THE USE OF ERS ALTIMETER DATA WITHIN THE REFERENCE3D® PRODUCTION PROJECT

Landry.Tripon@spotimage.fr
Christophe.Cortes@spotimage.fr

February 2006

Table of content

- SARCOM presentation
- The project :use of ERS Altimeter data

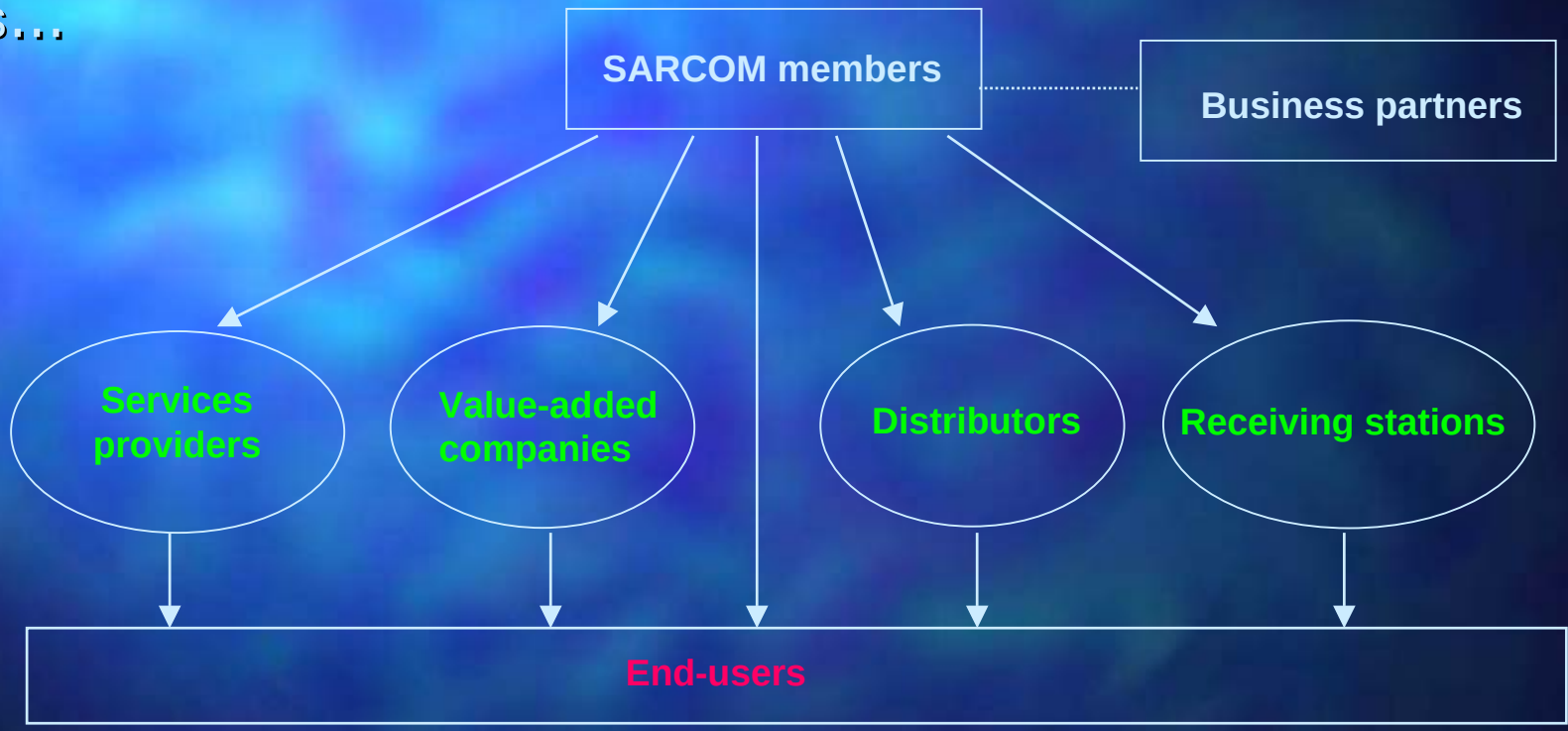
SARCOM Consortium

- SARCOM consortium has a specific agreement with ESA for the distribution of ERS/ENVISAT data

