EXPERIENCES WITH THE INDIAN IRS-P6 RESOURCESAT-1

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ABSTRACT

IRS-P6 Resourcesat-1 has completed its seventh year in orbit. For Euromap GmbH, IRS-P6 has become an important asset to participate in the provision of satellite data to the various ongoing EO programs and activities in Europe.

IRS-P6 Resourcesat-1 is part of a series of EO satellites within the IRS program, which operate in the optical domain at various resolution levels ranging from MR through HR to VHR. Euromap has, in close cooperation with the German Aerospace Center (DLR), a long-standing tradition in receiving, processing and exclusively distributing data from these systems into Europe since 15 years.

1. INTRODUCTION

Through several data reception agreements with Antrix, the commercial arm of ISRO, Euromap became the first and only actor in Europe to successfully receive, archive and market Indian Earth observation satellite data. Current agreements grant Euromap the right to receive and exclusively distribute data from IRS-P6 Resourcesat-1 and also the IRS-P5 Cartosat-1 satellite with its unique stereo capabilities. Resourcesat-1 data are being received and distributed since 2004. The area covered includes Turkey and parts of northern Africa.

Through recent agreements with the European Space Agency (ESA), worldwide IRS data and related services are made available to the GMES user community. Through Euromap, the IRS-P6 Resourcesat-1 mission significantly contributed to European activities like Image2006, Image2009, Monitoring Agriculture with Remote Sensing (MARS) and other mapping projects.

The German Aerospace Center (DLR) is Euromap's long-term partner regarding reception and archiving activities, as well as the integration of the Neustrelitz IRS ground segment into ESA's Coordinated Data access System (CDS) infrastructure and the development of new products.

2. CONTRIBUTION OF RESOURCESAT-1 TO EUROPEAN DATA REQUIREMENTS

Through framework contracts with the Joint Research Center (JRC) of the European Union, Euromap contributed IRS data to several EU projects. LISS-III data were continuously supplied to the EU's agricultural subsidy control programs since 1997. This program requires data to be acquired during given acquisition windows over a large number of clearly defined sample sites well spread over the European territory. Unfortunately such requirements do not really match with the technical design and typical mission profile of Resourcesat-1. Therefore it is understandable that this data market is dominated by competitors operating EO satellites with highly flexible pointing capabilities such as SPOT and other VHR systems.

With respect to the so called GMES Fast Track initiatives, requesting European wall-to-wall coverages at two seasons every three years, Resourcesat-1, turned out to be the preferred source of information as demonstrated below.

The capability to simultaneously collect LISS-III and AWiFS data is an asset that improves the feasibility of Resourcesat-1 for many applications. But also as a single sensor, the use of AWiFS has been requested for several monitoring applications such as for the GMES-GSE Forest Monitoring projects.

Indirectly, through Antrix and EOTec, the United States Department of Agriculture (USDA) has became a major user of AWiFS data acquired over Europe and northern Africa.

Due to the increasing competition from various HR and VHR systems, which also tend to be more flexible, there was very little demand for LISS-IV data.

The European Space Agency (ESA) and Euromap signed a GMES Space Component Data Access (GSC-DA) agreement in May 2009. Through this agreement European and world-wide IRS data are accessible to the GMES user community. The agreement covers optical remote sensing data from the current IRS-P6 Resourcesat-1 and IRS-P5 Cartosat-1 missions, as well as historical data from IRS-1C and IRS-1D.

3. APPLICATIONS

3.1. GMES Land Service Image2006 and Image2009

Through a consortium with Spot Image as the prime contractor, Euromap provided a large amount of IRS-P6 Resourcesat-1 LISS-III data for the two multispectral coverages of 37 European countries for the Image2006 project in the frame of the GMES Fast Track Land Service. During this project the value of the LISS-III

sensor with its swath of 140 km could be successfully demonstrated.

As a result Euromap has been awarded by ESA with the provision of the next European wall-to-wall coverage, also referred to as Image2009. This contract implied two IRS-P6 Resourcesat-1 LISS-III coverages again of 37 countries. The first coverage had to be acquired within country-specific acquisition windows, ranging from 45 to 225 days, during the vegetation phase. Acquisitions for the second coverage were required to be at least four weeks away from the acquisitions of the first coverage.

The quick look mosaics in Figure 1 and Figure 2 demonstrate the LISS-III coverages achieved by October 15, 2010. At this time about 98.5 % of the data were already ortho rectified and delivered.

