Template product information package

Product	**Small Water Bodies**
Participant ID	**VITO, JRC**

1. General Information

In semi-arid regions, the surface water can be discriminated with standard VEGETATION S10 data because of the contrast between water and dry soil. The waterbodies detection products generated by Vito in the framework of Geosuccess from an methodology developed at JRC (Gond et al., 2004), indicates free water, humid area and mix of free water and humid area. A full description of the method can be found in the above mentioned paper provided hereafter.

Although VEGETATION provides images with a 1-km resolution, it was demonstrated that it is sufficient to accurately map and monitor the presence of water in ponds and swamps of about 1 km² in size. The accuracy obtained is in the order of 90%, i.e. 90% of the water bodies detected with the method over an area of 1 million 1 km² were found to be correct.

From theses data sets, two main products are developed at JRC within GEOLAND OLF: to provide (1) the date for start of replenishment and (2) the end of draining/evaporation. A synthesis of the products, by grids (1°x1°, ½°x ½ °) or administrative units is also provided.

2. Application of the product

Water is available in limited quantities in arid and semi-arid regions. Monitoring surface water scattered in small water bodies provide useful information for several applications, including human activities, cattle management, epidemiology, biodiversity (incl. migrating birds). In addition long term times series of water occurrence in semi arid regions might be an interesting indicator of the impact of climate variation.

There is currently no such product. It should be noted that the product was developed upon specific request of local users.

3. Algorithmic methodology

The “Small Water Bodies” (SWB) products are produced for each decade of VEGETATION-S10 data, and indicate the water surface state: dry land, free water, humid

area, mixture of free water and humid area. The algorithm is fully described in the annexed paper.

The SWB products generated by Vito are assembled in time series, thus the detection of the start of replenishment and of draining/evaporation developed by GEOLAND OLF correspond to the change in state of the waterbodies (dry land to water/humid area/ mixture and vice-versa). To avoid false detection, two of the three following criteria must be fulfilled:

- Temporal detection: positive detection for 2 out of 3 observation dates
- Contextual criterion: on the 3 x 3 window surrounding the detected pixel there are 3 detected pixels (including the centre pixel)
- Geographic criterion: the detected pixel is located in a site where the occurrence of a water body is possible: this is achieved by comparison with a reference map

The current reference map merges information from GLWD (Global Lakes and Wetlands database), drainage from DCW (Digital Chart of the World). A new version is being constructed within GEOLAND OLF to account for gaps and mistakes in the existing documentation. It will be based on historical occurrence of free water and humid areas registered between 1999 and 2004 on SWB products. Where necessary it will be completed by improved drainage network maps and by ecozones (to avoid mis-interpretation in environments different to semi-arid regions.

4. Ancillary data

GLWD (Global Lakes and Wetlands database) are available from WWF web-site. This database is a combination of available sources for lakes and wetlands on a global scale (1:1 to 1:3 million resolution). It focuses on three coordinated levels on (1) large lakes and reservoirs, (2) smaller water bodies, and (3) wetlands.

The drainage network of ESRI's DCW (Digital Chart of the World) is used separately as a reference. It describes Perennial inland water (includes perennial lakes and streams, estuaries, lagoons, unsurveyed perennial streams, reservoirs, and navigable canals), and nonperennial inland water (includes nonperennial and seasonally fluctuating lakes and streams, wadis, sabkhas, and abandoned navigable canals). It provides also punctual information (spring, waterhole, small reservoir, dam…). A updated map is being generated by GEOLAND OLF.

The combination of theses ancillary data will be used to define a validity mask, used for to check the geographic criterion described above. The mask will be validated against a Landsat TM mosaic.

5. Examples

The figures below show examples of products. The first image displays in blue waterbodies and humid area on Burkina Faso (SWBproduct).

