Documentation for the HyMap hyperspectral data cube from Zackenberg

The products described in the following document are available for research use and can be downloaded or requested at the homepage:
http://www.dmu.dk/1_Om_DMU/2_afdelinger/3_am/4_Expertise/5_Research/6_Climatechange/HyperZack_data.asp

All use of data should acknowledge: Danish National Environmental Research Institute, dep. for Arctic Environment, Institute of Geography at University of Copenhagen and Danish Research Academy.

Sensor specification

The Australian HyMap sensor that was used for the survey was at the time of the campaign considered the best hyperspectral airborne sensor available. The sensor has 126 bands between 0.45 and 2.5 µm with a varying bandwidth between 15 and 20 nm. The sensor consists of 4 detectors in the visible, the short-nearinfrared, the long-nearinfrared and the mid-infrared range. The band placement and FWHM (Full width-half maximum) can be seen in the Figure 1.

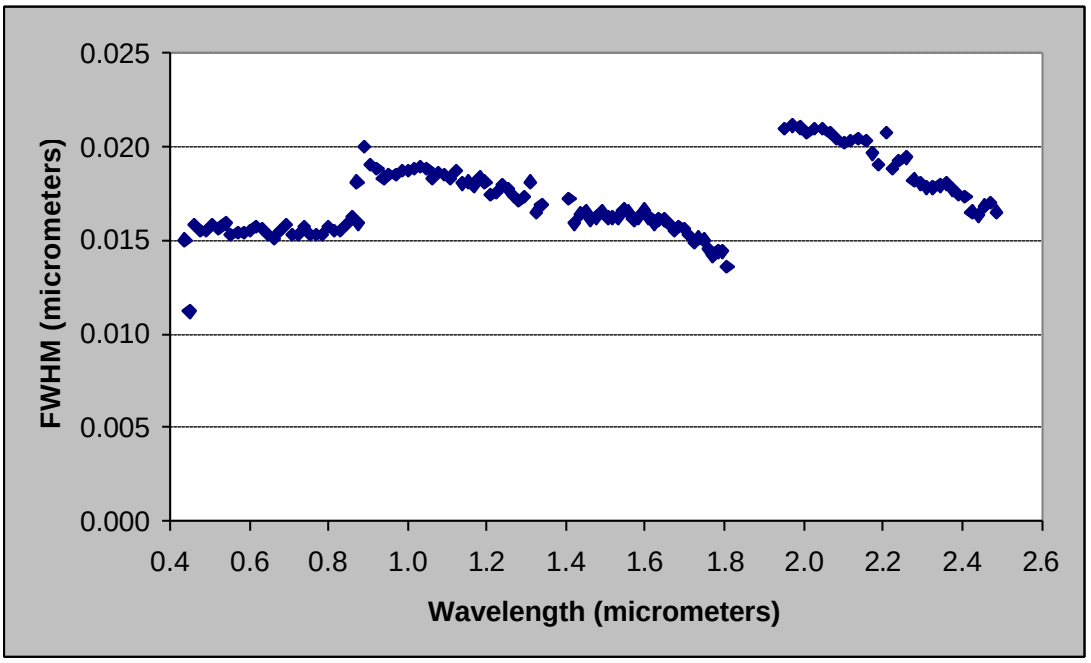

Figure 1 *Band placement and Full width - half maximum (FWHM) for the HyMap sensor configuration used at Zackenberg*

Signal to noise ration for the instrument is very high (>500) ensuring the best possible analyses based on this type of configuration.

Flight specifications

The campaign was flown on 7th August 2000 using a Dornier 228 flown by German Aerospace Centre (DLR). Weather conditions were partly cloudy resulting in flight lines with some cloud shadows but for the

most part clear with no wind. Weather conditions and atmospheric conditions were monitored throughout the campaign for later use during the atmospheric correction process.

Flying altitude was approx. 6600 feet with a speed of 277 km/h resulting in a pixel size of 4-5 metres. Overlap between lines was approximately 20%.

Geolocation and image geocoding was achieved with DGPS and an integrated IMU (inertial monitoring unit):

- The differential GPS is applying an Omnistar service that updates its readings every second and allow interpolation to ten readings per second.
- The Inertial Monitoring Unit (IMU) samples at the frequency of the GPS, i.e. ten samples per second.

These data are summarized in *.out files that lists all necessary information for the geocoding of the strips.

The data generated by the spectrometer system (approximately 2.5 MB per second) was recorded on Mammoth 8900 Exabyte tapes. The scanner was spectrally and radiometrically calibrated by Terry Cocks, HyVista Corpo-ration, at the beginning of the survey in Oberpfaffenhofen. The spectrometer system worked well throughout the entire survey programme.

Atmospheric correction

Atmospheric correction was carried out using the software ATREM. The parameters that were used for the processing are shown in Table 1.

Table 1 Parameters used for the atmospheric correction of the strips using the ATREM software.

Strip	Time (local)[1]	Flight alt.	Lat. (center)	Long. (center)	Scene elevation	Channel ratio	Gas selectors	Ozone	Aerosols	Visi-bility	Atmosphere
		(m)	dec.-deg.	dec.-deg.	(m)			(atm. cm)		(km)	
13	14:24:19	3091	74.55917	-20.92389	300	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
14	14:09:38	3077	74.52417	-20.861389	300	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
15	13:35:14	3092	74.51917	-20.799722	300	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
16	13:58:34	3078	74.51583	-20.738056	300	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
17	13:23:37	3060	74.56944	-20.674722	100	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
18	13:46:58	3080	74.54167	-20.613333	100	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
19	13:12:31	3083	74.58528	-20.550000	200	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
20	12:38:36	3080	74.56944	-20.488056	200	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
21	13:01:18	3066	74.51583	-20.427778	200	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
22	12:27:16	3082	74.54972	-20.364444	275	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
23	12:50:03	3074	74.55000	-20.302222	255	Vegetation	- CO	0.299	Continental	100	Subarctic Summer
24	12:15:32	3086	74.54889	-20.240278	281	Vegetation	- CO	0.299	Continental	100	Subarctic Summer

Geocoding

Geocoding of the strips are done using the PARGE software. The raw or atmospheric corrected strips in BSQ format is needed along with the corresponding OUT-file and a digital terrain model of the area covered by the hyperspectral strip.

Due to the low accuracy of the IMU data (GPS; not DGPS and drift of the alignment of the IMU) it is not possible to obtain a subpixel accurate geocoding using the data and OUT-files alone. GCP's need to be input as well and can be done using the high-resolution orthophoto that are available from the flight.