Simulation of EnMAP data using AVIRIS data

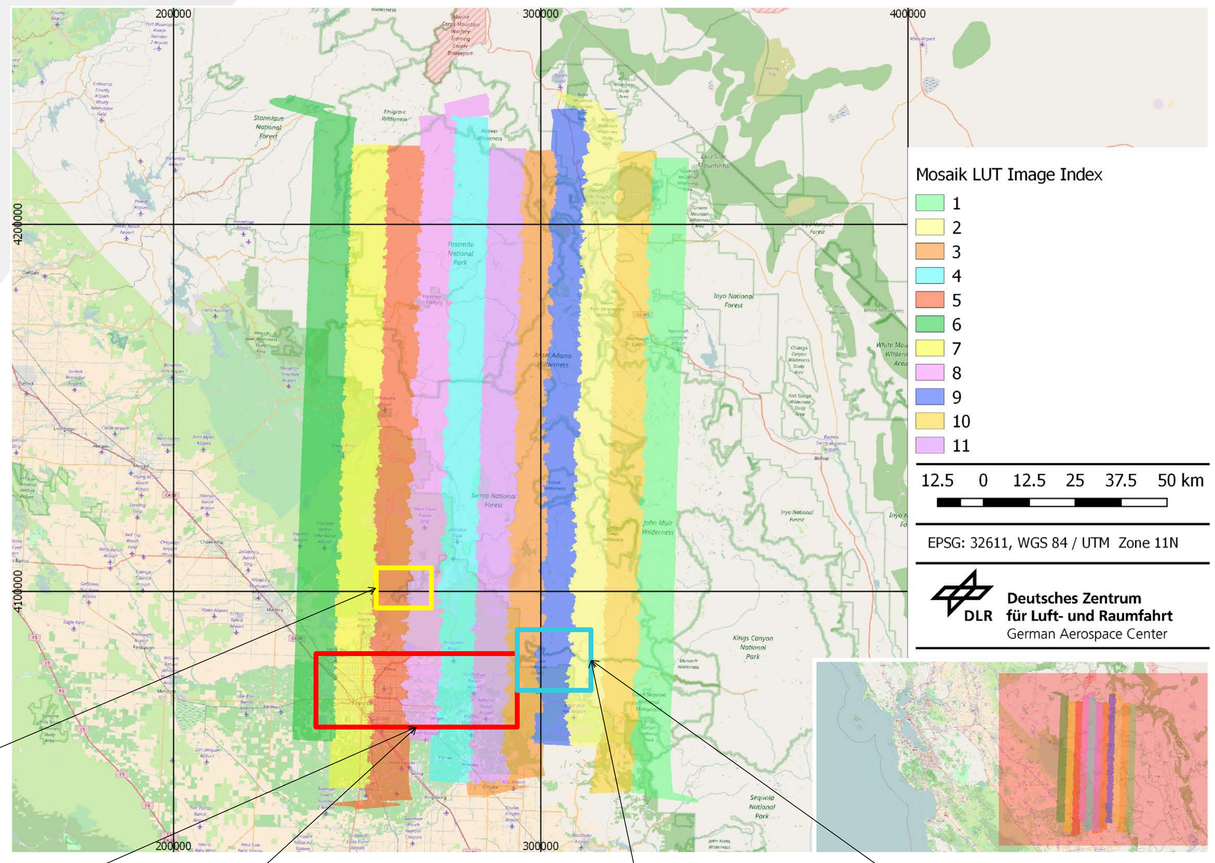
10th EARSel SIG Imaging Spectroscopy Workshop
Zurich, 2017

Peter Fischer, Jakub Bieniarz, Peter Schwind, Tobias Storch
Remote Sensing Technology Institute, German Aerospace Center (DLR), Münchener Str. 20, 82234 Wessling, Germany