The second show an example of start of season product on Namibia: the raining season occurs from end September to April. This example was computed directly from Vito's waterbodies product, without using the geographic criterion mask (this mask is under validation). Figure 3 displays a first version of the geographic mask (in gray) and waterbodies that fall within (green) or out (red) of GLWD. To validate red point, they must meet one of the additional criterions (temporal or contextual criterion). Obviously, most of single points in South of figure 3 correspond to false detection, while some extended area may correspond to occasional wetlands.

A new version of the waterbodies detection is now available, a new map of historical records will be built and use to produce and updated version of the geographic mask. Moreover, an effort will be made to validate the mask.

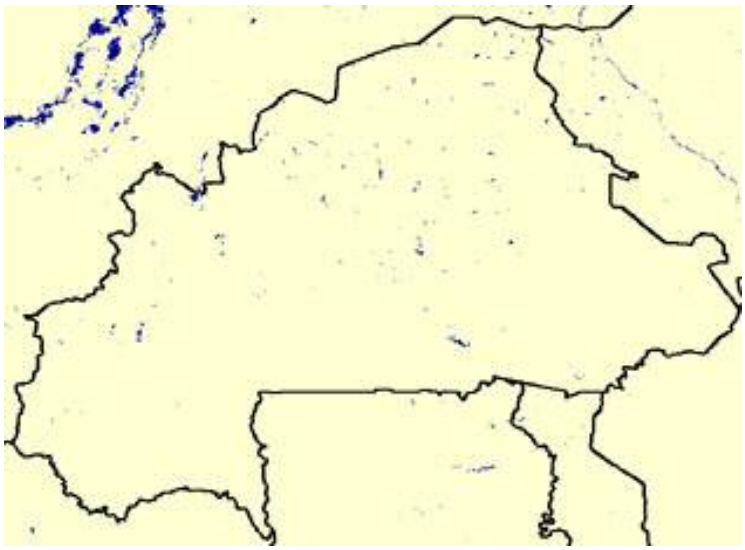

Figure 1 Vito's product 'waterbodies', Burkina Faso and neighboring regions, 01-10-2001 (source http://www.geosuccess.net)