- SARCOM Members
  - Spot Image, Geoserve, KSAT, METRIA, NPA, MDA, Spot Asia
  - All are radar experts
  - Multisource data distributors (Spot, ERS/ENVISAT, Radarsat, FORMOSAT-2, DEM, VHR...)
  - Offering complementary skills and applicative expertise
    - Basic products offer
    - Value added products and services
    - ERS/ENVISAT telementry for GRS

SARCOM Consortium

- Worldwide platform for EO data & services in partnership with different actors…



Market segments (users' requirements)

Geology/ exploration

Marine/ Coastal

Risk management

Environment

Mapping

Agriculture/ Forestry

Defence

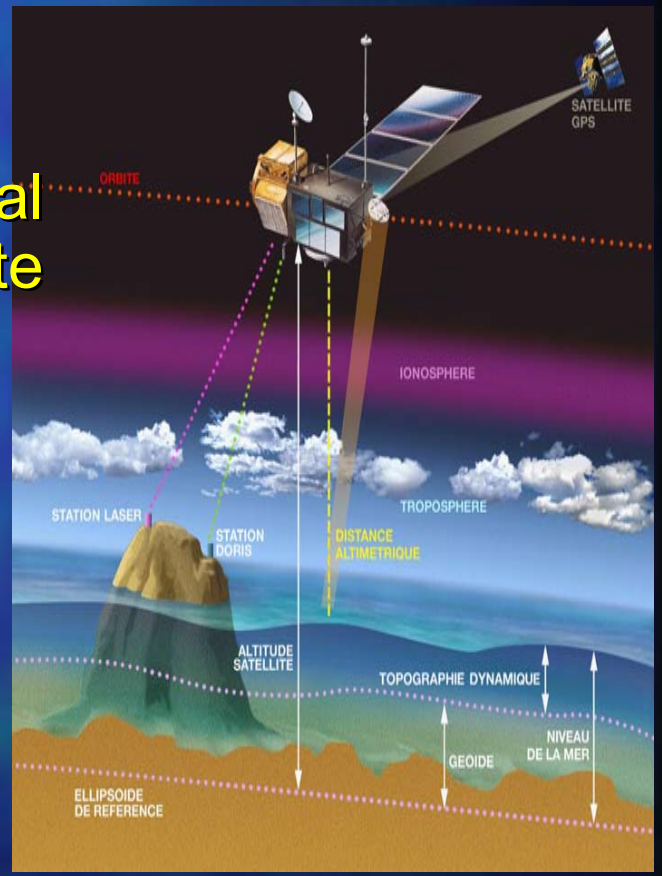
THE USE OF ERS ALTIMETER DATA WITHIN THE REFERENCE3D® PRODUCTION PROJECT

- **ERS altimeter** = accurate ocean altitude

- Though not designed for continental areas, ERS altimeters provide accurate elevations over some areas :

  - Flat areas (see ISPRS 2004)