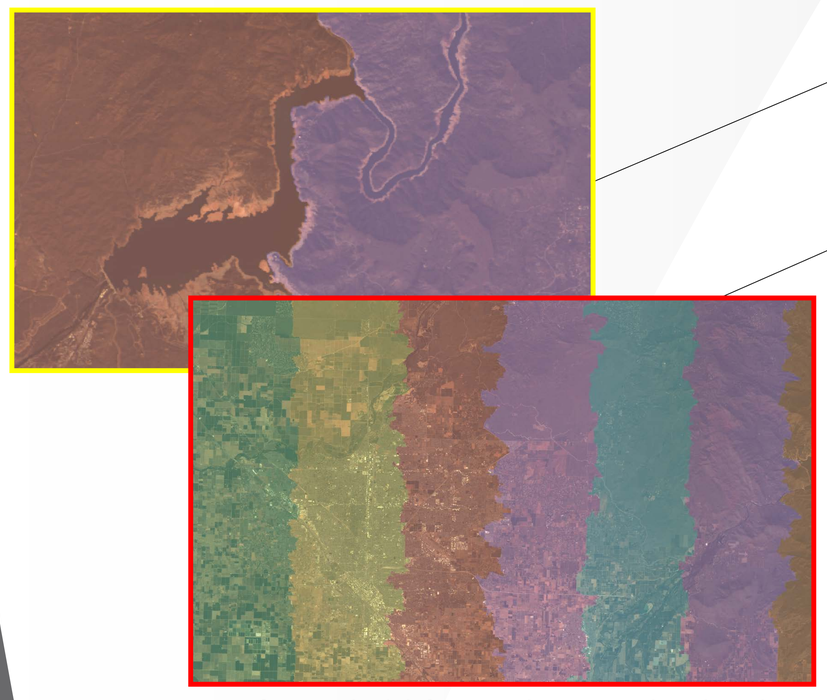
Abstract

This contribution focuses on mosaicking of airborne data of AVIRIS (Airborne Visible InfraRed Imaging Spectrometer) that is used for various preparatory activities of the spaceborne mission EnMAP (Environmental Mapping and Analysis Program; www.enmap.org) planned to be launched in 2019. Such data can e.g. be used for validating the fully-automatic image processing chain or to provide, in advance and as realistic as possible, example products to future EnMAP users. AVIRIS is selected since it covers a spectral range from 380 nm to 2500 nm which is slightly larger than that of EnMAP (420 nm to 2450 nm). Both sensors exhibit a similar contiguous spectral sampling distance of 10 nm. The dataset consists of 11 stripes covering an area in California/USA and was acquired on April 14 2007 between 17:05 and 22:55 UTC with the sensor to ground distance ranging from approximately 16 km to 20 km, which results in many atmospheric effects similar to the spaceborne data. AVIRIS data have a higher geometric resolution and a swath of only 11 km. In order to obtain EnMAP's geometric parameters with the swath of 30 km and geometric resolution of 30 m × 30 m at least four flight lines have to be combined taking appropriate overlaps and margins into account.

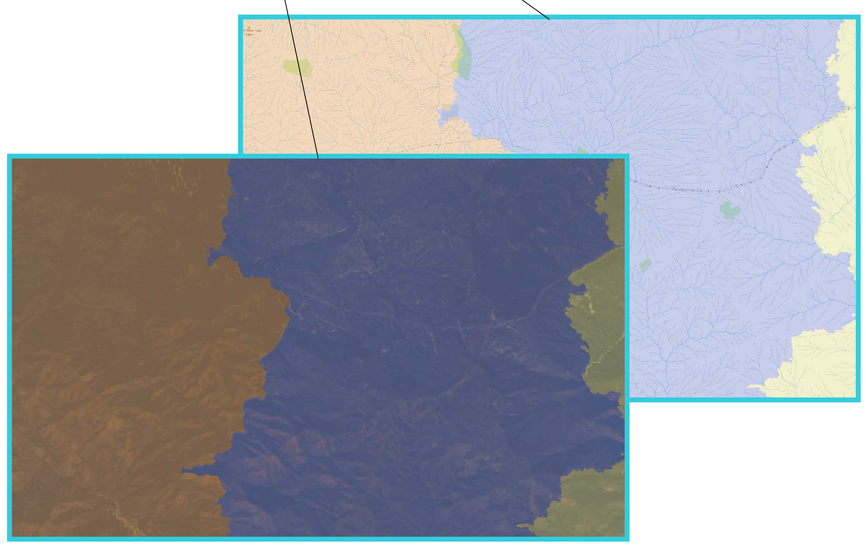
To close the gap between AVIRIS and EnMAP data, three steps have to be conducted, (a) a single mosaic has to be generated using the AVIRIS data, (b) the dataset has to be spectrally resampled and (c) a geometric transformation has to be applied.