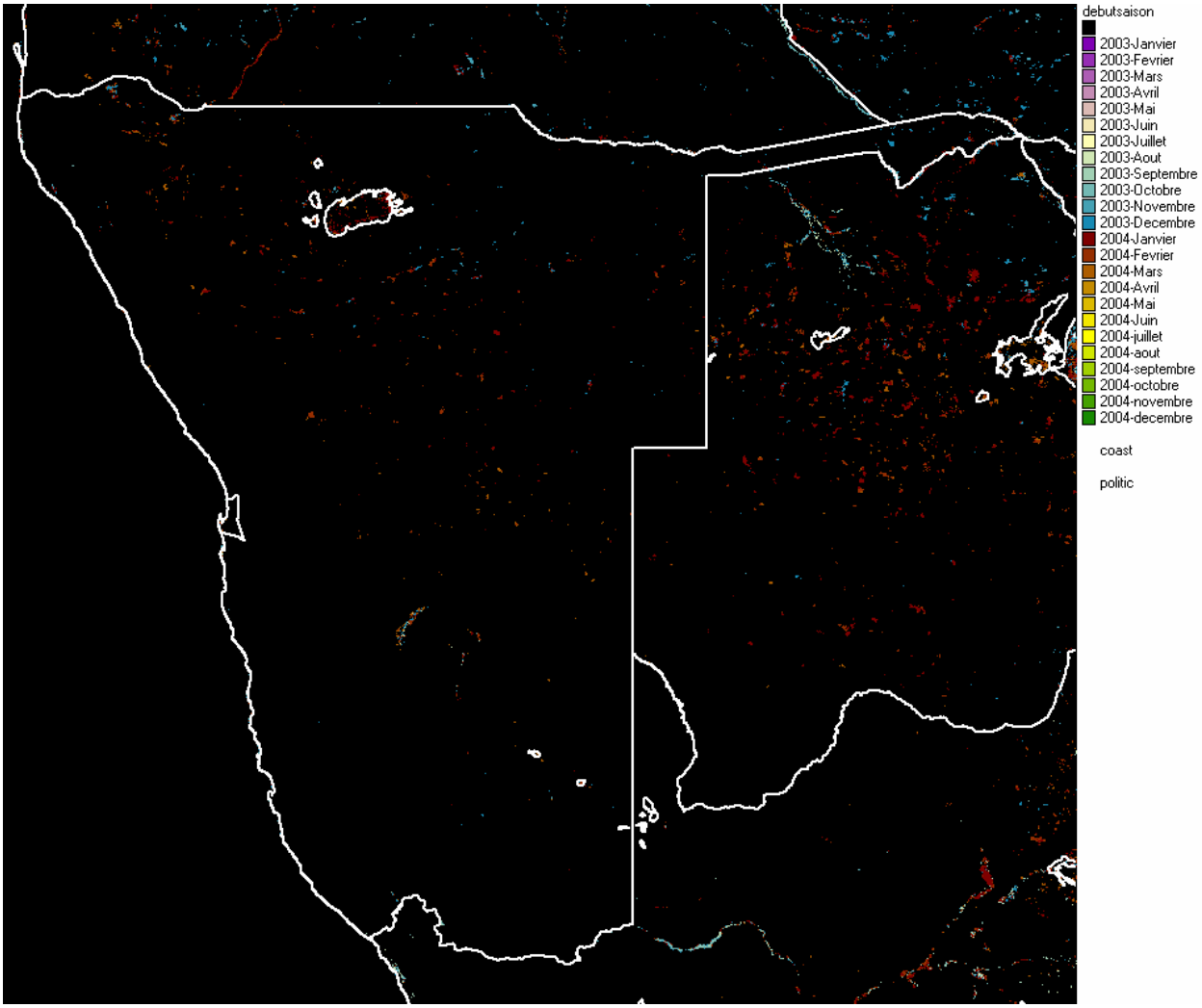

Figure 2 Namibia, start of replenishment, and temporal profile of the succession of humid area (150) and dry land (255), from 11/04/1998 to 20050201

