Data Quality Report - 2022

Hyperspectral - Ibis

NEODAAS

Updated on: April 26, 2023

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1 Introduction

The NERC Earth Observation Data Acquisition and Analysis Service (NEODAAS) have processed hyperspectral data collected with NCEO's Specim AISA Ibis instrument starting in 2022.

The Ibis is a Solar-Induced Fluorescence (SIF) sensor. It records spectral measurements across the 'red-edge' region of the near infrared wavelengths with a spectral range of 670 - 780 nm. The Ibis comprises 1004 bands with bandwidths of 0.11 nm when operated with a binning factor of 1 or 502 bands with bandwidths of 0.22 nm when operated with a binning factor of 2.

This data quality report describes issues for hyperspectral data acquired with the Ibis instrument that should be considered when further processing any NEODAAS datasets acquired in 2022.

This document may be updated over the course of the year, the latest version is available at:

https://nerc-arf-dan.pml.ac.uk/trac/wiki/Reports

2 Geo-referencing accuracy

NEODAAS currently delivers level 1b (calibrated at-sensor radiance) and level 3 data (mapped level 1b data). This offers users quick access to geo-referenced data whilst maintaining the capability to operate on the original pre-gridded data and use a coordinate projection or datum of choice.

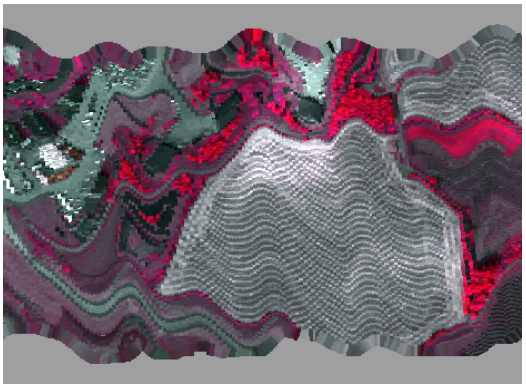
The quality of the geocorrection for each project is described in the documentation supplied with the delivery. Typically the geocorrection is of the order of a couple of metres, equating to approximately 1 pixel depending on flight altitude. High accuracy relies on an accurate Digital Surface Model (DSM). The freely available global ASTER digital elevation data are used during quality checks and an elevation model is supplied with the delivered mapped files. Accuracy may be improved by using a DSM derived from higher resolution data such as LiDAR.

It may be possible to tune specific flight lines for higher accuracy and instructions can be provided on how to make your own alignments. If a higher accuracy is required, please contact us at: helpdesk@neodaas.ac.uk

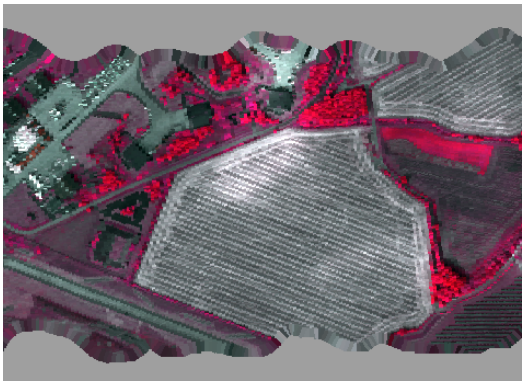
3 Timing Errors

If the navigation data and scanline imagery are misaligned then it will manifest itself as a distortion in the geocorrected image. This misalignment is most often caused by an error in the timing, which means that the scanlines get syncronised to incorrect navigation (position and attitude). A timing error can range from a fraction of a second to tens or hundreds of seconds if the system crashes. An example is shown in Figure 1.

This issue was extensively investigated and fixed in 2016 for the NCEO Fenix instrument. This fix also applies to the Ibis instrument . If any distortions are found in your data then please contact us at helpdesk@neodaas.ac.uk and we will investigate and correct (where possible).



(a) *Timing error in a flightline.*



(b) *Corrected version of the above image (1 second timing difference).*

Figure 1: *Illustration of timing offset present in geo-referenced Ibis data.*

4 Sensor calibration

The Ibis sensor calibration was undertaken by Specim, the manufacturer, in December 2020 before being delivered to NERC for the 2022 field campaign. The Specim calibration reports can be found in the 2022 data quality report section here: https://nerc-arf-dan.pml.ac.uk/trac/wiki/Reports

NCEO aims to undertake new sensor calibrations before each of the following yearly campaigns in collaboration with NEODAAS and the NERC Field Spectroscopy Facility to ensure spectral (wavelength) and radiometric accuracy.

5 Bad CCD Pixels

The Ibis instrument has a varying number of pixels that provide inaccurate values, these are identified and flagged as 'bad pixels' during calibration. In this case, the latest calibration was performed who provided a list of bad pixels with the calibration data. The processed data delivered by NEODAAS include level1b mask files which account for those bad pixels. The delivered mapped files are already masked.

For the 2022 flight campaign, the aircraft slit that the Ibis observes through was not large enough to include the full swath. Therefore the mask files provided also include pixels located at the edge of the Ibis swath to mask these regions. This is expected to be resolved before future campaigns take place. This effect is clearly visible in the example image in Figure 2. From the full Ibis swath of 768 pixels, 13 pixels have been masked from the right side.

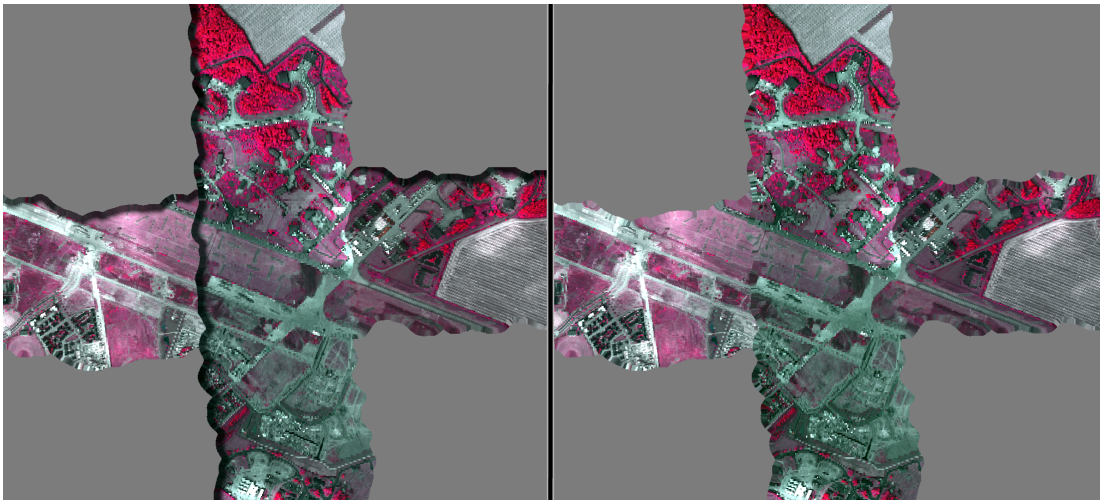


Figure 2: *The image on the left shows level-3b geocorrected Ibis data unmasked, whilst on the right the data are masked. Note the swath edge have been removed.*