

Assessing the use of LSA SAF VEGA data for environmental monitoring in Africa: Fractional cover and natural vegetation condition assessment

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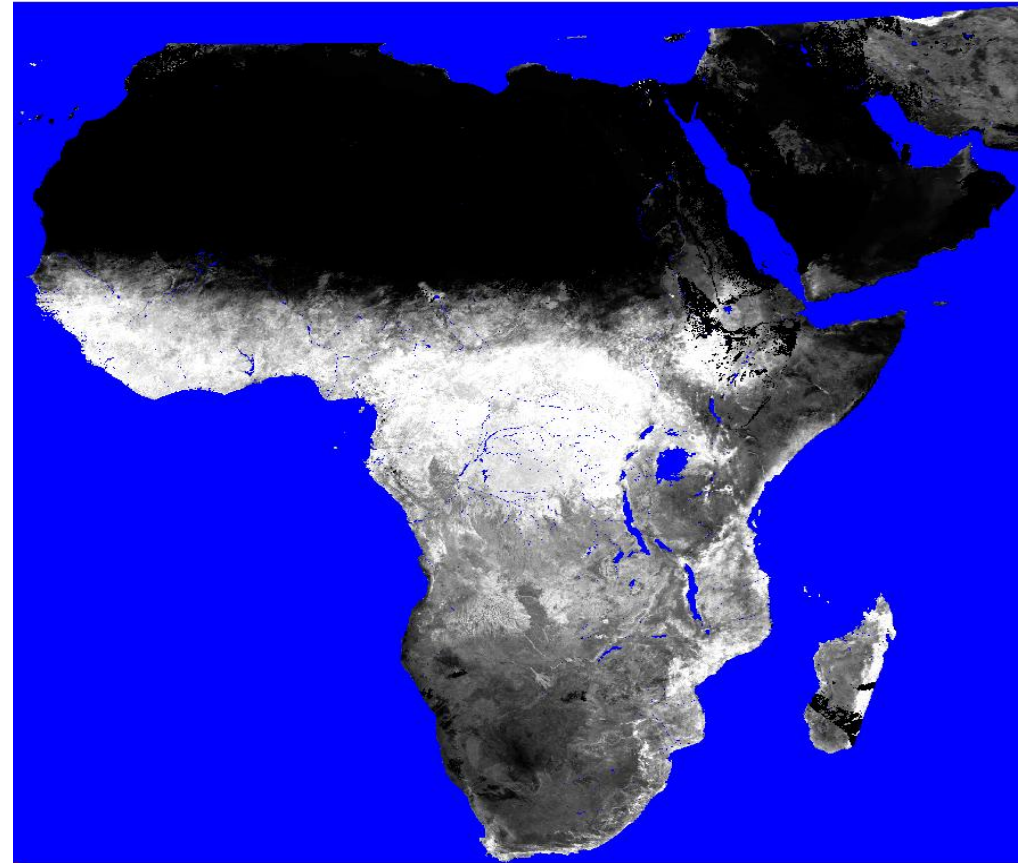
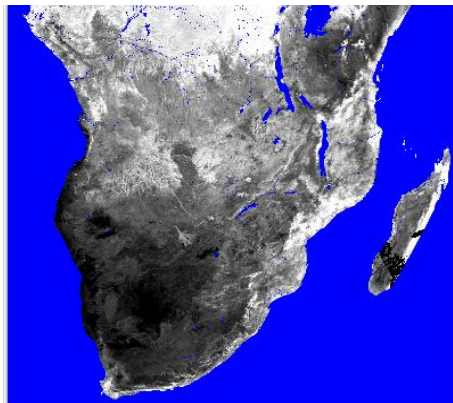
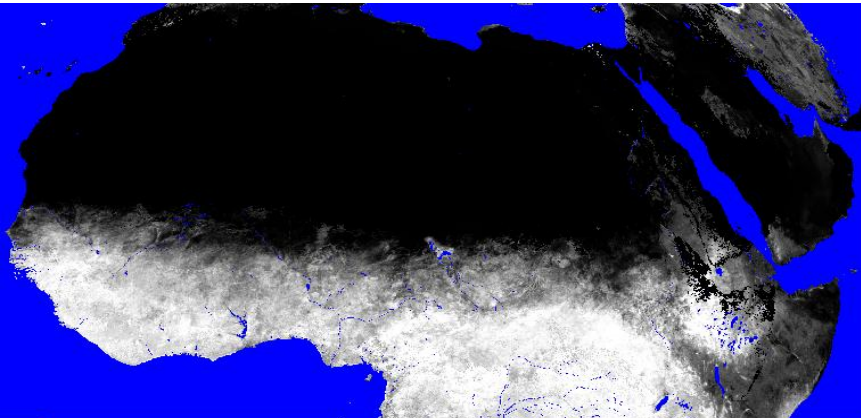


Assess the adequacy from a user point of view of the Fraction of Vegetation Cover (FVC) product over Africa for non meteorological applications (agriculture, forestry, environment management, food security,...)

