

INTERFEROMETRIC PROCESSING OF ENVISAT-1 /ASAR IMAGE MODE AND ALTERNATING POLARISATION MODE FOR APPLICATION IN LAND COVER AND CROP MAPPING.

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ABSTRACT

The paper describes the progress and the preliminary results of the “interferometric part” of the project entitled “Synergetic use of ASAR and SPOT data for land cover mapping and crop monitoring” carried out in the framework of ESA’s ENVISAT AO Projects (ID:783). The main data sources for this research are ENVISAT / ASAR detected products (both Image Mode and Alternating Polarization Mode - Geocoded). The acquisition dates and imaging parameters were programmed regarding ASAR flight schedule and instrument availability. Some of the images were demanded in two options: as geocoded detected products and as single look complex data. Long time interval between the acquisitions (temporal interferometric decorrelation) and unpredictable baselines at the moment of image ordering made the data set not optimal for interferometric processing. The interferometric set is undergoing the processing using BEST, DORIS and EV_InSAR Atlantis software packages. Two pairs of ASA_IMS images were processed to coherence maps but the ASA_APS data is still under processing - testing several processing options and variants.

1. INTRODUCTION

The main data sources for this research are ASAR detected products: Image Mode and Alt.Pol Mode. Different polarimetric configurations for Alt.Pol Mode as far as for Image Mode are exploited jointly with a few different imaging angles. Additionally single look complex ASAR products both for Image Mode and Alt. Pol Mode are processed for coherence map generation to create an additional source of potential useful information like in well known case of ERS-1/2 tandem and 35-days repeat pass interferometry. The acquisition dates and imaging parameters were programmed for the test site Malbork located in the North of Poland during 2003 growing season regarding ASAR **flight schedule and instrument availability**. The interferometric pairs are chosen **amongst the available** sets of ASAR data previously acquired for detected product generation. Simultaneously to ASAR acquisition the field observation over test site were performed: visual examination and measurements of some bio-metric parameters of crops. On the other hand the series of 5 optical SPOT images were acquired during the period April-August 2003 for facilitating ASAR images interpretation and understanding. Both sensors are exploited jointly for examining the complementarity and synergism of them. The interferometric set is undergoing the processing using BEST, DORIS and EV_InSAR software packages. Long time interval between the acquisitions (temporal interferometric decorrelation) and unpredictable baselines at the moment of image ordering made the data set not optimal for interferometric processing. The authors had an earlier experience in interferometric processing of ERS-1/2 SLC image series (Image Mode) but this work is a newly gained experience with single look complex data registered in Alternating Polarization Mode.

2. MATERIALS AND METHODS

2.1 Test area.

The test area Malbork is located in the northern Poland near Gdansk agglomeration in the Vistula river delta. This is an agricultural region where dominate the cereals, rape seed and sugar beet as a main crops. The terrain is flat on the west side (delta) and with moderate, postglacial relief on the east side (+/- 20 m high differences). The main advantage of

this area for testing RS technologies are large parcels of agricultural crops.

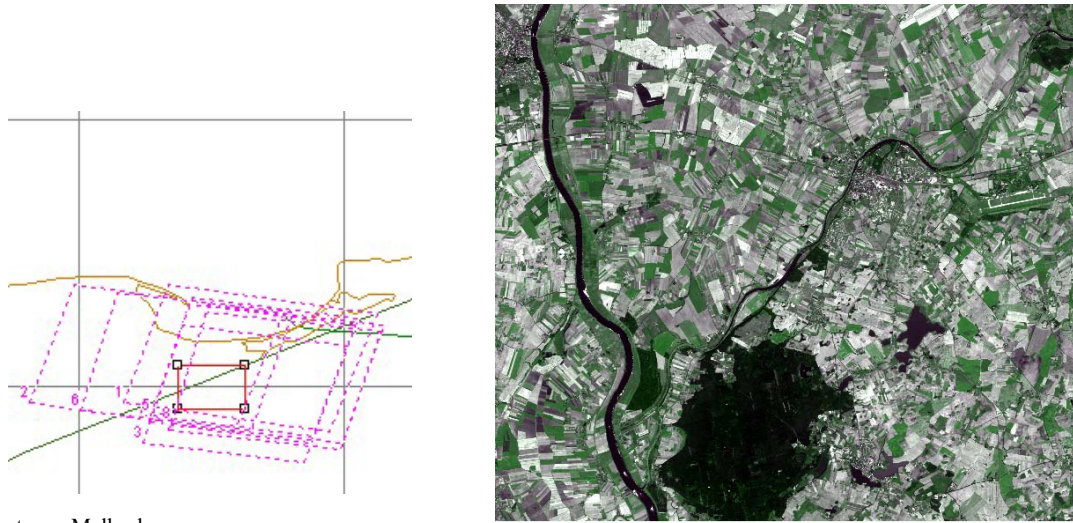


Fig.1 a,b. Test area Malbork:
a) ENVISAT / ASAR frames with AOI boundaries.

b) SPOT 5 color composition (SPOT Data / Program ISIS
@CNES 2003, distributed by Spotimage S.A)

2.2. ASAR_IMS and ASAR_APS data sets.

A series of ASAR Image Mode (ASA_IMG) and ASAR Alternating Polarization Mode (ASA_APG) products was programmed and ordered for their use in land cover and crop mapping. From this data set the backscattering coefficients could be calculated for the parcels of several crops for investigating of backscattered signal changes in the time due to crop state and crop developing stage changing. This part of the project will not be presented in this paper. For the several dates of ASAR acquisitions, chosen amongst all dates for which registrations were programmed and detected products were generated, also single look complex images were ordered. The details of the interferometric data set are shown in the tab.1.

