Global Watch

Research Project

towards an operational processing

of optical time series

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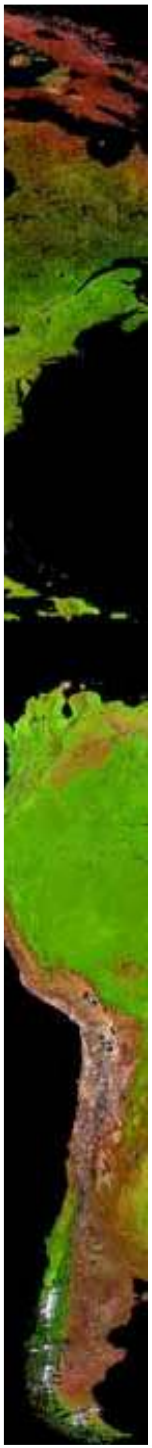
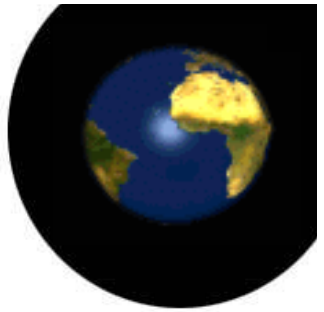
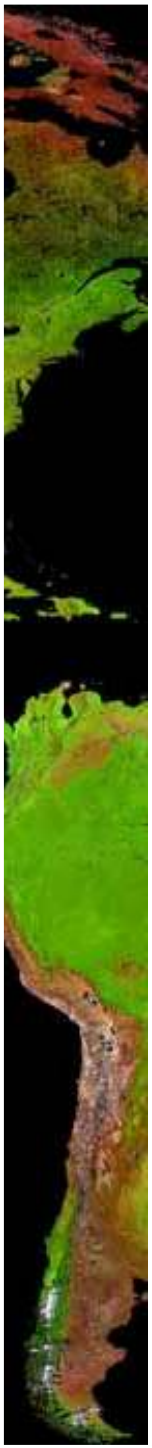


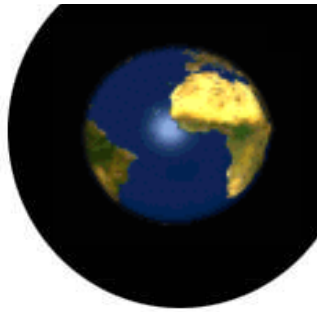
Contents



- Objectives
- Background
- Dataset
- Generalization of the mean compositing strategy
  - at the global scale
  - for other sensors
- Change detection in the remotely sensed signal for the monitoring of
  - the habitat of the desert locust
  - wetlands and flooding
  - tropical forest
- Conclusions

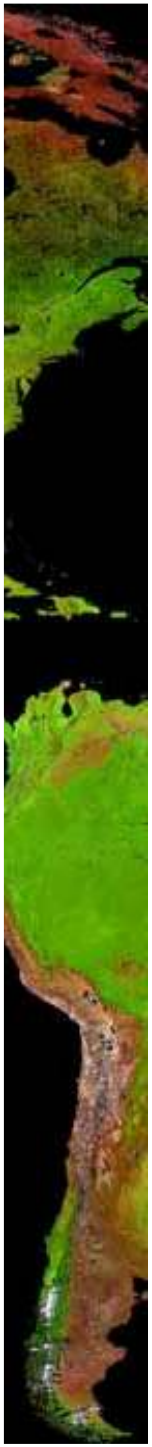


Objectives

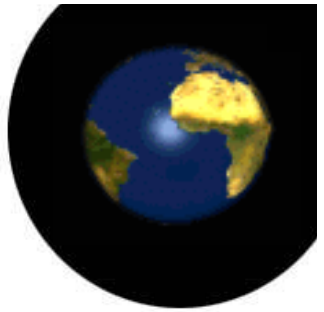


• Generalization and validation of the new compositing strategy, at the global scale and for other sensors of medium and high spatial temporal resolution.

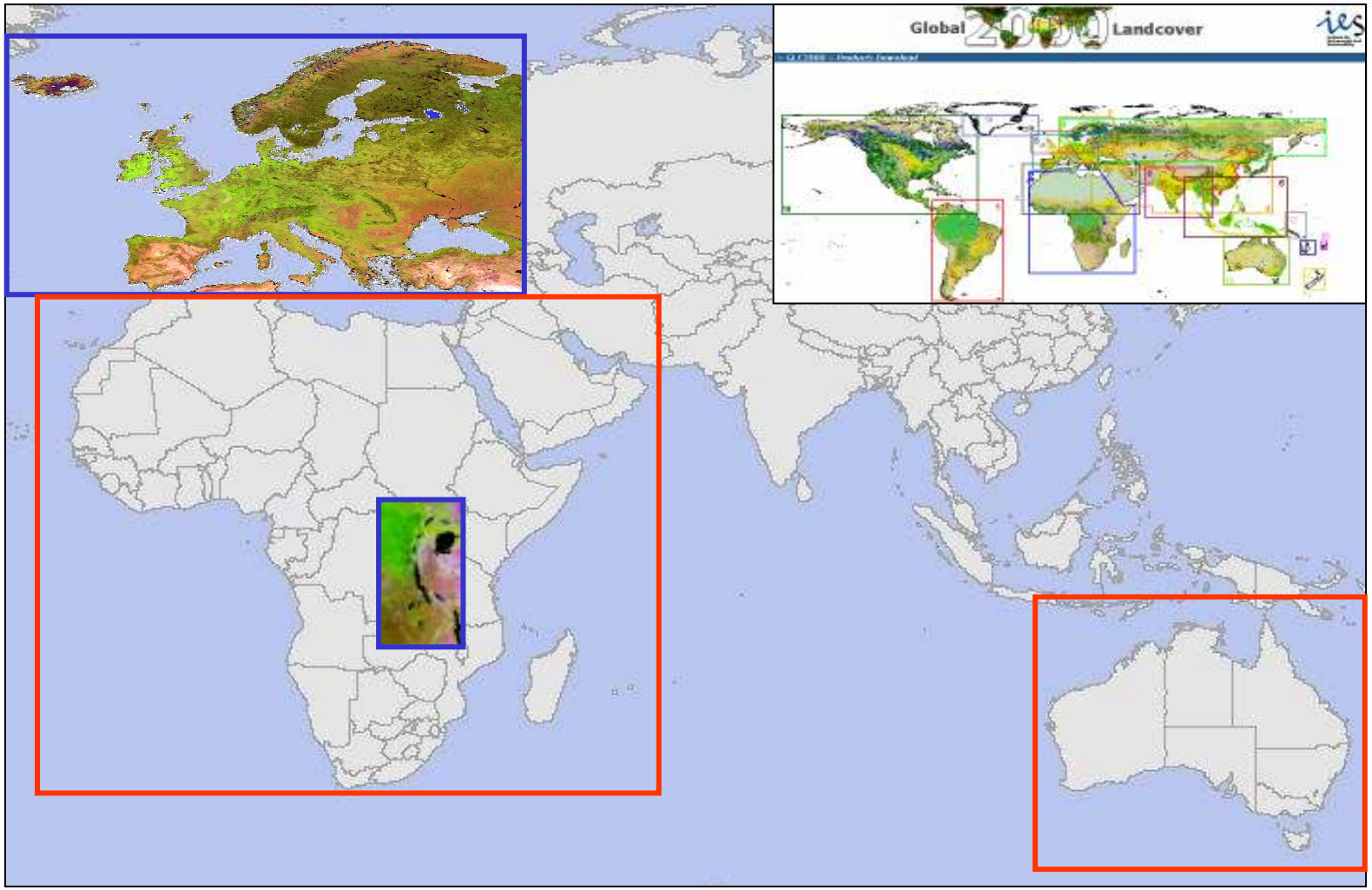
• Extension and development of the automatic algorithm of change detection in optical time series with high temporal resolution.