In particular:

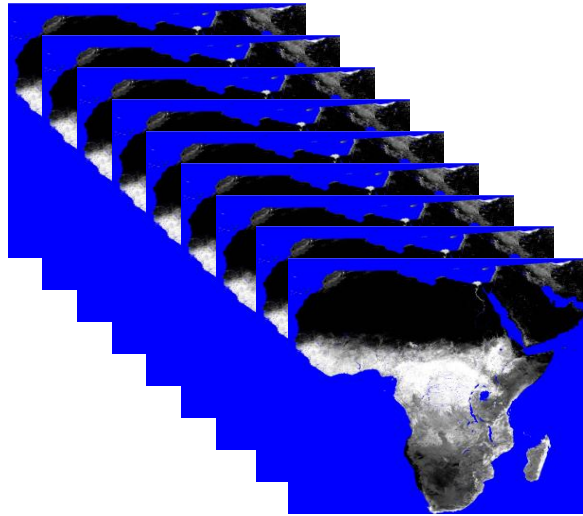
- **Identify the post-processing procedures needed for such applications**
- **Assess the FVC in term of usability for the main biomes by comparison with products from higher spatial resolution instrument but with a lower acquisition frequency (SPOT VEGETATION)**

Mosaicking, projection and image format conversion (geoTif)

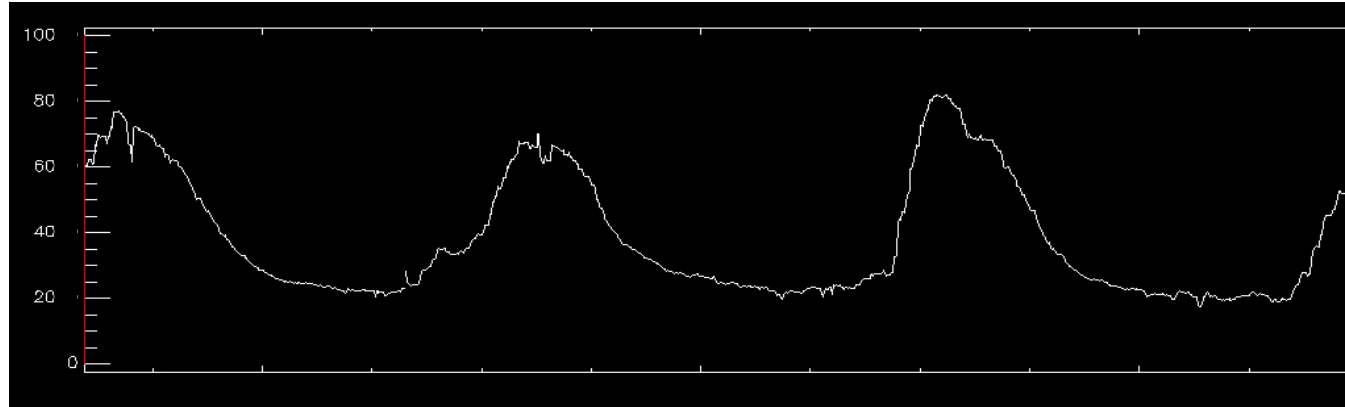


Geostationary Satellite View of the Earth

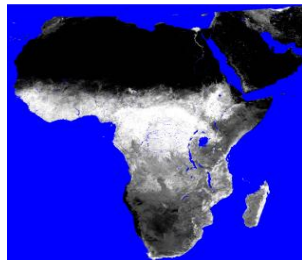
Plate carrée projection (datum WGS84)



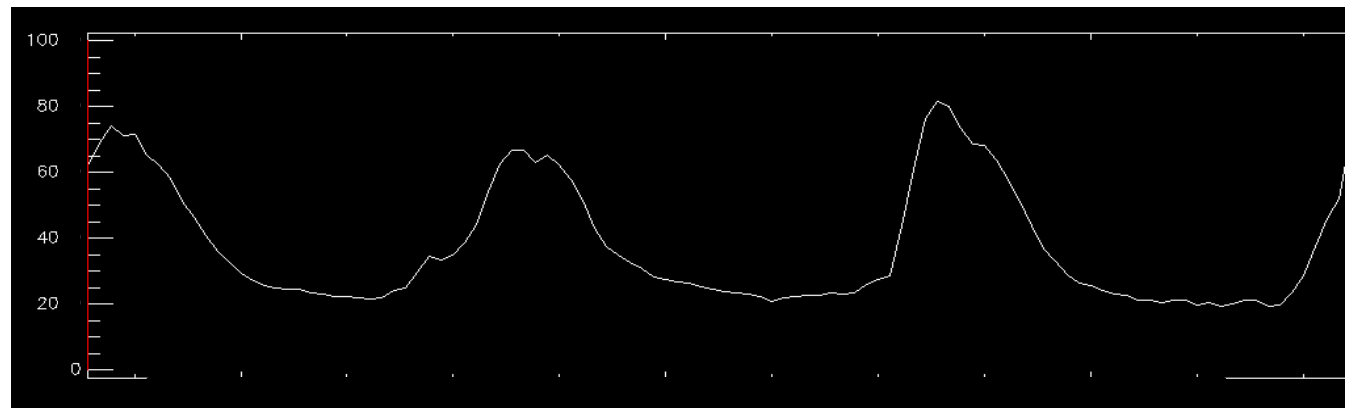
1-day Composite



Mean Compositing (Average of the valid observations)