MOSAICING



City of Fresno (CA), left image showing gradient based seamlines, right image showing mosaic



Seamline following dominant feature of landscape (e.g. river).

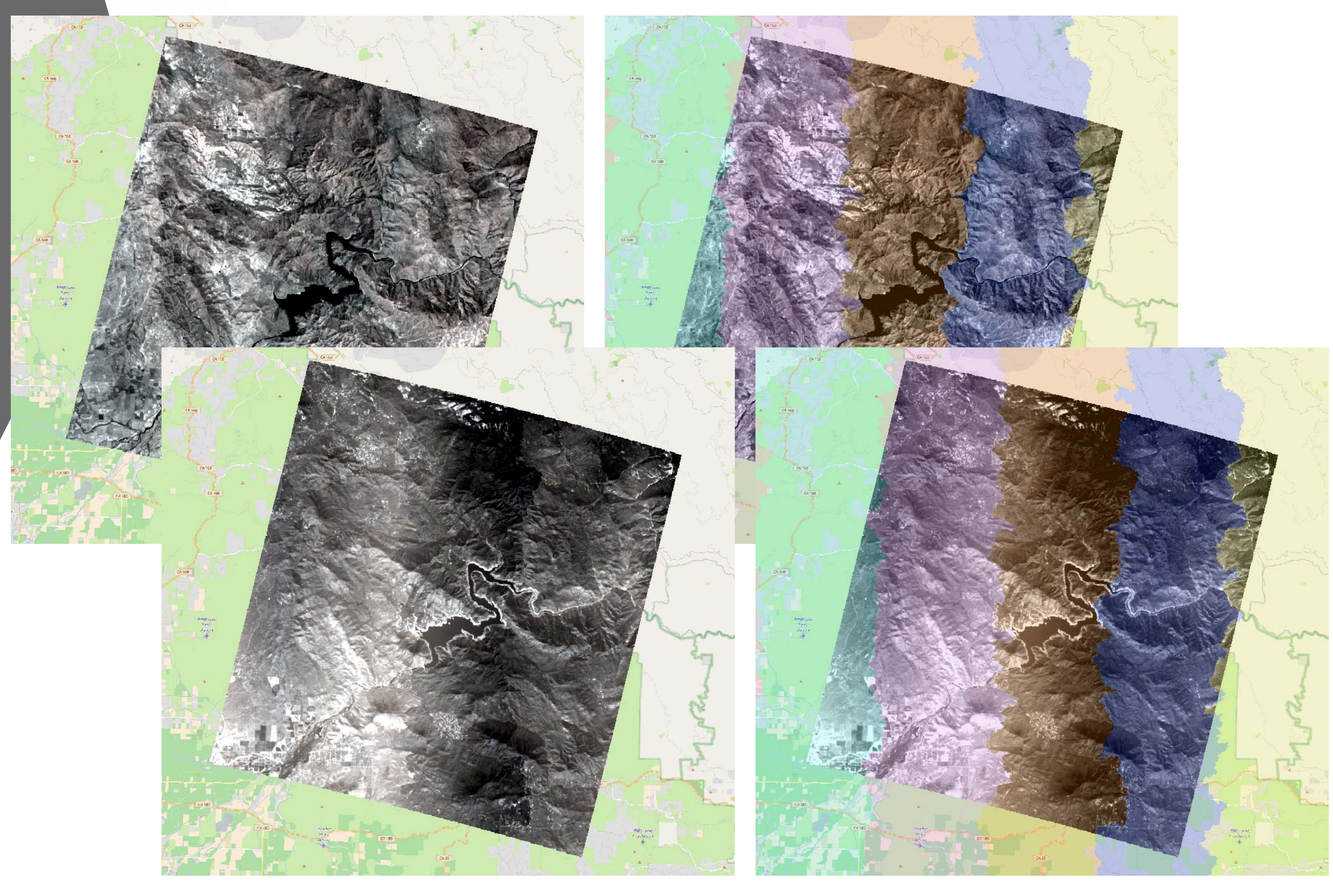
Upper Image: Background OpenStreetMap, Foreground LUT

Lower Image: Same situation with mosaic in Background

RESAMPLING

In the second step AVIRIS mosaic is spectrally resampled to match the central wavelengths and full width maximum of EnMAP spectral bands. Finally a detailed geometric simulation based on the current specifications of the EnMAP SWIR and VNIR instruments is done. This simulation comprises a filtering of the data to EnMAP resolution to avoid aliasing effects and the calculation of artificial orbit and attitude values based on the planned EnMAP orbit and sensor model. Using these simulated orbit and attitude values the mosaic is rescanned to create an output image in EnMAP sensor geometry.