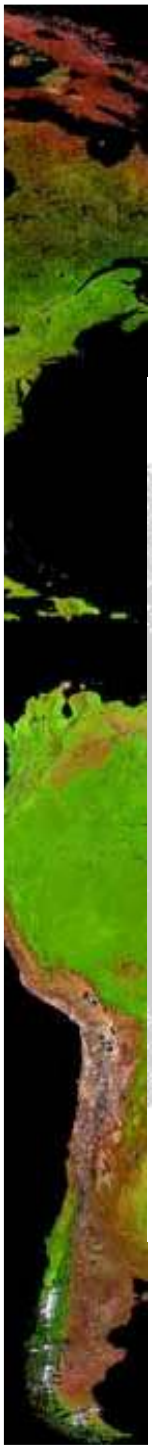


Background



Global Land Cover 2000 program





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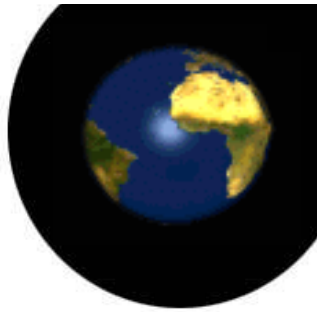
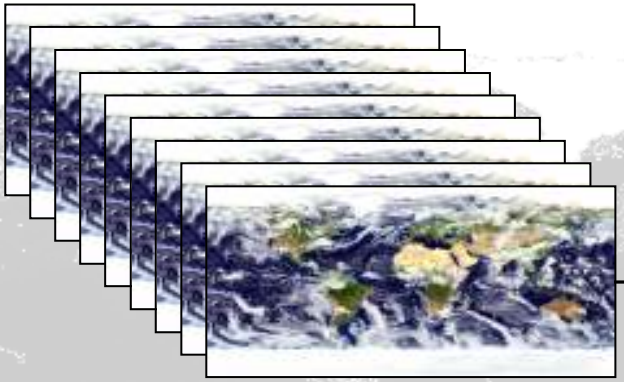