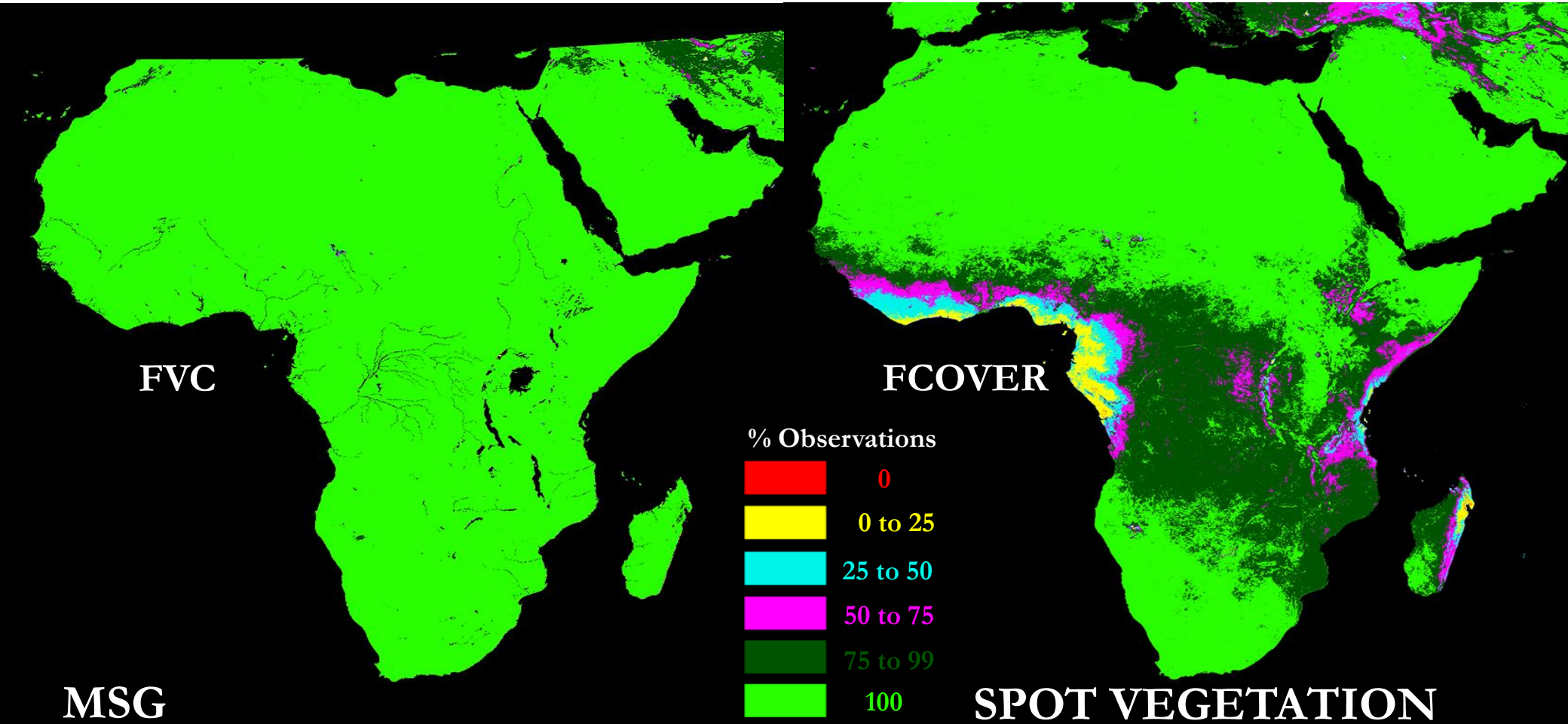


10-day Composite



Dataset

Product	FVC	FCover (VGT4Africa)	NDVI (VGT4Africa)
Sensor	MSG	SPOT VEGETATION	SPOT VEGETATION
Sensor observation frequency	15 min	~ 1day	~ 1day
Spatial resolution	3X3 km	1X1 km	1X1 km
Product temporal resolution	1 day	10 days	10 days



