A 10-daily 1km NDVI from METOP-AVHRR

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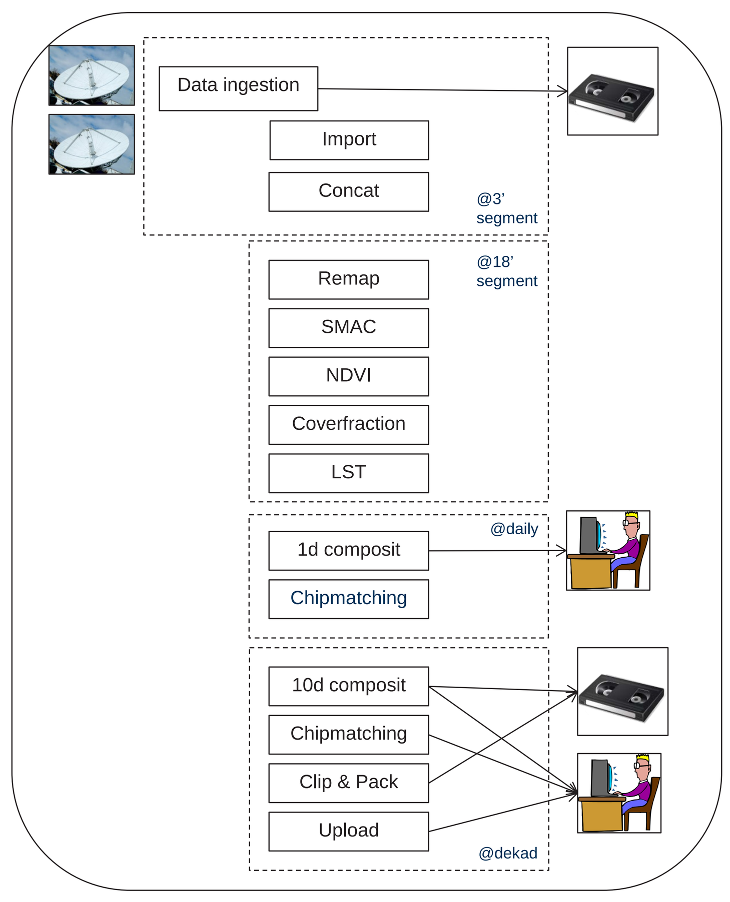
Many applications and studies rely on the Normalized Difference Vegetation Index(NDVI). In order to obtain sustainable long term data sets it is inevitable to combine data originating from different sensors, but the NDVI is sensor-dependent.

VITO is currently distributing 10-daily global composites from SPOT-VEGETATION, METOP-AVHRR and ENVISAT-MERIS. The data are all remapped to the lat/lon projection with the identical resolution and framing. The METOP-AVHRR product is recently added to the **LSA-SAF product** portfolio as **ENDVI10**. The poster introduces this product and presents a first comparison between the NDVI of these 10-daily composites in order to inform the users of the similarities and the differences.



Processing

METOP EPS L1B files are received through EUMETCast. The segments over land and during daytime are selected and joined before processing. The processing per segment performs first a re-projection of the spectral bands to WGS84 Geographical lat/lon with framing of 1° /112 (~1km) before the on-board registered radiances are converted to surface reflectances. The NDVI is computed before a related Land Surface Temperature (LST) is calculated from the two TIR brightness temperatures using split window technique (Coll and Caselles, 1997) over the Vegetation Fraction.

The reflectance bands, the NDVI and LST are composited into a 10-daily product selecting the "best available" observations, before freely distribution through a Spatial Data Infrastructure based on OGC standards.

@Disclaimer: LST is provided solely under courtesy of VITO

Data

Ten-daily composites (max NDVI) of **SPOT-VEGETATION** and **METOP-AVHRR** for the years 2008-2011 were used. The global images were systematically subsampled using a window size of 21x21 pixels. These 'degraded' images are still representative for the global vegetation patterns.

Sampling design

Paired observations that met the following **conditions** were selected.

1) Equal day of registration
2) Identical value before and after smoothing
3) Viewing zenith angle < 30°
4) Viewing azimuth angle <180° or >180°

Different combinations of these constraints were used for the following masks:

» All: (1), (2), (3) & (4)
» noVZA: (1), (2) & (4)
» noVAA: (1), (2) & (3)
» noVA: (1) & (2)

Validation Methods

The following **measures** were calculated in **three ways**:

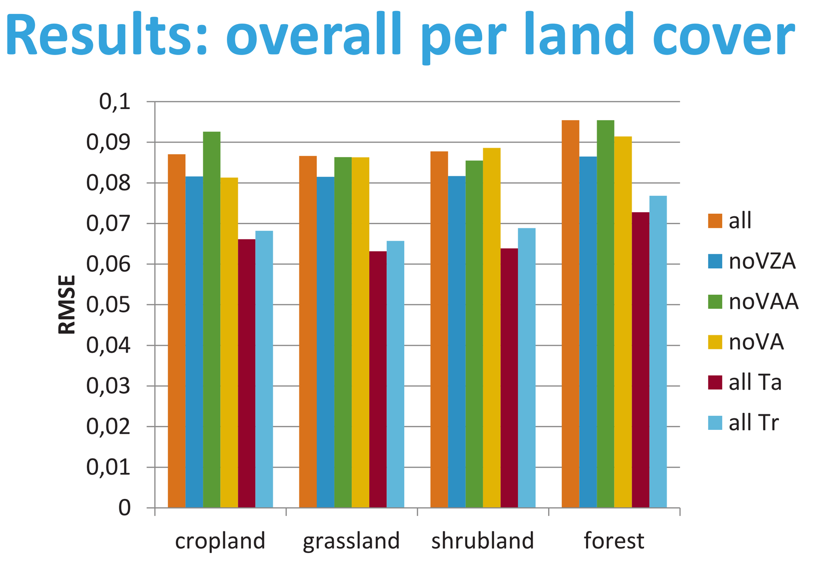
» R^2
» Agreement coefficient (AC)
» Root Mean Squared Error (RMSE)
» Mean Bias Error (MBE)
» Mean Absolute Error (MAE)
» Scatterplots

» <u>**Overall**</u>: a random sample of all cloudfree paired observations in the 48 composites, or per land cover
» <u>**Per pixel**</u>: all paired cloudfree observations over the 48 composites
» <u>**Per scene**</u>: a random sample of all paired cloudfree observations per composite, or per land cover

Data transformation

Trishchenko et al. (RSE, 2009) was used to empirically correct for the difference in Spectral Response Function between the sensors. Both data sets were transformed and the new data sets are named **Ta** and **Tr** for the absolute and relative correction functions.

Results: overall per land cover



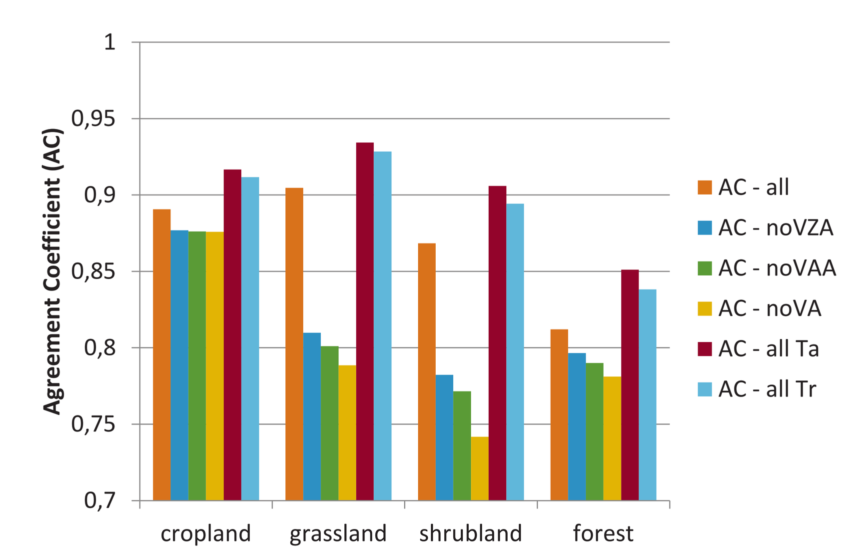


Figure 1: RMSE and Agreement Coefficient (AC) between the NDVI of the 2 sensors, for each land cover class. The different bars are different sampling schemes.