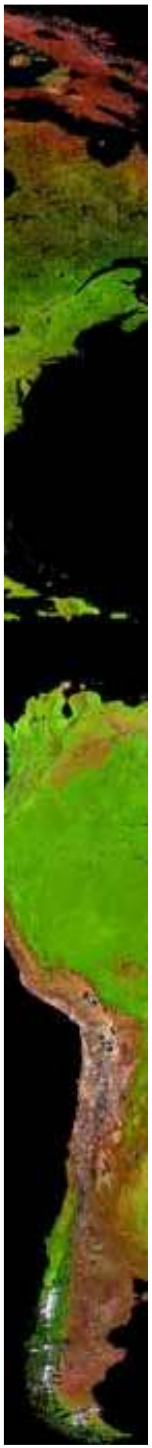
Compositing



Temporal series of daily data

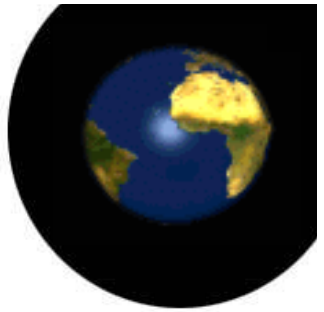
Compositing

Composite

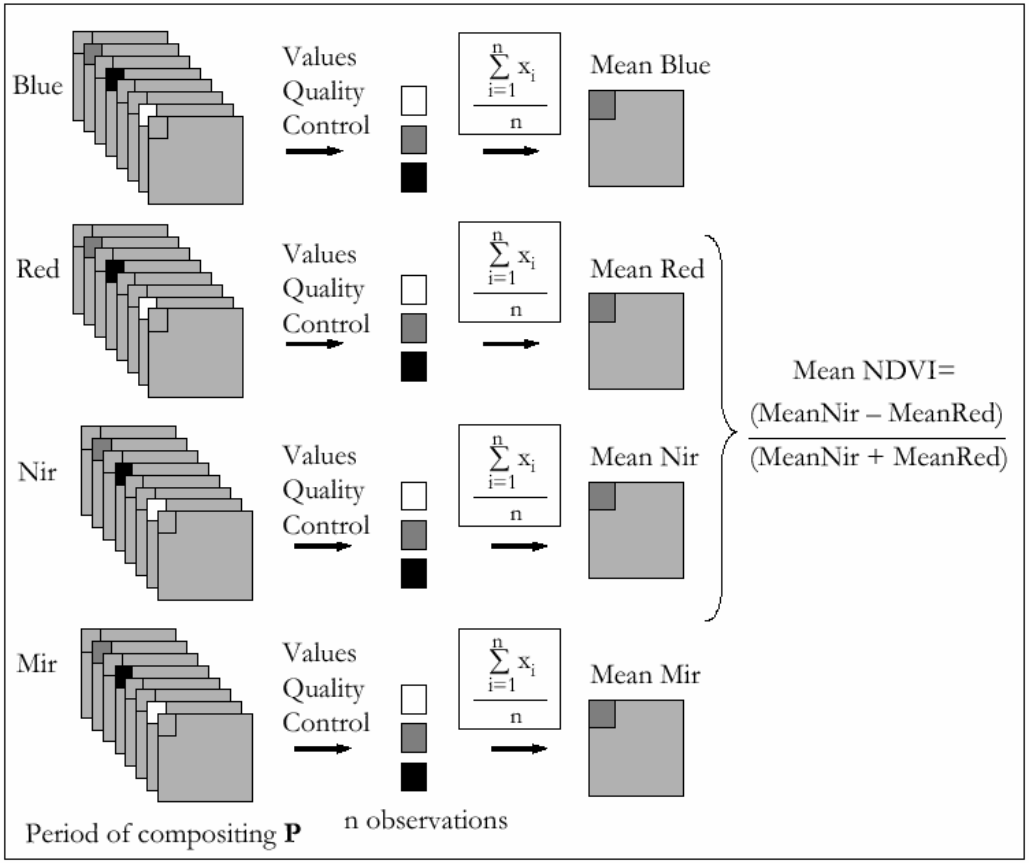


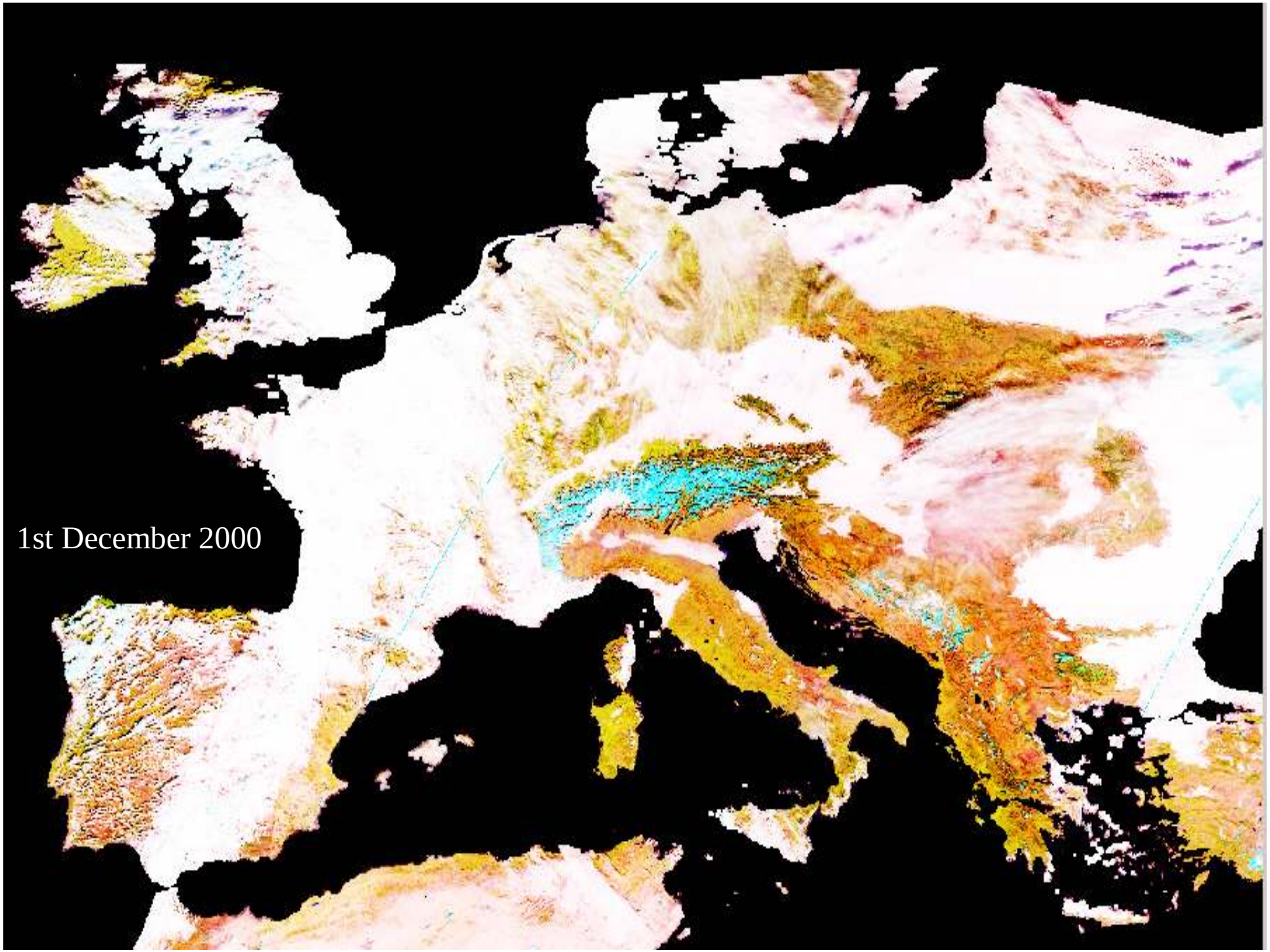
Background

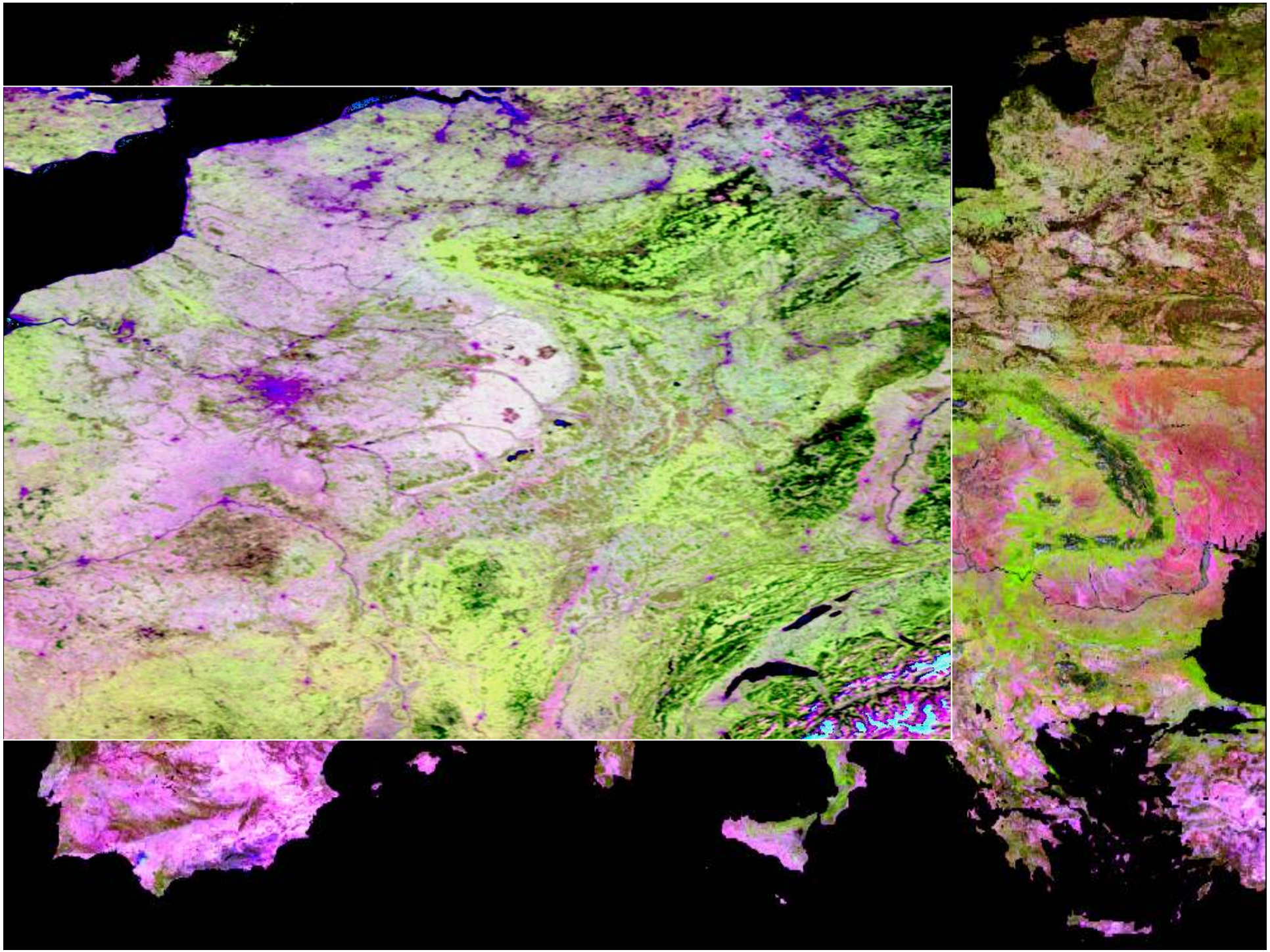
Mean Compositing

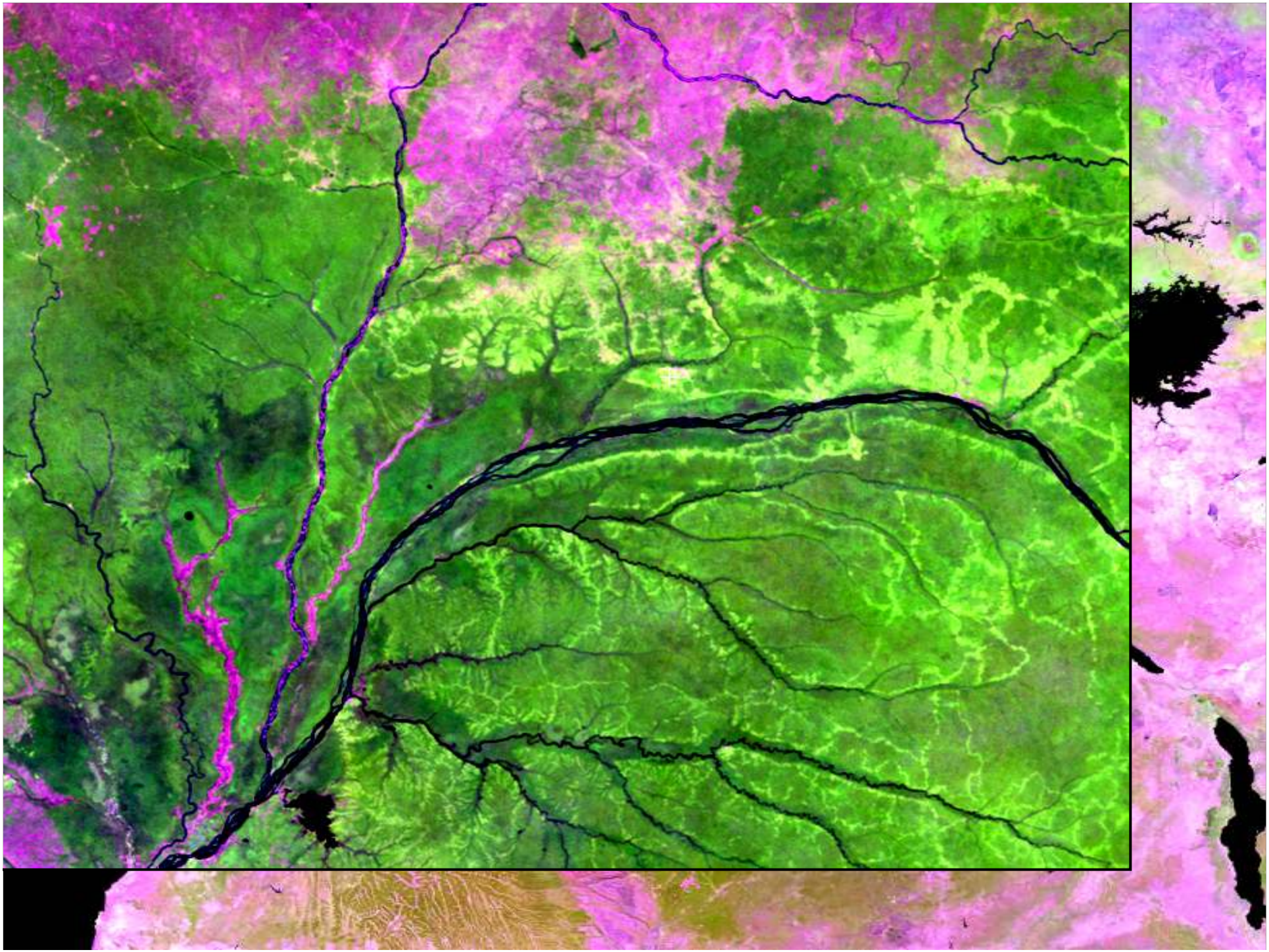


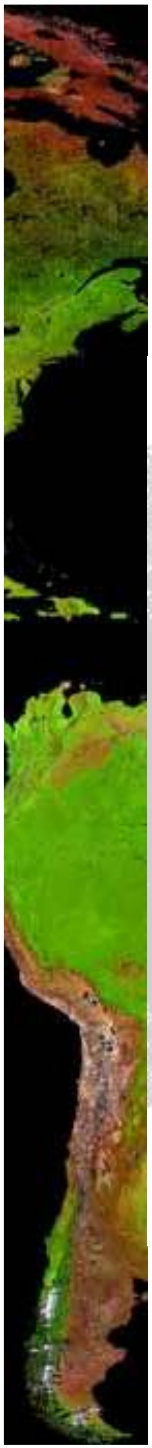
Averaging of all the quality controlled reflectance values in all spectral bands




1st December 2000

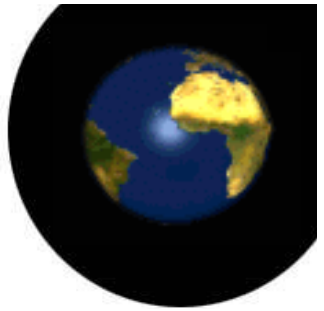






Dataset

SPOT VEGETATION daily data

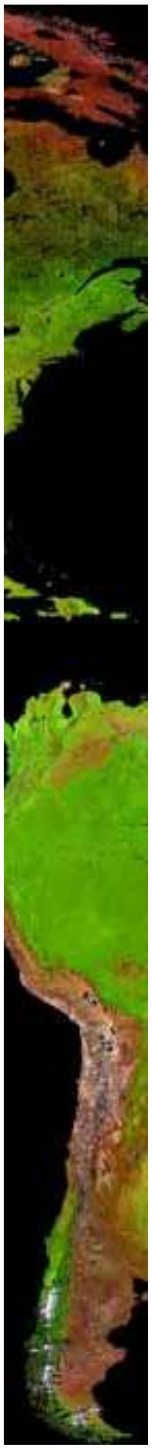