  - Specular measurements

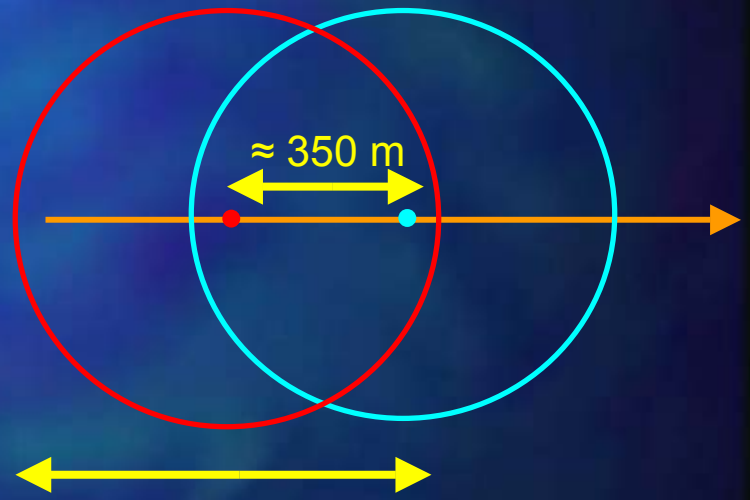


Principle of altimeter data

Along the orbit, a measurement is taken every 350m

On the ground, the radar wave spreads within a circle

The exact position of the elevation given by the altimeter is not known.



Size of the ground measurement circle ranges from 850 m to 8,000m

Objective

Previous studies showed the possibility to extract precise elevation from ERS altimeter over some water bodies.

The aim is to find some reliable elevation data to check Reference3D accurate DEM (made from SPOT data) vs independant « truth ».

SPOT IMAGE

Problems to overcome

We know that specular measurements can provide the precise elevation of water bodies

… but where exactly is the “responding” water body located within the measurement circle area ?

… and what if several water bodies are in sight ?

THE USE OF ERS ALTIMETER DATA WITHIN THE REFERENCE3D® PRODUCTION PROJECT

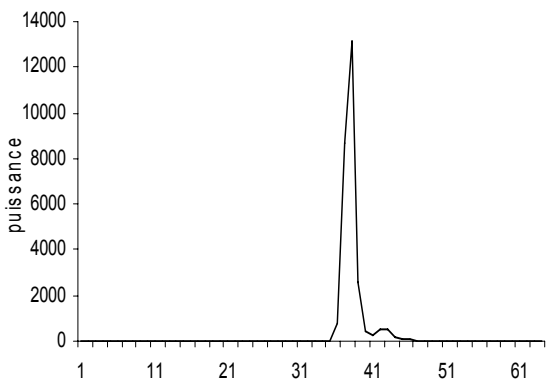
Inputs :

- ERS 1&2 altimeter data
- VMAP1 (vector map) hydrological layers

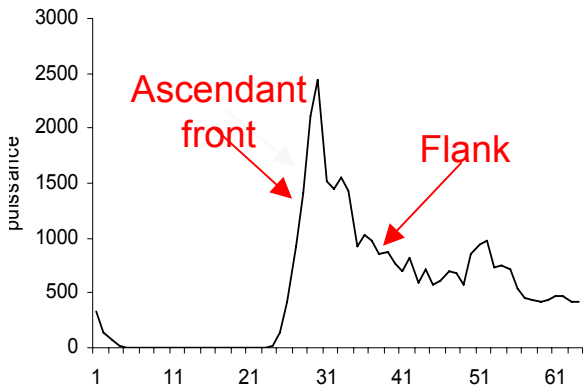
Methodology :

- Detection & selection of ERS Specular measurements
- Computation of altimeter data horizontal localization
- Linking of each specular measurement with a water body within VMAP1
- Check of data coherence on a given water body

Detection and selection of ERS Specular measurements



Specular wave



Non-specular wave

Specular measurements correspond to surfaces that return a powerful echo during a short time (eg. water ; glass roofs ; metal corner,…)