MSG

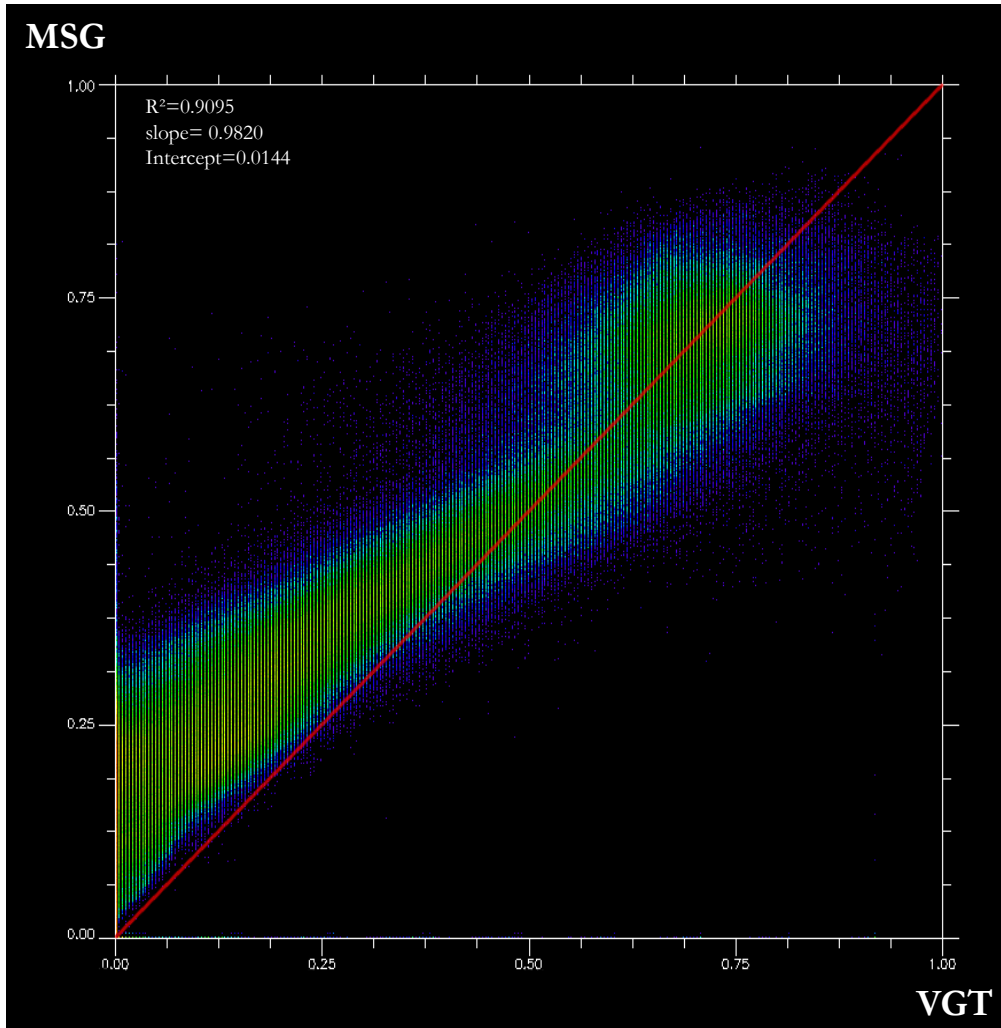
No missing value thanks to the high frequency of MSG