- Global time series for years 2000 and… 2004, 2005
- Continental time series (Africa, Europe and South America) for years 2001, 2002, 2003

4 wavelengths: Blue, Red, NIR, SWIR

1 day = 6,6 Giga octets

1 Year = 2413 Giga octets



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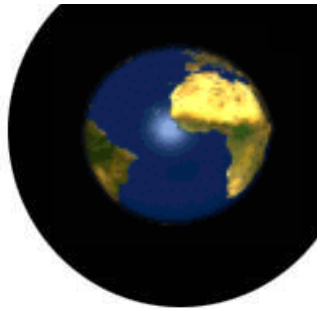


- Continental time series (Africa and Europe) for years 2003, 2004

MODIS (TERRA):

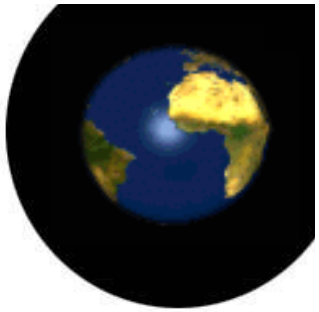
Spatial resolution:	1 km	Radiometric resolution :	8 Vis, 4 Nir, 6 MWIR, 15 WIR, 10 TIR
	500 m		2 Vis, Nir, 2 SWIR
	250 m		Vis, Nir