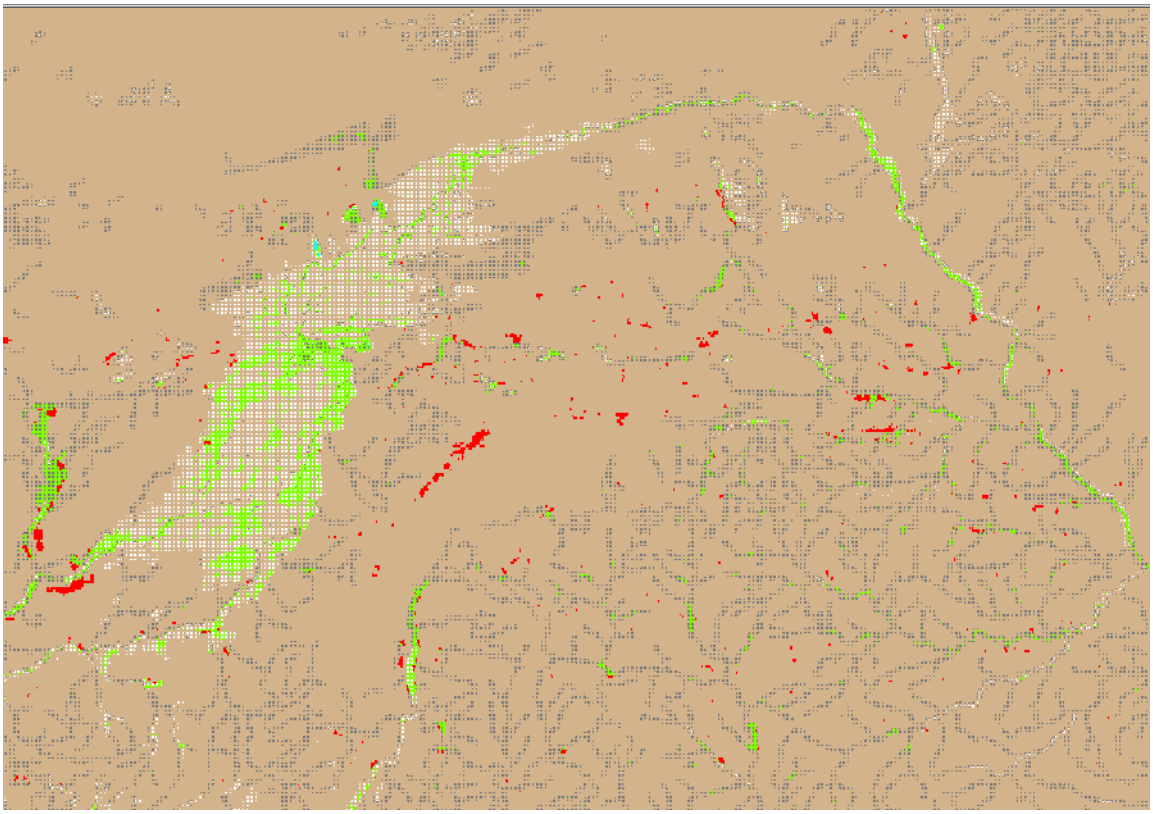

Figure 3 Geographic validation (Niger inner delta). In green waterbodies that fall in the mask, in red detection that fall out of the mask (do not satisfy the geographic criterion).

6. Validation evidence

The method was validated during the development phase, and showed that there was a commission error level of about 10% Omission errors over the validation area (about 1 Mkm2 in size) are in the order of 30%, and mostly correspond to objects that are smaller than the instruments IFOV (see Gond et al., 2004)

The validation will be extended at the occasion of the update of the quality control mask.

7. Estimated cost from 'pre-operational' to 'operational'

The algorithm for the production of SWB is already implemented at VITO (GEOSUCCESS product), and may account easily for the update of the quality mask (cost TBC). The derived date products are new products. Cost of implementation TBD.

8. References

Gond V., Bartholomé E., Ouattara F., Nonguierma A. and Bado I, 2004, « Surveillance et cartographie des plans d'eau et des zones humides et inondables en régions arides avec l'instrument VEGETATION embarque sur Spot 4 », *International Journal of Remote Sensing, 25,5,987-1004*

Geosuccess web site: http://www.geosuccess.net/

Lehner B. and Doll P., "Development and validation of a global database of lakes, reservoirs and wetlands", *Journal of hydrology*, 296, 1-22, 2004

Global Lakes and Wetlands Database GLWD: http://www.wwfus.org/science/data.cfm

Drainage from DCW or equivalent: http://www.maproom.psu.edu/dcw/dcw_about.shtml

9. Technical product sheet

Product name *Small water body Products for seasonal water resources analysis*
Algorithmic Methodology *Generates a Small Water Body SWB product from S10 data based on contextual analysis. SWB is exploited to to detect start of replenishment and draining/evaporation dates. To avoid false alarm, check the reality of the detection (fulfil 2 out of the 3: other occurrence exist in the history AND/OR presence of surrounding detection AND/OR located on a reference mask of waterbodies)*
Geometric Resolution *1km, synthesis by grids (1°x1°, ½°x ½ °) or administrative units*
Product Accuracy *The accuracy and reliability are improved by a reference map (set up from GLWD, DCW and historical analysis of waterbodies) that is used to cancel false alarms.*
Frequency Delivery *10-days*
Ancillary data *GLWD (Global lakes and Wetlands database), drainage from DCW (Digital Chart of the World).*
Delivery time *Not more than 3 days*

Archive

Yes: GEOSUCCESS for N. African semi arid regions. Area being expanded for the whole of Africa (work in progress). Period available: from March 1999 (start of the GCP workshop at CTIV)