FCOVER

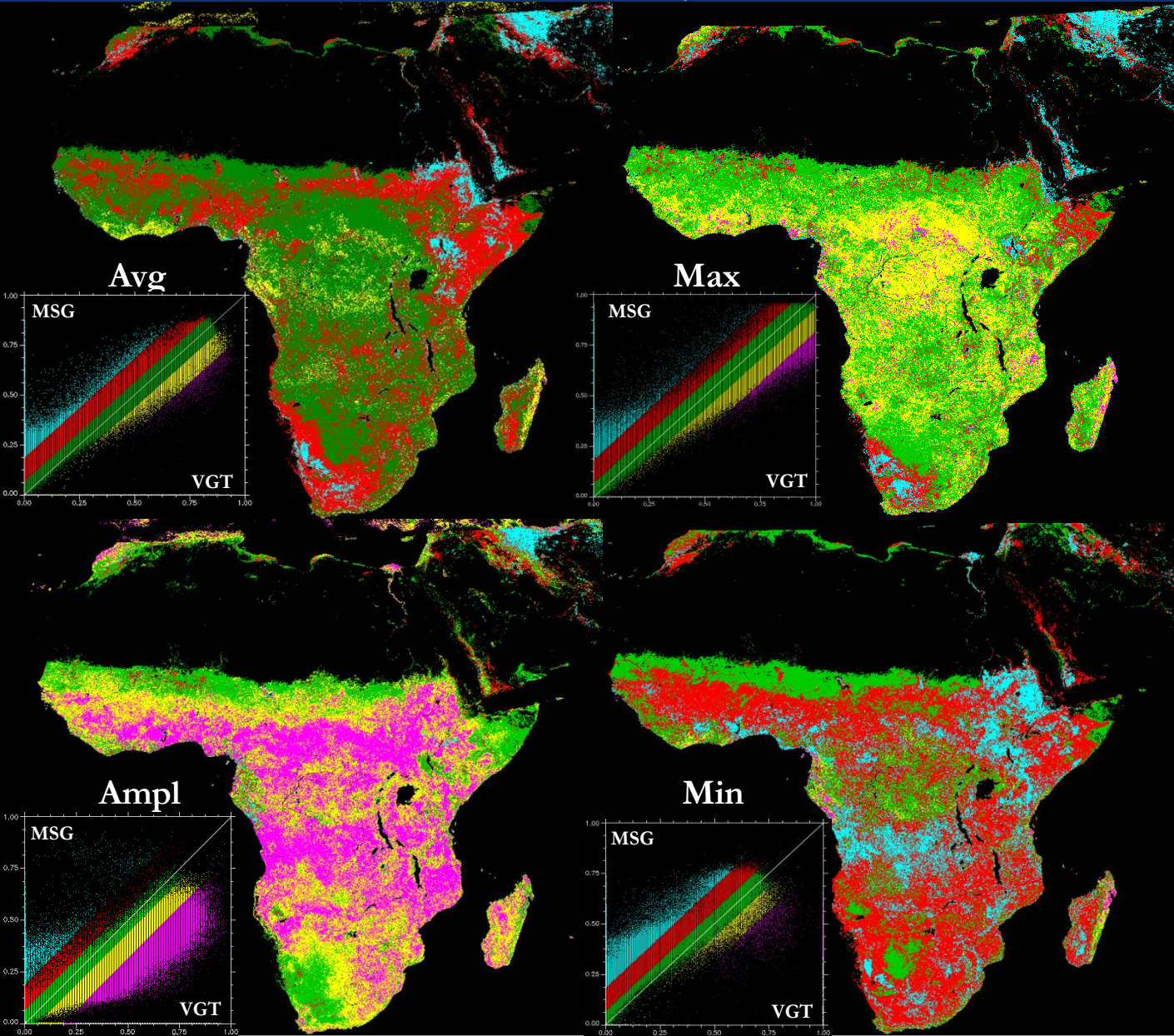
SPOT VEGETATION

Many missing values
Below 25% of observations available for regions of high cloud occurrence

MSG FVC_{Avg} vs VGT Fcover_{Avg} (all Africa, 2008 and 2009)



- Important discrepancies in term of magnitude
- Systematic overestimation of the MSG FVC vs VGT for low values (i.e. steppe, savanna, cropland, shrubland)



Cyan +20 to +100%
 Red +5 to 20%
 Green + / - 5%
 Yellow -5 to -20%
 Magenta -20 to -100%

- MSG_{Avg} is higher except for some areas in the dense humid forest (because there is no value up to 95% for MSG)
- MSG_{max} is higher for steppe, and lower for one part of the dense humid forest
- MSG_{Ampl} is lower except for steppe and savanna
- MSG_{Min} is higher except for steppe, savanna and one part of the dense humid forest

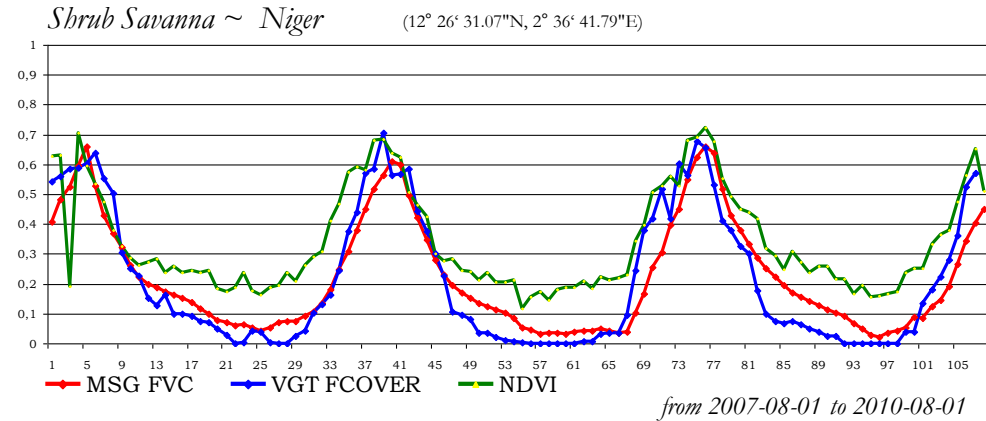
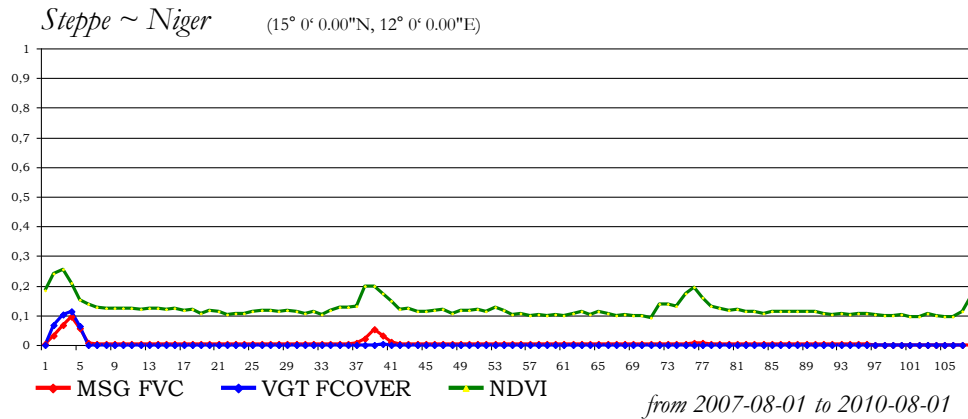
Important discrepancies in term of magnitude for all landcover types!