SELECTION CRITERIA

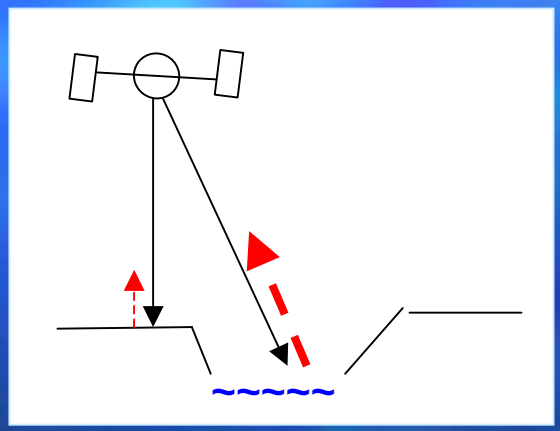
0,5 < ascendant front < 1 door

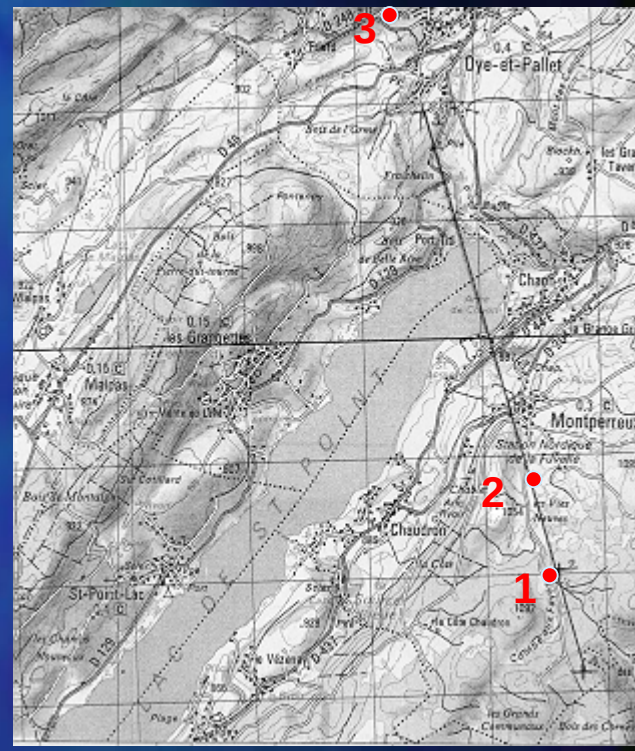
flank < - 0,11 Neper/door

Intensity > 22 dB

Problem : the radar echo can come from a surface which is not exactly located at the nadir of the satellite

↳ **Wrong altimeter measurement**



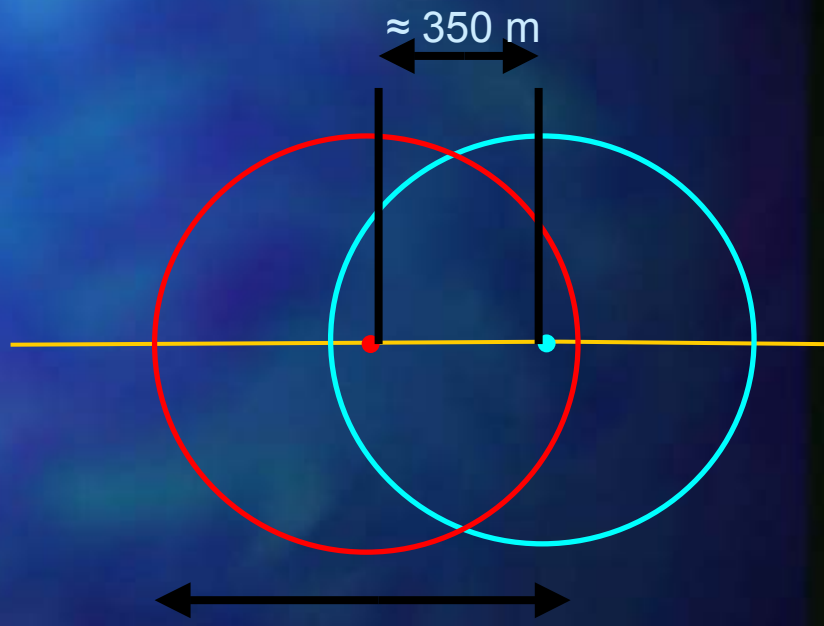


The water body linked with the specular wave has to be identified. VMAP1 is the adequate DB for this step.