Tab.1. Interferometric images taken over test area Malbork.

| Date yy-mm-dd | Swath | Orbit | Track | | Product Type / Level | Product Acronym | Polarisation | Status on 31.12.2003 |
|------------------|-------|-------|-------|--|----------------------|--------------------|--------------|-------------------------|
| 03-04-09 | IS 3 | 5787 | 3 222 | | Alt. Pol. SLC | ASA_APS_1P | VV/HH | Delivered |
| 03-04-12 | IS 2 | 5830 | 2 265 | | Image Mode SLC | ASA_IMS_1P | HH | Delivered |
| 03-04-25 | IS 4 | 6016 | 4 451 | | Alt. Pol. SLC | ASA_APS_1P | VV/VH | Not yet delivered |
| 03-05-01 | IS 2 | 6102 | 2 036 | | Alt. Pol. SLC | ASA_APS_1P | HH/HV | Delivered |
| 03-05-11 | IS 4 | 6245 | 4 179 | | Image Mode SLC | ASA_IMS_1P | VV | Delivered |
| 03-06-05 | IS 2 | 6603 | 2 036 | | Alt. Pol. SLC | ASA_APS_1P | HH/HV | Delivered |
| 03-06-15 | IS 4 | 6746 | 4 179 | | Image Mode SLC | ASA_IMS_1P | VV | Delivered |
| 03-07-04 | IS 4 | 7018 | 4 451 | | Alt. Pol. SLC | ASA_APS_1P | VV/VH | Delivered |
| 03-07-10 | IS 2 | 7104 | 2 036 | | Alt. Pol. SLC | ASA_APS_1P | HH/HV | Delivered |
| 03-07-26 | IS 2 | 7333 | 2 265 | | Image Mode SLC | ASA_IMS_1P | HH | Delivered |
| 03-08-11 | IS 3 | 7562 | 3 494 | | Alt. Pol. SLC | ASA_APS_1P | VV/HH | Delivered |

Both the IMS and APS data was processed using BEST software (Beta version 3.0) made available free by ESA / ESRIN for the ENVISAT data users. The IMS data was processed also using EV-InSAR, commercially available software of Atlantis Scientific. At the moment of this data processing the option of Alt_Pol_Envisat was not yet

3. PRELIMINARY RESULTS

At the moment of publication only two pairs can be regarded as fully processed:

- IMS_IS4_VV from 11.05 and 15.06.2003
- IMS_IS2_HH from 12.04 and 26.07.2003.

This two pairs composed of ASA_IMS images were processed to coherence maps in slant range geometry. In both cases the interferometric coherence is poor. The reasons are of long time interval between acquisitions but also very long baselines. In the case of the first pair (IMS_IS4_VV from 11.05 and 15.06.2003) we can distinguish easily urban areas and railways as the places of higher coherence. See fig.1. The rest of the terrain is characterized by a very low coherence regardless its origin. On the other images of coherence it is possible to distinguish, often with difficulties, some strong scatterers in the urban areas or along the river banks.

The ASA_APS data are currently under processing testing several processing options and variants and the results are not presented in this paper.

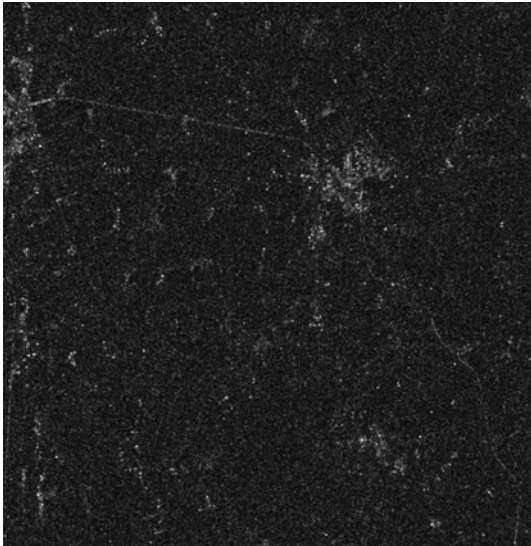


Fig.1. Coherence image from IMS_IS4_VV pairs acquired on 11.05 and 15.06.2003.

An attempt was made to generate also the polarimetric coherences between the co-pol or cross-pol channels of the same registration. The processing of a “zero baseline” pairs shows no coherence. The half-pixel shift between MDS1 and MDS2 datasets in range direction reduced a spectral overlap which was probably the main source of decorrelation.

Acknowledgment:

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4. REFERENCES

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