Localization of the 29 sites used for the analysis (From the desert to the dense humid forest)

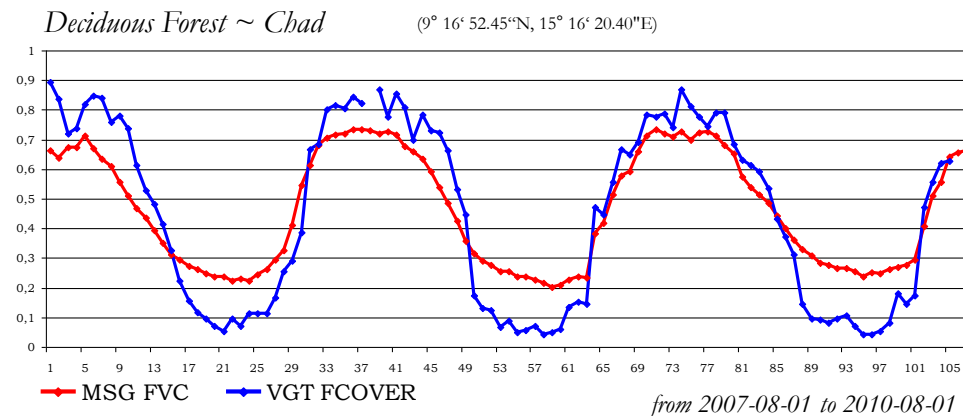
LandCover	Country	Latitude	Longitude
Sand Desert	Algerie	33°23'2.14"N	7°38'34.29"E
Sand Desert (Erg Ubari)	Lybia	24°24'6.43"N	13°29'60.00"E
Steppe	Niger	15° 0'0.00"N	2° 0'0.00"E
Steppe	Niger	15°0'0.00"N	12°0'0.00"E
Savanna	Mali	14°30'0.00"N	5°45' 0.00"W
Jachère herbacée	Nigeria	13°14'27.86"N	2°16'36.43"E
Shrub savanna	Niger	12°26'31.07"N	2°36'41.79"E
Tree Savanna	Bostwana	20° 1'45.57"S	21°29'40.89"E
Tree Savanna	Tanzania	2°41'15.00"S	36°32'40.71"E
Okavango	Botswana	18°53'3.61"S	22°27'9.05"E
Niger Delta	Mali	15° 1'4.21"N	4°37'29.95"W
Agro forestry	Benin	9°40'8.78"N	1°33'44.91"E
Oil Palm Plantation	DRC	2°18'26.99"N	20°33'55.59"E
Deciduous Forest	Chad	9°16'52.45"N	15°16'20.40"E
Swamp Forest	DRC	2° 6'41.79"N	20°58'7.50"E
Dense humid forest	DRC	0° 3'3.63"S	21° 6'30.73"E
Dense humid forest	Gabon	1° 59' 43.93"N	13°24'22.50"E
Cropland	Mali	13°55'42.80"N	3°25'10.67"W
Cropland	Ivory Coast	8°10'42.86"N	3°54'6.43"W
Cropland	Nigeria	12°14'27.85"N	14° 0' 0.00"E
Cropland	Nigeria	13°39'6.40"N	7°44'27.87"E
Cropland	Soudan	12°28'55.71"N	24°18'45.00"E
Cropland	Ethiopia	12°45'42.21"N	37°46'0.62"E
Cropland	Egypt	29°22'30.00"N	30°42'19.29"E
Cropland	Niger	15° 3'12.85"N	7°49'17.13"E
Cropland	Tanzania	3°44'31.02"S	34° 5'35.15"E
Cropland	Nigeria	12°38'55.12"N	12°45'53.81"E
Cropland (Irrigation)	Soudan	14°40'42.84"N	32°59'27.85"E
Cropland (Irrigation)	Swaziland	26° 9'54.64"S	31°55'58.93"E