Horizontal localization of the altimeter data

Several altimeter measurements are grouped using the following criteria :

- same orbit
- same date
- distance < 1000 m (3 measurements)



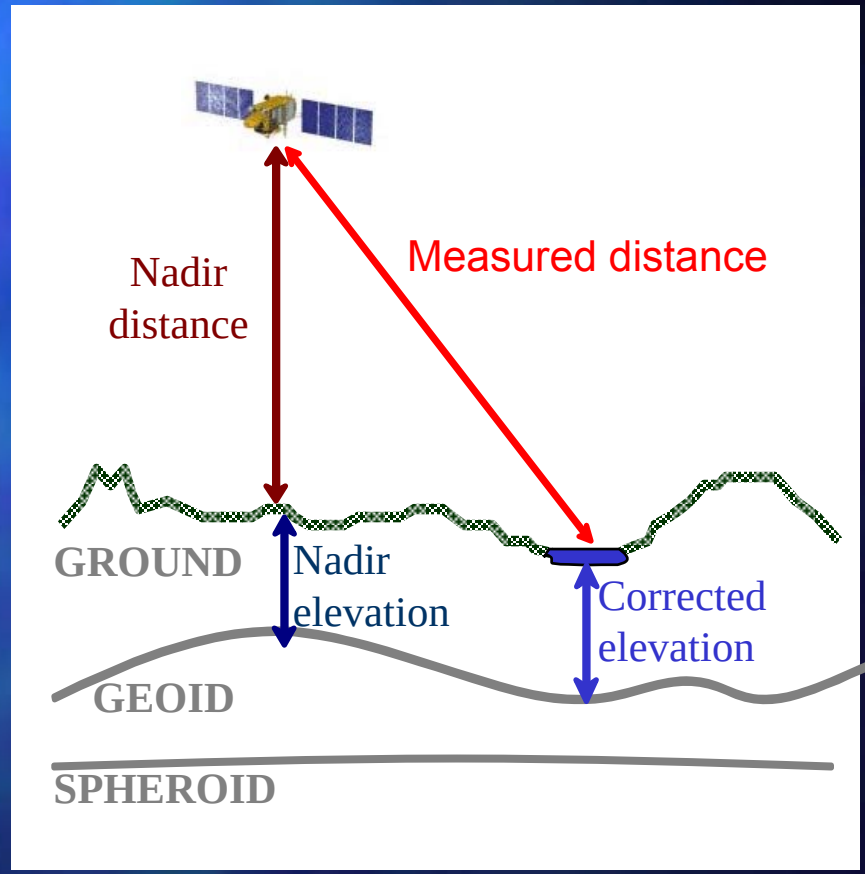
In the following step, each group is linked with a VMAP water body using the following criteria :

- Distance
- Nadiral point
- Intersection between orbit and VMAP water body

A confidence level is also evaluated for each ERS measurement-Water Body correspondence

Group consistency :

- The corrected altitude of each ERS measurement in the group is computed
- The consistency of the various altitudes within the group is checked



Consistency within a water body

- Several groups must show “compatible” elevations for the same water body
- Specific criteria :
  - Lakes : a ±10m tidal range is admitted
  - Rivers must show a flowing direction