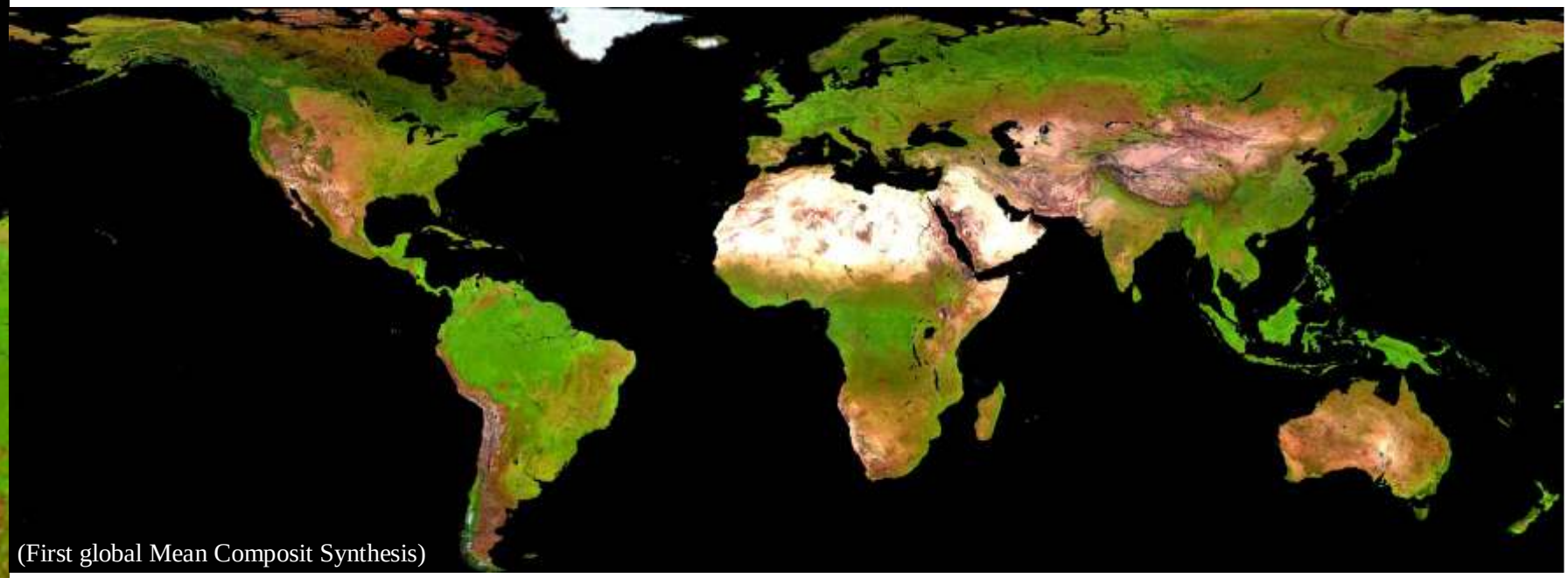
MERIS (ENVISAT):

Spatial resolution: 300 m Radiometric resolution : 12 Vis, 3Nir

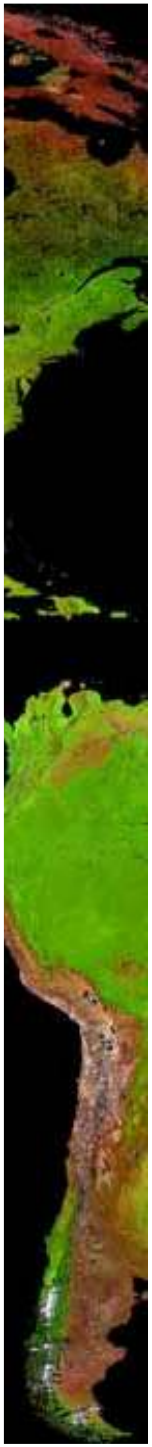
Operational computing

at the global scale



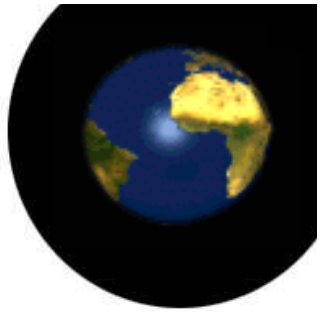


(First global Mean Composit Synthesis)



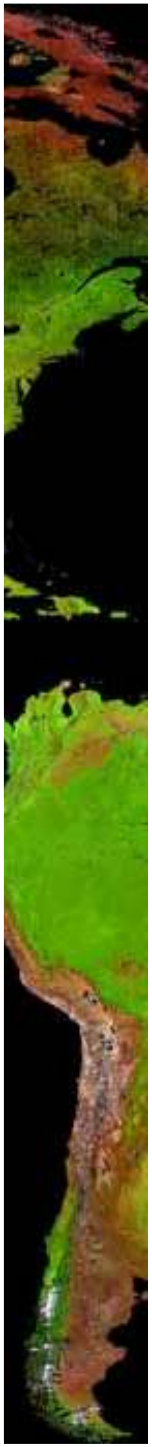
Generalization

To other sensors



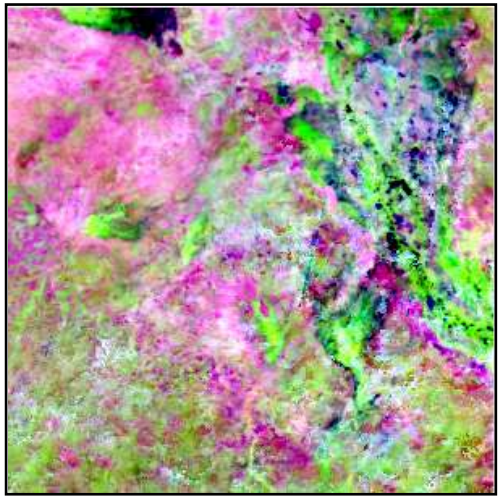
MERIS (ENVISAT)

MODIS (TERRA)

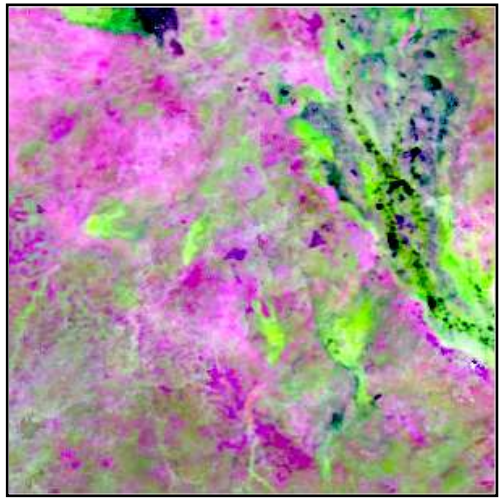


Validation methodology

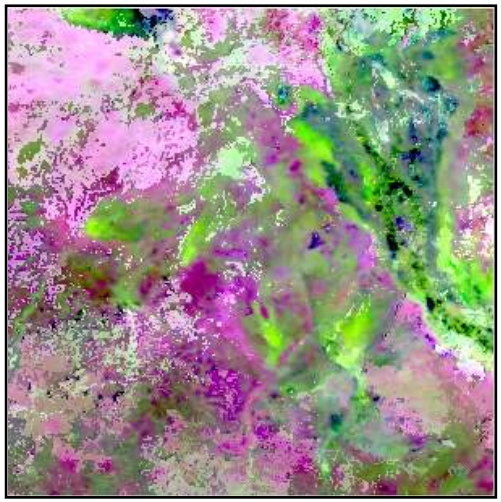
- Qualitative : visual comparison and ranking