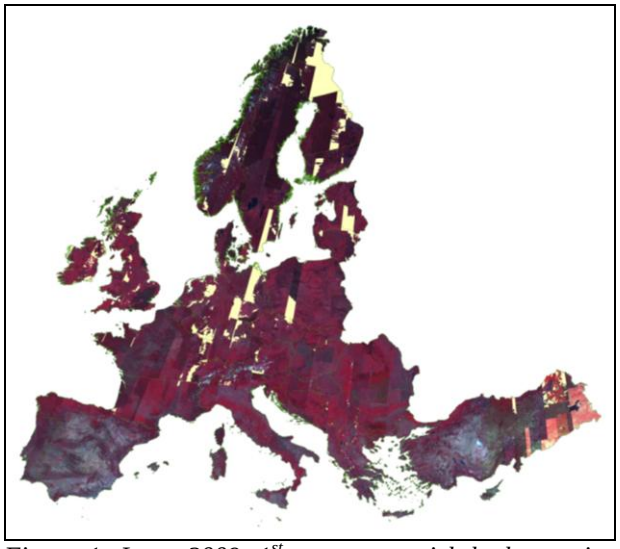

Figure 1: Image2009, 1st coverage quick look mosaic, as of 15-Oct 2010

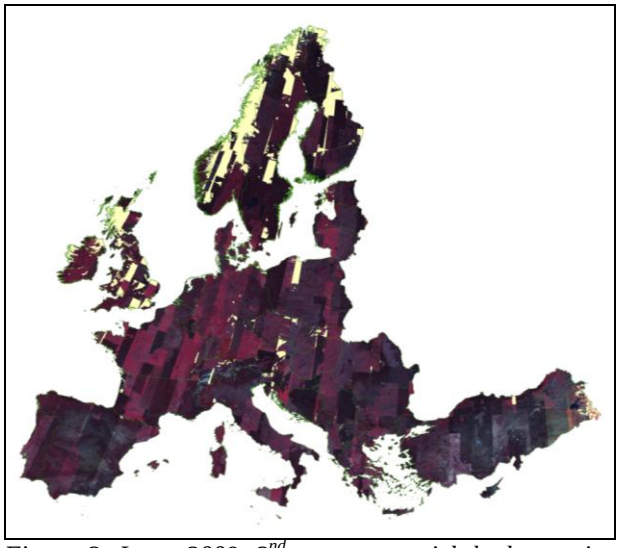

Figure 2: Image2009, 2nd coverage quick look mosaic, as of 15-Oct 2010

Considering the area of all countries together, a cloud-free coverage of 96.4 % for the 1st coverage and 95.7 % for the 2nd coverage was achieved and delivered by October 1, 2010. The contribution made by acquisitions from different years is shown in Table 1.

Table 1: Image2009, area covered cloud-free

Priority	Acquisition Year	1st Coverage [%]	2nd Coverage [%]
1	2009	44.70	66.72
2	2008	43.22	25.44
3	2010	8.46	3.56
Total		**96.38**	**95.72**

A gap-filling exercise is still in progress.

3.2. Europe Land Cover of Forests

The potential of the Resourcesat-1 AWiFS sensor to provide MR multi-temporal coverages with high frequencies was utilized by Geoland-2 through the GSC-DA agreement for the Europe-land-cover-of-forests data set.

Figure 3 and Figure 4 show quick look mosaics of the AWiFS time series delivered for the Munich-Verona transect. The 2005 time series with three acquisitions in Figure 3 was acquired in just two months. Thanks to its enormous swath and its 5 d repetition rate at the equator, the AWiFS sensor has the potential to provide high-frequency multispectral time series over entire countries.

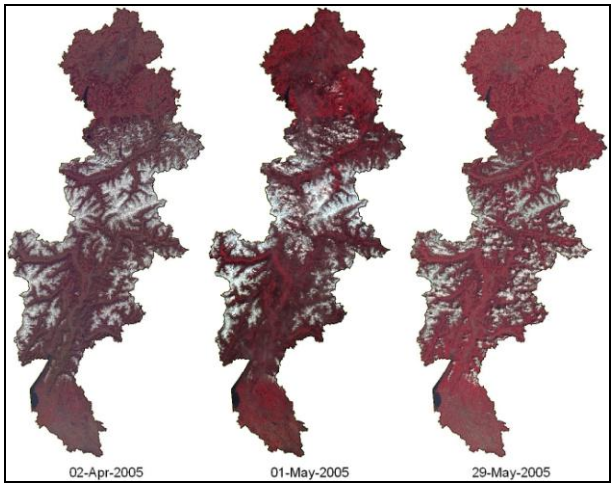

Figure 3: Transect Munich-Verona, 2005 time series quick look mosaics

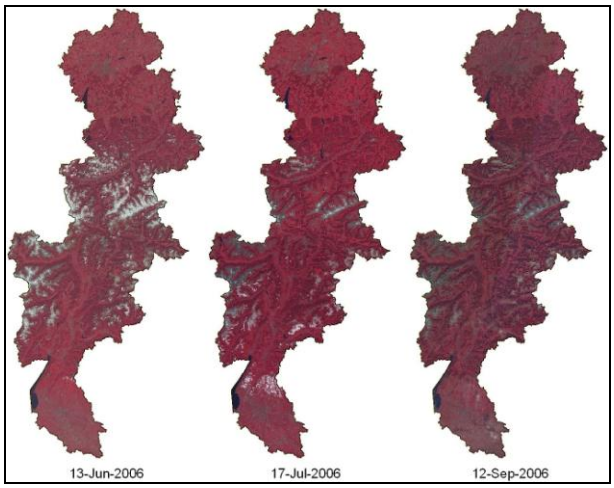

Figure 4: Transect Munich-Verona, 2006 time series quick look mosaics

4. CONCLUSIONS

With the IRS program, ISRO has established one of the world's leading EO programs. Through Euromap, the exclusive supplier of data from several IRS missions in Europe, IRS-P6 Resourcesat-1 has significantly contributed to GMES and other European activities. Considering the upcoming IRS EO missions, the IRS program has the potential to continue being a significant data source satisfying European data needs.

Nevertheless, due to the ESA Sentinel satellites and the Sentinel Data Policy that establishes free-of-charge, full and open access to all Sentinel data, the market for EO data will change. To maintain a role in the European market, quality of services around data and systems have not only to be maintained but to be adapted to increasing requirements concerning data access, special acquisition requirements, payload programming and delivery of highest quality data products.