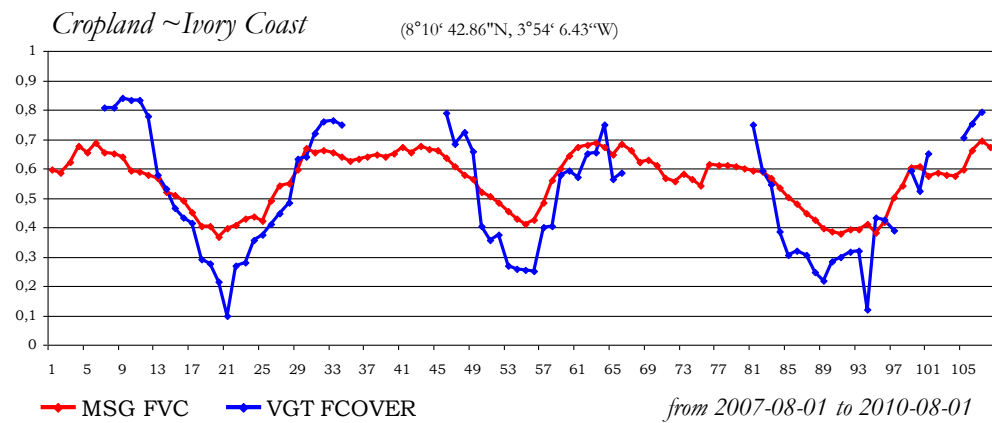
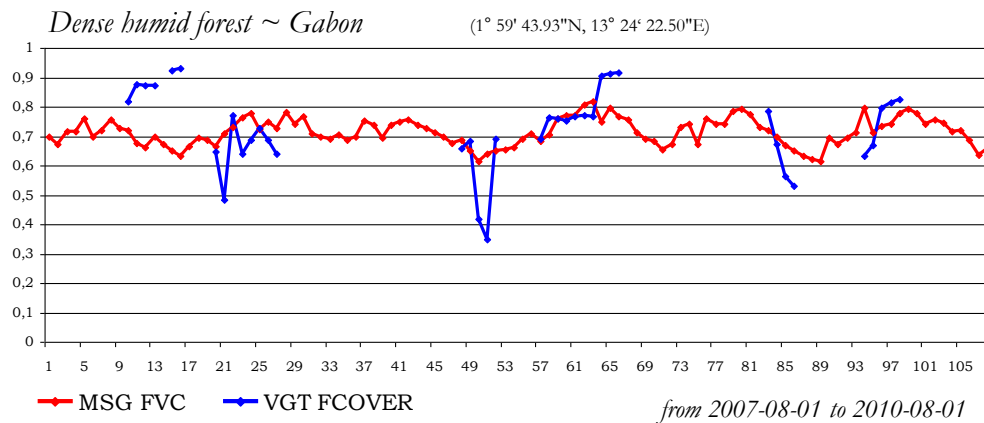
- **MSG FVC follows well the seasonality of the vegetation activity for all biomes**



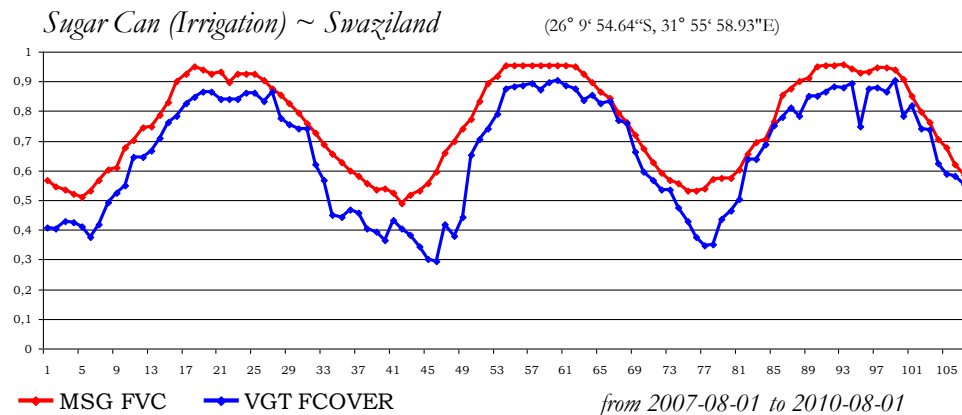
- **Both products present similar seasonal and inter-annual variations but show important discrepancies in term of magnitude**



- **MSG FVC** presents a high spatial and temporal continuity over all Africa. At the opposite **VGT FCOVER** shows periods without observations over regions of high cloud occurrence

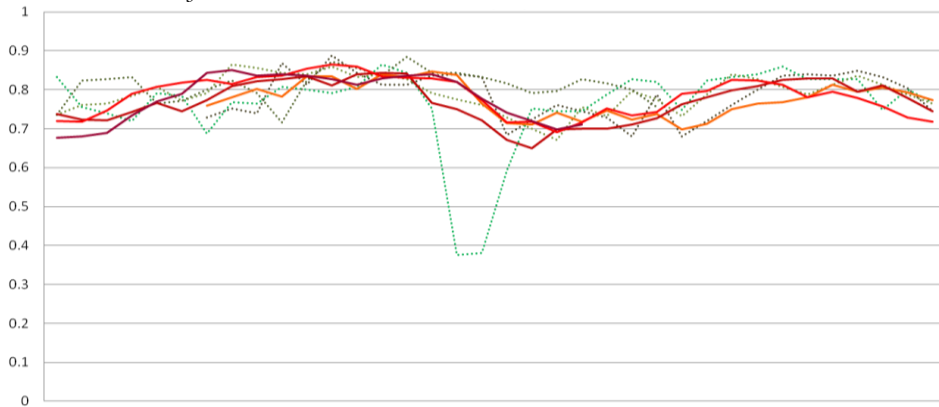


- **MSG FVC** presents a higher temporal stability (smooth profiles) than **VGT FCOVER**, regardless the land cover type and the area