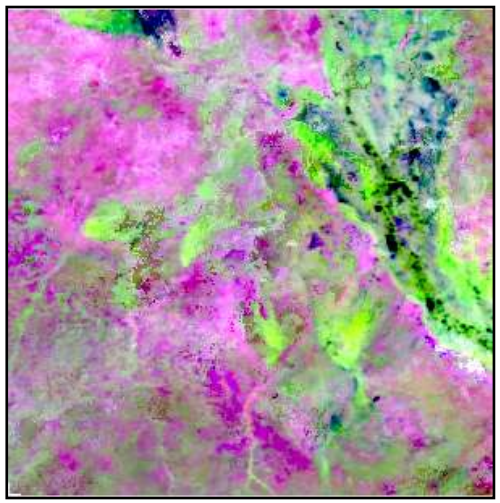
BDC



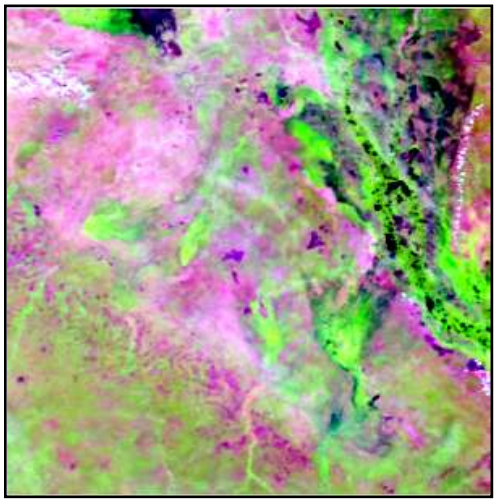
MC



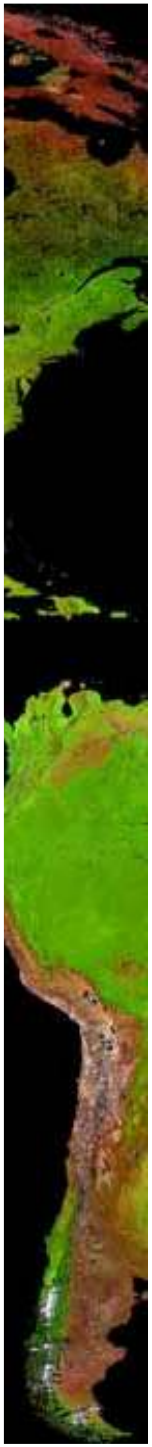
MVC



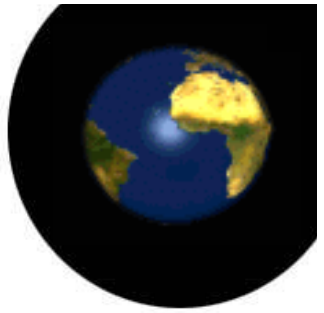
AVG



Best S1

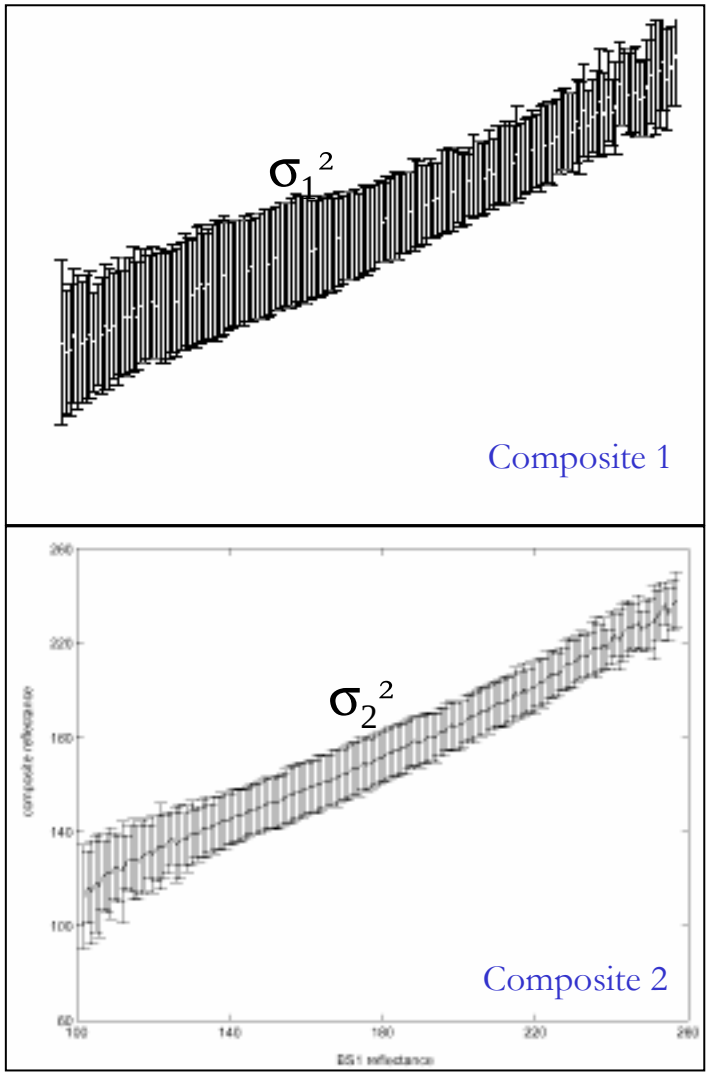


Validation



- Quantitative : Wilcoxon signed rank tests

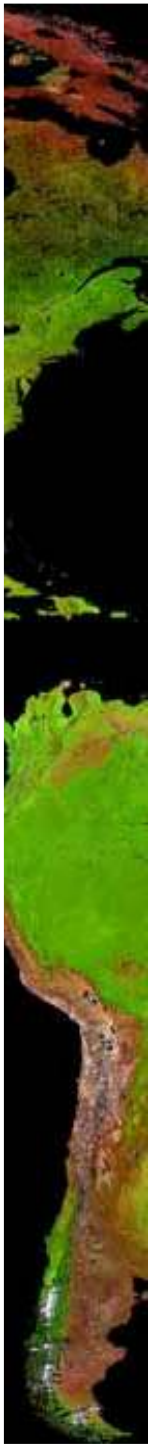
(p 0.01significance)