THE USE OF ERS ALTIMETER DATA WITHIN THE REFERENCE3D® PRODUCTION PROJECT

SPOT IMAGE

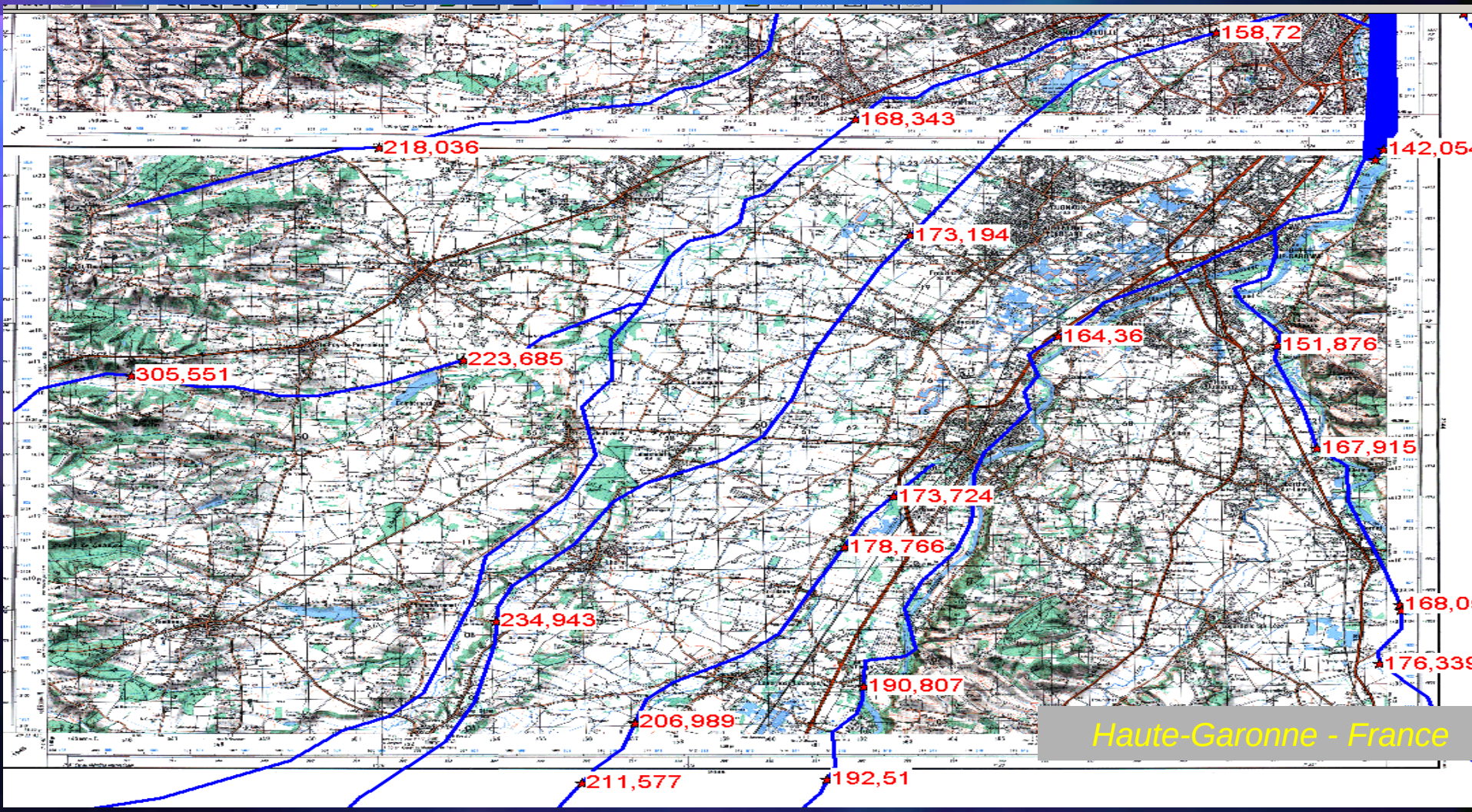
- Consistency within a lake
  - Possible wrong position of VMAP data, mainly with VMAP0
  - **Consistent results**

Mauguio
Herault - France

THE USE OF ERS ALTIMETER DATA WITHIN THE REFERENCE3D® PRODUCTION PROJECT

SPOT IMAGE

Consistency along rivers (flowing direction)



CONCLUSION

- Extraction of precise elevations from ERS altimeter over continents is possible. Previous studies shown excellent accuracy over flat areas (ISPRS 2004)
- Some specular ERS altimeter measurements can be linked with VMAP water bodies
- A careful selection should be made to preserve homogeneity and consistency of the resulting data set

Production is going on…