The final dataset can serve as starting point for a broad range of experiments for the development of the EnMAP processing chain.



Final simulated EnMAP scenes based on AVIRIS mosaic, after spectral and spatial resampling. From left to right SWIR image, SWIR image with mosaic mask overlay, VNIR image, VNIR image with mosaic map overlay.

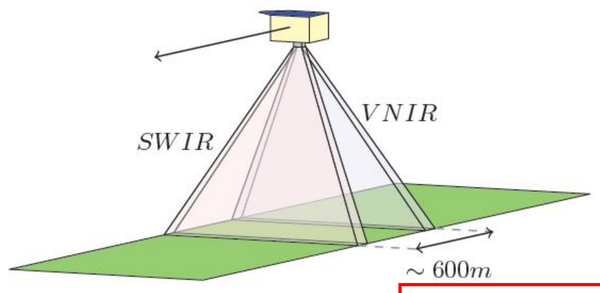
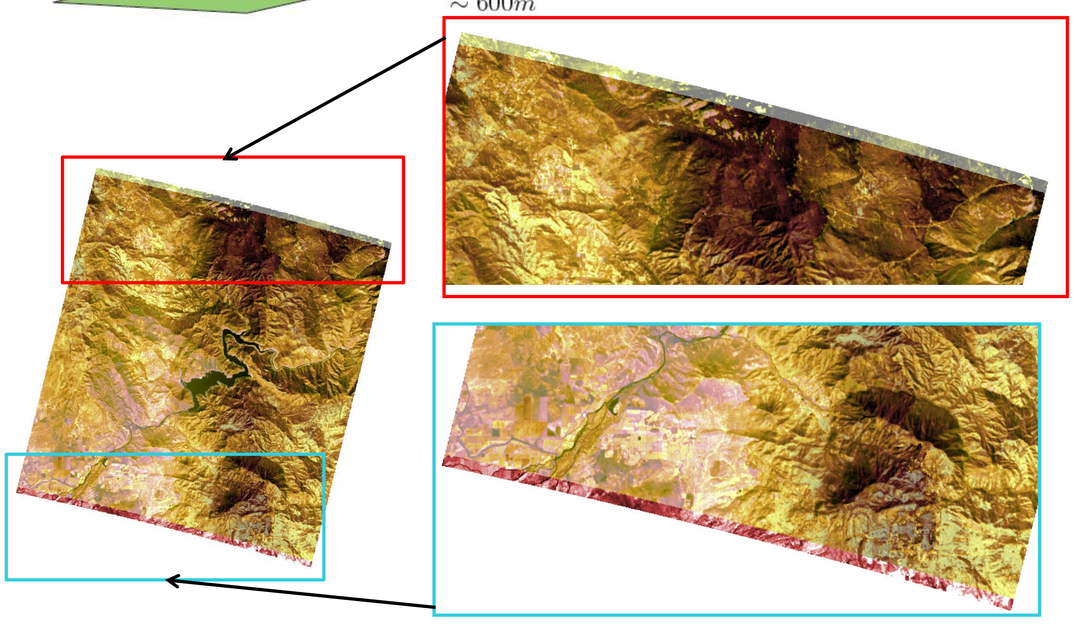


Figure illustrating the instrument design leading to a partly shift between VNIR and SWIR dataset.



One scene, VNIR highlighted in yellow, SWIR in red. Due to instrument design the two datasets are spacially shifted in flight direction.

Deutsches Zentrum für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

DLR – German Aerospace Center
Remote Sensing Technology Institute
D-82234 Weßling
http://www.dlr.de/caf/

REMOTE SENSING TECHNOLOGY INSTITUTE