Reflectance

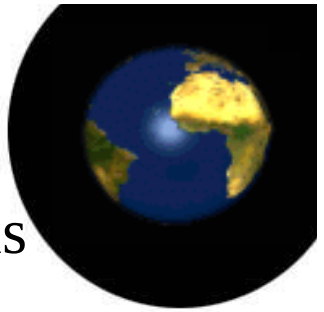
Texture

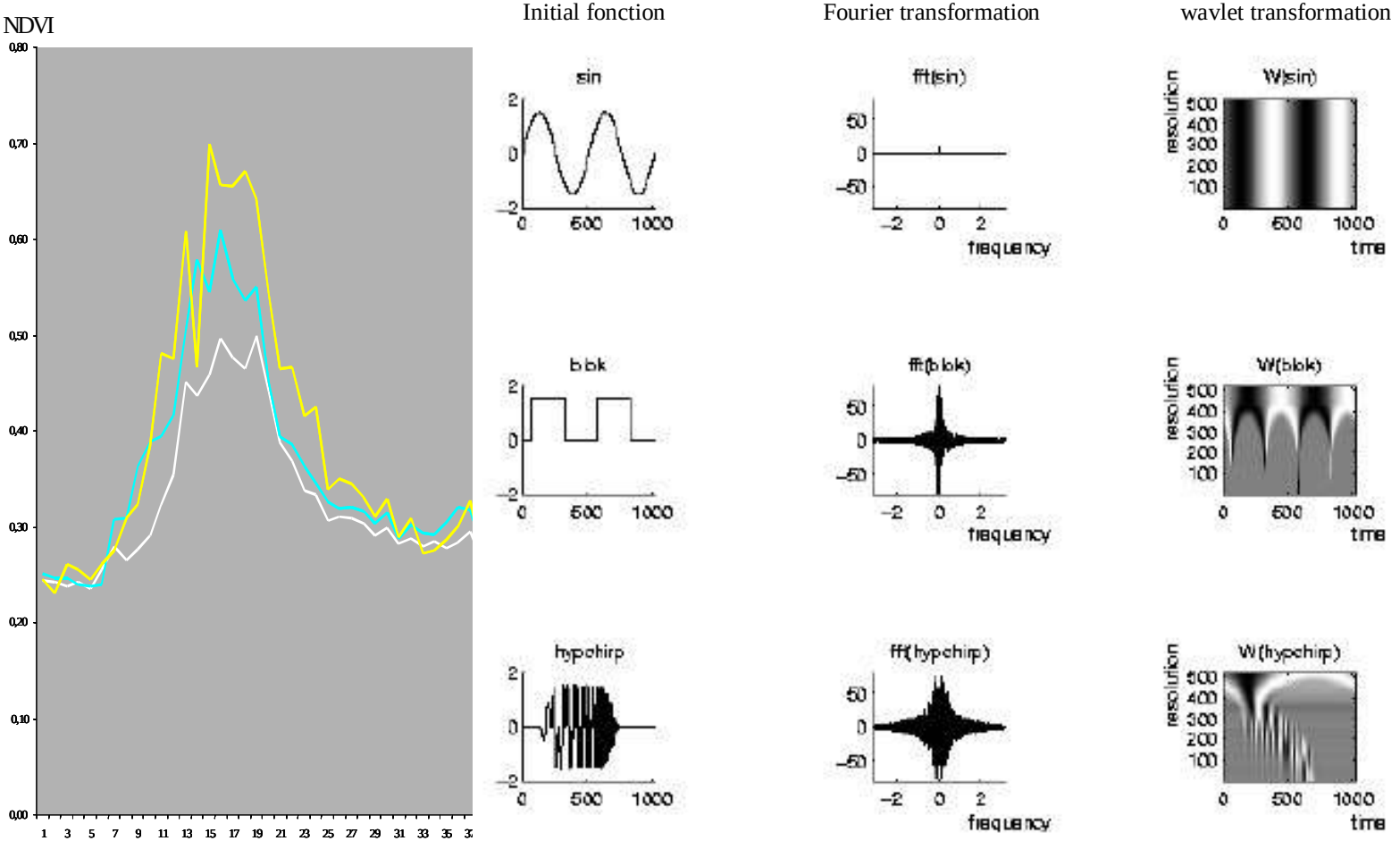
	Red				NIR				MIR			
Samples	MC	BDC	MVC	AVG	MC	BDC	MVC	AVG	MC	BDC	MVC	AVG
An-06	1	2	4	3	1	2	4	3	1	2	3	2
Bf-06	1	3	3	2	1	1	3	2	1	4	3	2
Bf-11	1	2	4	3	2	1	4	3	1	2	4	3
Bo-06	1	1	3	2	1	1	3	2	1	2	4	3
Bo-11	3	2	4	1	3	1	4	2	2	2	3	1
Dr-06	3	4	2	1	1	2	4	3	1	4	3	2
Eg-06	1	4	3	2	1	2	3	2	1	4	3	2
Eg-11	1	4	3	2	1	4	3	2	1	4	3	2
Sg-06	1	2	4	3	1	2	4	3	1	2	4	3
Sg-11	1	2	4	3	1	1	3	2	1	2	4	3
So-06	1	3	4	2	1	2	4	3	1	3	3	2
So-11	1	3	4	2	1	2	4	3	1	2	3	2
Tc-06	2	3	2	1	1	2	4	3	1	3	4	2
Tc-11	1	3	4	2	1	2	4	3	1	2	4	3
Ug-06	3	2	4	1	1	2	4	3	1	2	4	3
Zi-06	3	4	1	2	1	3	2	2	3	4	1	2
AFR	**25**	**44**	**53**	**32**	**19**	**30**	**57**	**41**	**19**	**44**	**53**	**37**
Be-06	3	4	1	2	3	1	4	2	2	4	3	1
Fr-06	3	4	2	1	2	1	4	3	2	3	4	1
Gr-06	2	4	3	1	1	2	4	3	1	3	4	2
Ro-06	2	4	3	1	1	2	4	3	1	2	3	2
Sw-06	2	3	2	1	1	1	2	1	2	4	3	1
Tk-06	1	2	4	3	1	2	4	3	1	2	4	3
Uk-06	2	4	3	1	1	2	4	3	1	3	4	2
EU	**15**	**25**	**18**	**10**	**10**	**11**	**26**	**18**	**10**	**21**	**25**	**12**
Tot	**40**	**69**	**71**	**42**	**29**	**41**	**83**	**59**	**29**	**65**	**78**	**49**

