EVALUATION OF AVIRISwiss-91 CAMPAIGN DATA

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1. INTRODUCTION

On 5th of July 1991 at 2.10 p.m. the multidisciplinary testsite Rigi in Central Switzerland was covered by the ER-2 and its sensors, the AVIRIS, TMS and RC-10 within the NASA MAC Europe 1991 deployment.

Our focus of research is the evaluation of the applicability of hyperspectral data over rugged alpine terrain. The utility of imaging spectrometry under highly complicated terrain and atmospheric conditions shall be investigated with a team that has some experience in high precision adoption of airborne and satellite data through geometric and radiometric corrections and subsequent task-adapted classification procedures.

2. SUPPORTING MEASUREMENTS

A multidisciplinary team of specialists in remote sensing, image processing, geography, landuse, agronomy and botany, forestry, limnology and atmospheric research enabled a multitude of parallel measurements concurrent to the AVIRIS overflight. Synergism with an athmospheric research project "POLLUMET" which took place at the same time, and within the same area, yielded a wealth of measurements of meteorological and atmospheric parameters.

Concurrent to the ER-2 overflight, for instance vertical spectroradiometric profiles of the atmosphere were measured from helicopter descending from 3000 m GND to water level, and at the same time subsurface underwater spectroradiometric profiles were taken as well. Simultaneously hundreds of water samples were taken and measurements of chlorophyll, phytoplankton concentration, optical thickness of the water, acidity etc. acquired. Several teams were active assessing horizontal visibility along mountain profiles. Agrarian landuse mapping was carried out at specific testsites totalling 124 fields. Soil samples as well as forest cuttings were taken and stored for laboratory tests. This brief summary of course cannot give an in-depth insight into all the gathered information and the extensive activities of the involved approximately one hundred specialists on the ground.

The following table gives an overview on the activities in data capturing for the AVIRISwiss-91 campaign.

Table 1: Instruments and Data Collection during the AVIRISwiss'91 Campaign

Platform	System	Instrument	Target	Measurement	Use
Satellite	SPOT	HRV-PAN	central Switzerland	1 band, VIS	landuse
		HRV-XS	central Switzerland	3 bands, VIS, NIR	landuse
	Landsat	TM	central Switzerland	7 bands VIS, NIR,IR	landuse
	NOAA	AVHRR	central Switzerland	5 bands	meteorology
Aircraft	ER-2	AVIRIS	Rigi testsite	220 bands VIS, NIR	applied imaging spectrometry
		TMS	Rigi testsite	12 bands, VIS, NIR,IR	cross referencing to AVIRIS
		RC-10	Rigi testsite	color IR	photogrammetry
	engine powered glider	by MetAir	central Switzerland	P, T, M, O_3, NO_2, H_2O_2	atmospheric constituents
Balloon / Sonde	radiosonde	by LAPETH	testsite atmosphere	T, WD, WV	atmospheric parameters
	captive balloon	by KLIMET	testsite atmosphere	WD, WV, P, T, M, O_3	atmospheric parameters
	constant level balloon	by PSI	atmosphere	P, T, M, WD	atmospheric parameters
Helicopter	spectrometer	Spectron SE-590	selected test-areas	256 bands	spectral radiometry of targets and atmosphere
	photography	video (VHS)	selected areas	color	referencing
		camera	selected targets	color	referencing
Radar	ground radar	ADOUR	ER-2	2 frequency C-band	tracking of the ER-2 flight line
Ground	spectrometer	GER IRIS Mark V	selected reference targets	875 bands	target spectral radiometry, calibration
		LI-COR Li-1800		161 bands	
		Spectron SE-590		256 bands	
	analysts	Magellan GPS	selected targets, fields, etc.	landuse, cover state	classification
Boat	underwater spectrometer	LI-COR UWLi-1800	water	161 bands	optical properties
	Seccidisk	disk	water	% of light	optical thickness
	specific sondes	ME, WTW	water	T, Tr, Vis, Att, Chl	water chemistry

Legend: P = Pressure, T = Temperature, M = Moisture, Tr= up/down trans, WD = Wind Direction, WV = Wind Velocity, Vis = Visibility, Att = Attenuation, Chl = Chlorophyll (Scor)

3. ANALYSIS APPROACH

A fully integrated analysis approach is pursued in handling all datasets, sensor data as well as ground truth measurements, in a digital database. For this purpose most of the ground truth is already converted into digital form and ready for modelling.

A first analysis step is a thorough data quality assessment where sensor and scene related effects are investigated. Among them geometric factors such as distortions and errors are handled and radiometric influences due to blurring, striping and calibration problems etc. are analyzed and corrected as a preprocessing step. Scene related factors such as the ones due to sensor geometry and terrain as well as radiometric effects due to topography, viewing angle and atmosphere are investigated and removed using a high precision DEM (*Itten et al. 1992*). Georegistration in a mountainous environment is a challenge in itself, and slope-aspect corrections as well as atmospheric modelling, using 5S, LOWTRAN and MODTRAN, are tested.

In processing we propose an information based approach with a general broad aim in mind to considerably improve landuse mapping and detailed land cover state analysis. New ways for classifying scenes are foreseen by using an information based approach (*Meyer 1992*). Symbolic description is applied in spatial and spectral modes; segmentation procedures will be tested and rules generated for an application oriented automatic feature extraction.

Teams of hydrologists, botanists, geographers, foresters, agrarian engineers, climatologists as well as image processing and remote sensing specialists are actively involved. Since corrected data have only been received by the end of March'92, the investigation based on the RSL-DIPS and IDL/SIPS (by CSES/CIRES University of Colorado, Boulder) on a DECStation 5000 workstation is in full progress.

4. ACKNOWLEDGEMENTS

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5. REFERENCES

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