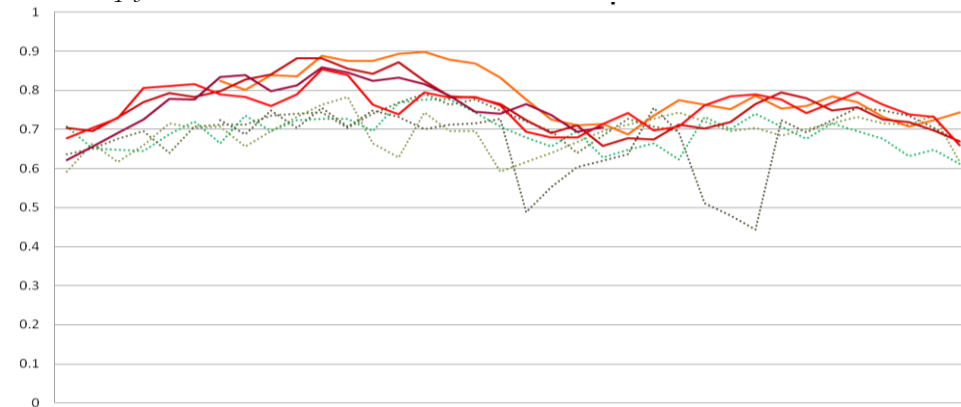


- The high temporal stability of MSG FVC over the most cloudy areas allows a consistent characterization and a fine monitoring of the phenology of the dense humid forests, what is much more challenging with orbital sensors
- The study of the inter-annual variations vs climatic and hydrologic observations should allow a better understanding of the dynamic of such areas

Dense humid forest ~ DRC (0° 3' 3.63" S, 21° 6' 30.73" E)



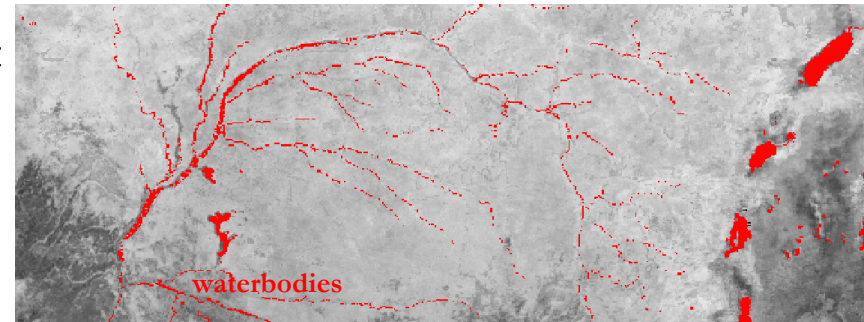
Swamp forest ~ DRC (2° 6' 41.78" N, 20° 58' 7.50" E)



- An accuracy assessment should be realized based on ground observations
- Longer time series are required to compute vegetation condition anomalies
 - Back processing from the first image acquisition is needed

- Provide a flag for waterbodies instead of masking it

└─→ Currently of poor quality !



- Provide a more user-friendly product by using:

- the plate carrée projection instead of the geostationary satellite view of the earth
- a format compatible with all image processing softwares (e.g. geotiff with LZW compression)
- a full extent for the north African window



- Provide 10D syntheses for the operational monitoring activities, but continue to provide the 1D synthesis for research teams

The FVC (MSG) :

- follows well the seasonality of the vegetation activity for all African biomes and allows a reliable identification of the main phenological metrics
- offers a high spatio-temporal stability, without gap even over the most cloudy areas
- shows large discrepancies with the FCOVER in term of magnitude, mainly for low values
- offers a lower spatial resolution compared to orbital sensors (VGT, MERIS, MODIS...).

FVC is a valuable alternative over the most cloudy areas where the quality of the information coming from orbital sensors is poor at such frequency

The spatio-temporal continuity and consistency of the MSG FVC product and its ability to follow accurately the vegetation activity for all biomes with a daily frequency could be exploited to:

- **Provide information on environmental conditions at different administrative scales. For this purpose, the lower spatial resolution of MSG is not a limiting factor, and the quality of the observations should allow to provide consistent information over all African administrative regions.**
- **Provide data for the monitoring of the vegetation conditions with a high frequency over the most cloudy areas where the orbital sensors can provide only erratic and unreliable measurements at such frequency.**