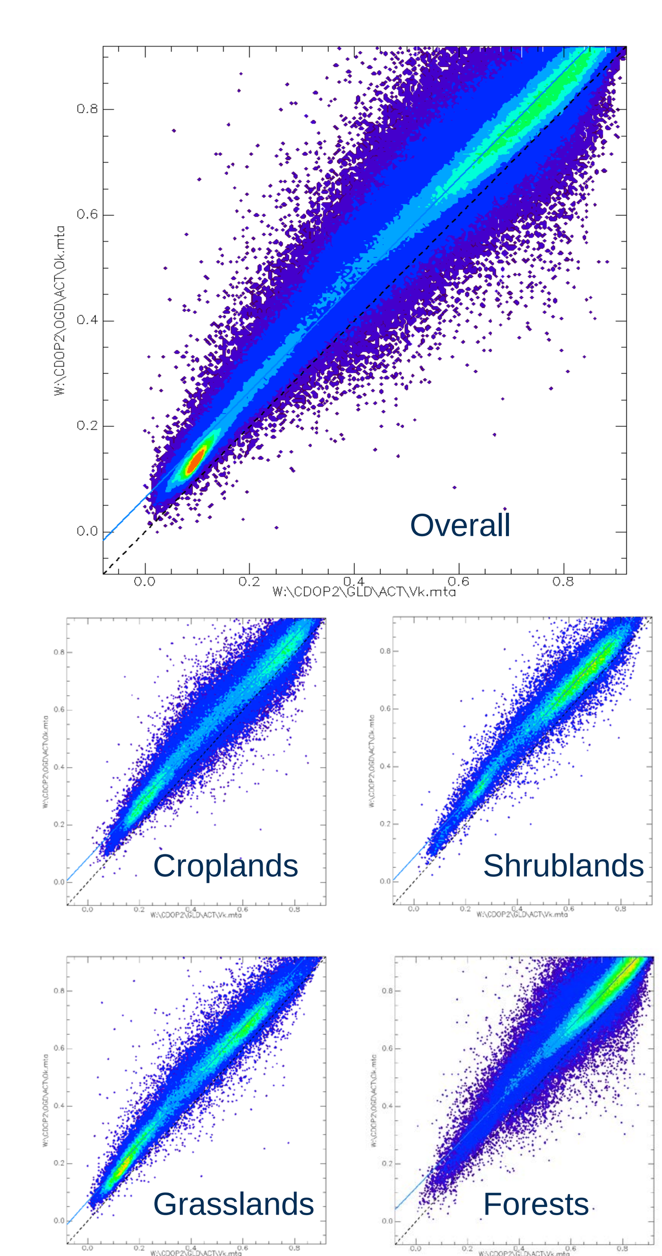
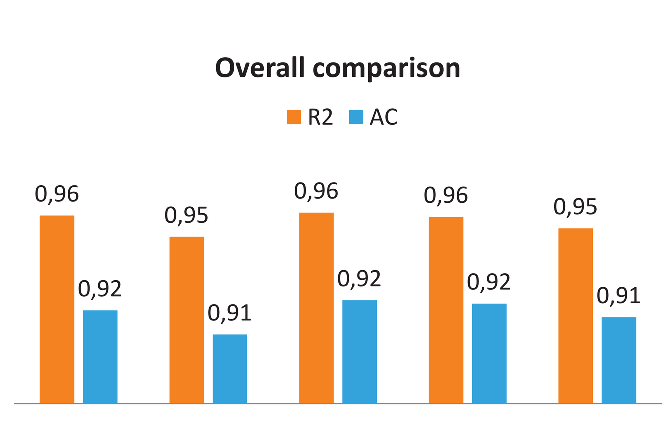


Figure 2: Scatterplots between the NDVI of VGT (X) and AVHRR (Y), overall and for a number of land cover classes

Conclusions

The NDVI, together with their reflectance bands and an LST, is provided every 10-days and freely accessible. In terms of geometry and contents, the ten-daily global composites are very comparable to the ones of SPOT-VEGETATION.
A high, near linear agreement was found between the NDVI of VGT and METOP-AVHRR, and the results were stable over time. The relationship expressed through the geometric mean regression has a slope very close to 1.
The slight non-linearity could be attributed to the differences between the spectral response functions. Applying the corrections functions of Trishchenko et al. (RSE, 2009) resulted in a substantially lower RMSE and higher agreement (AC).
Other influencing factors, such as viewing geometry were also demonstrated. As expected the errors (RMSE) were lower and the agreement (AC) higher when constraining for viewing geometry.
The different land cover classes showed similar errors and agreement, the highest errors were associated with the forest class. Still the agreement was within user requirements.

Results: overall



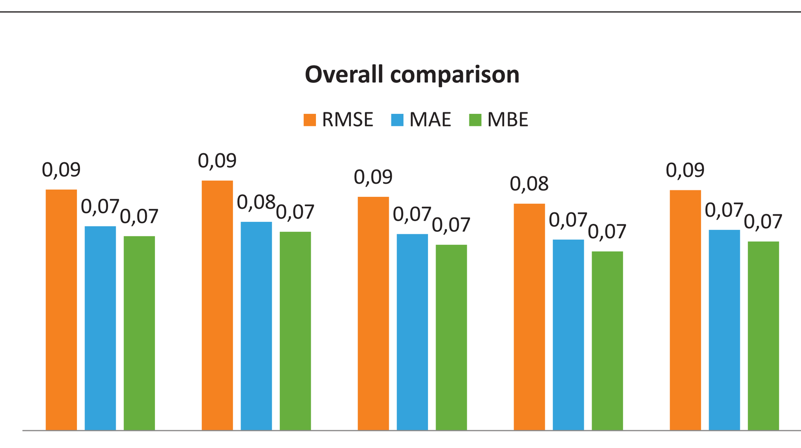


Figure 3: R^2, AC, RMSE, MAE, MBE between METOP-AVHRR and SPOT-VGT, per year and all years. Only pixels under all constraints were used.

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