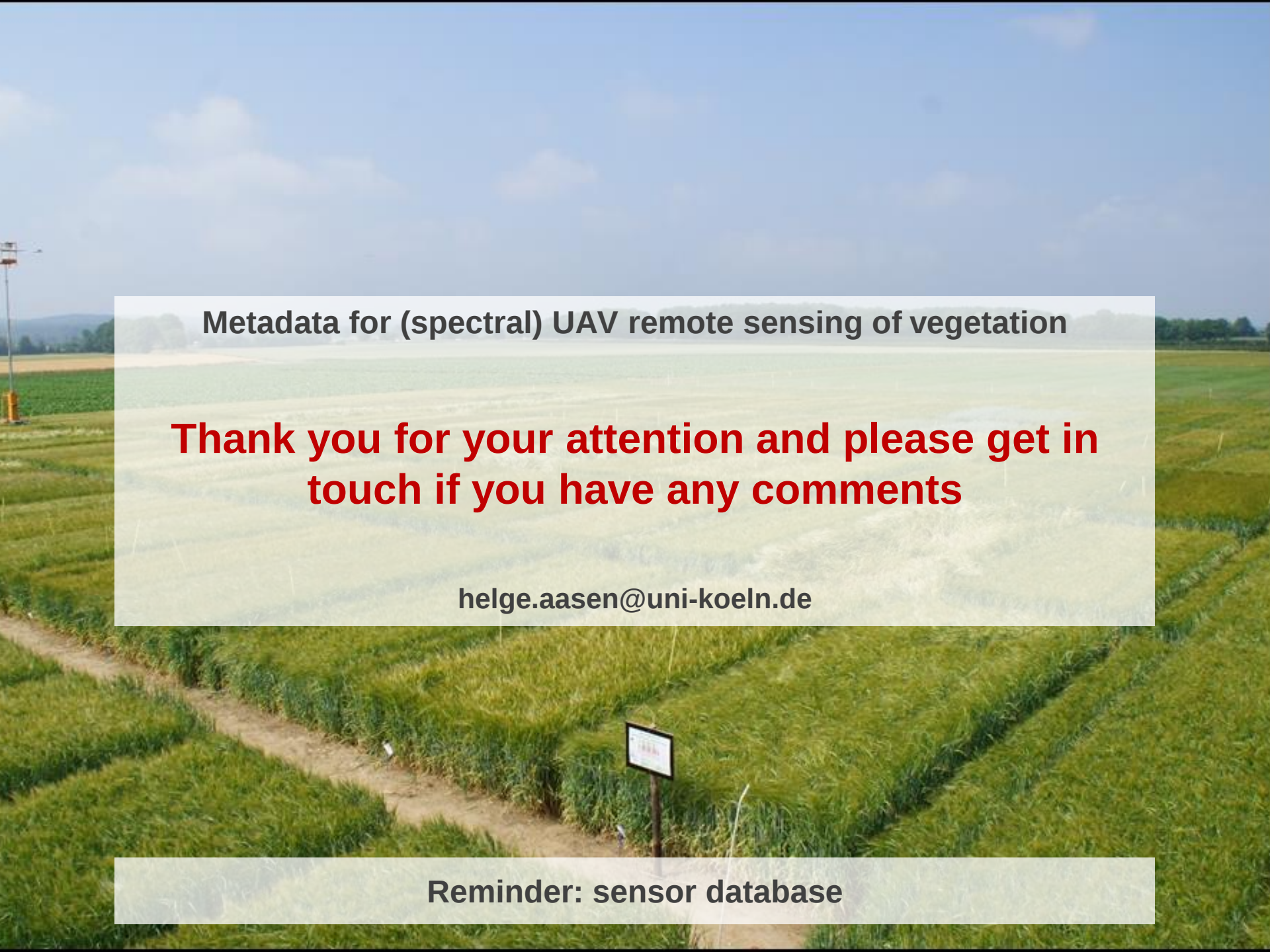
Data product metadata (to accompany the final data product)

- **General (summary of the data acquisition circumstances)**
 - Spatial and spectral resolution, band configuration
 - Corrected parameters (were irradiance / BRDF changes corrected?)
 - Environmental metadata
- **Pixel wise**
 - Reference to sensor pixel wise parameters (to calculate SNR, radiometric precision etc. if needed)
 - Image cubes containing the pixel wise information from the sensor characterization

Conclusions

- High spatial and temporal resolution make environmental effects more visible
 - We are responsible to ensure good data quality
 - We are responsible for the data management
- Lets connect



An aerial photograph of a lush green agricultural field, likely a wheat or barley field, with distinct rows of crops. A dirt path runs diagonally through the field. In the foreground, a small white sign with red text is visible. The background shows a clear blue sky with some light clouds and distant hills.

Metadata for (spectral) UAV remote sensing of vegetation

Thank you for your attention and please get in touch if you have any comments

helge.aasen@uni-koeln.de

Reminder: sensor database