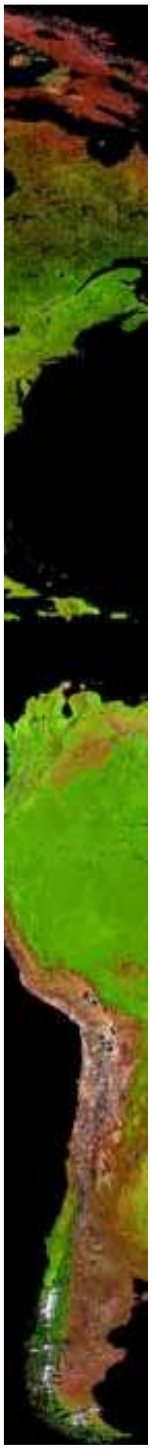


Change detection

Comparison of temporal profiles by wavelet analysis







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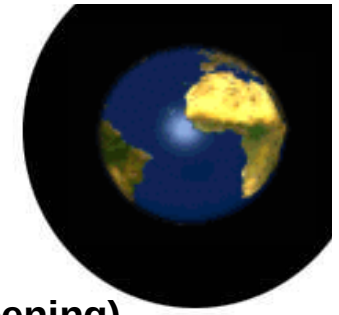
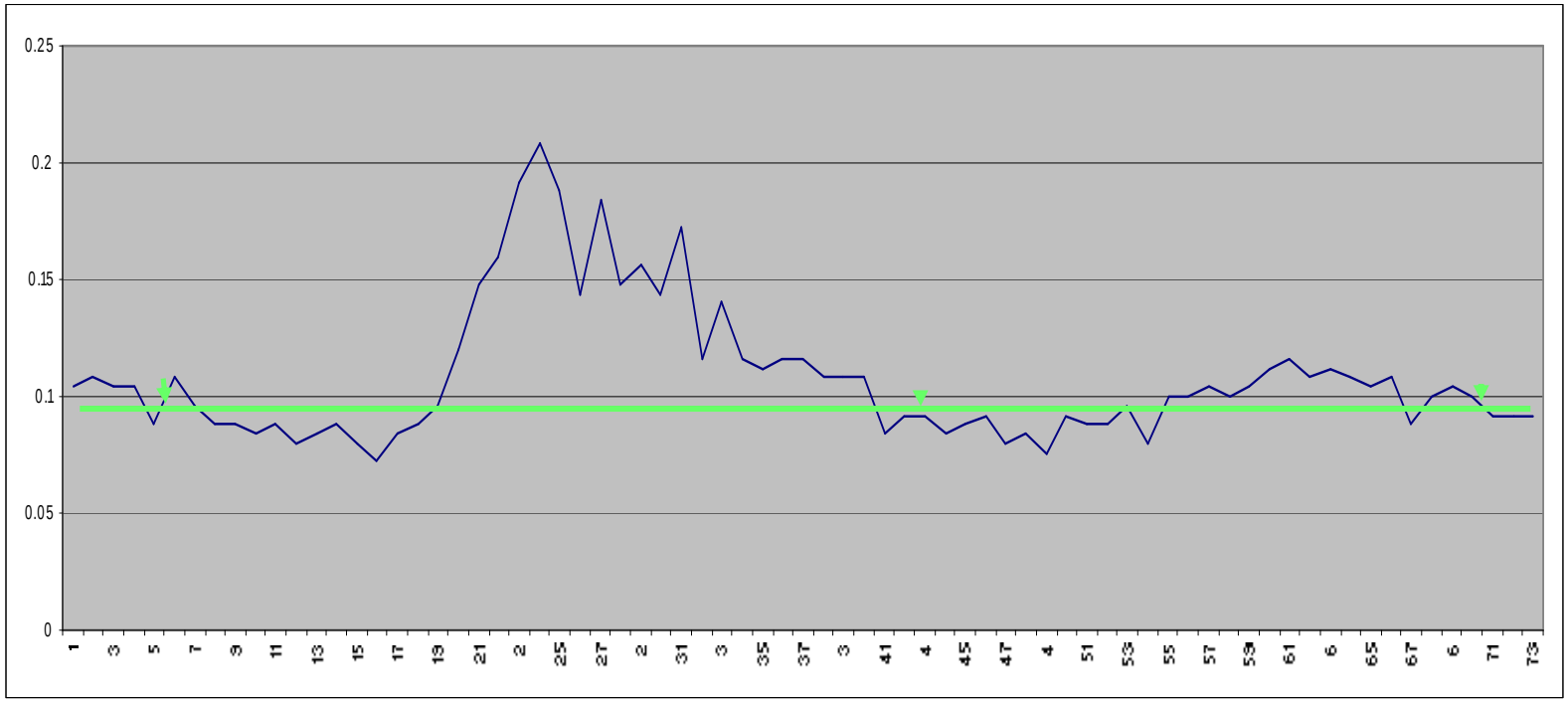


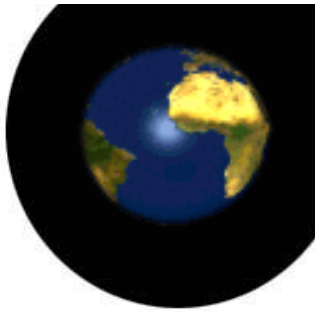
Principle of automatic detection of events

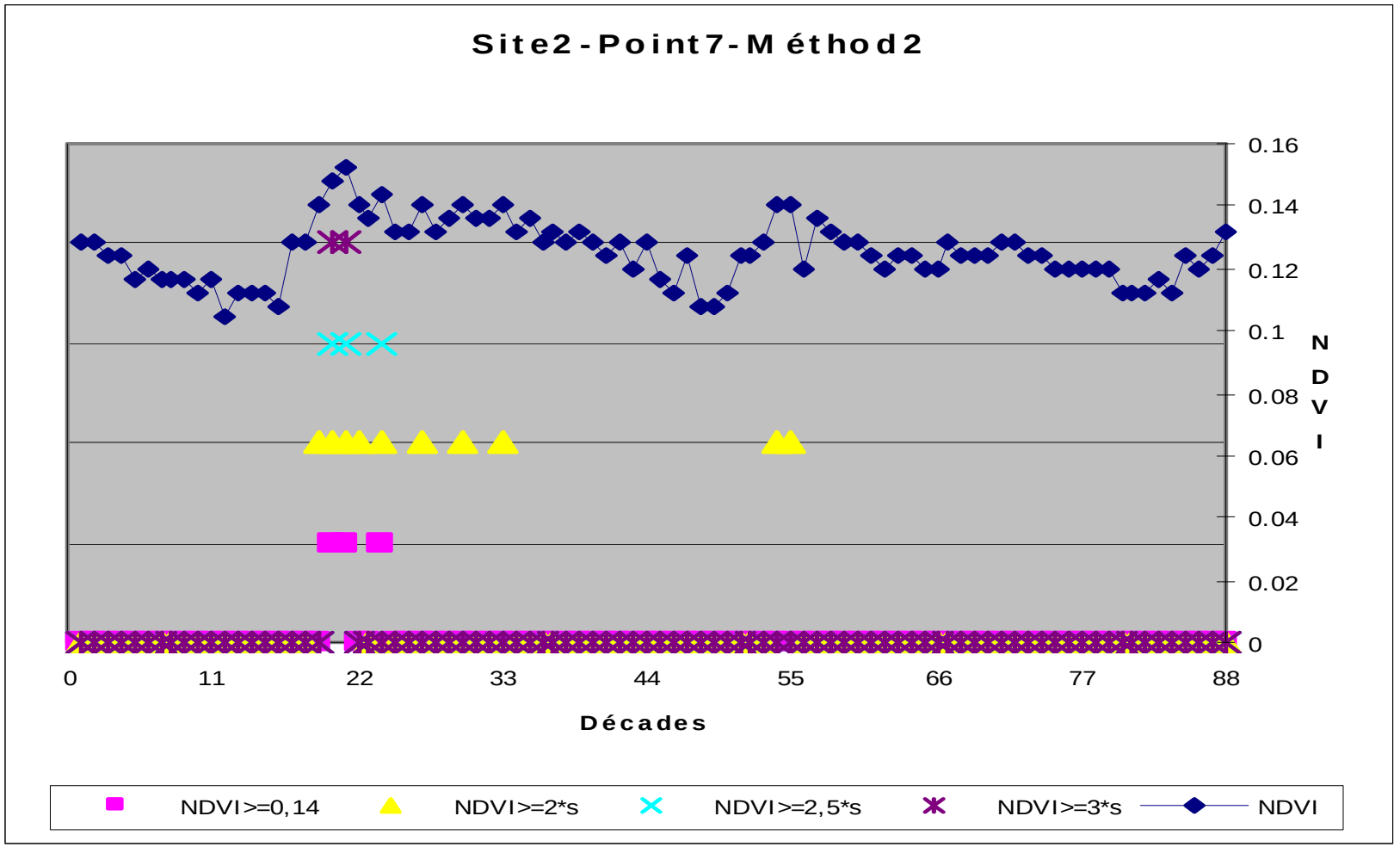
- **cleaning of the time series (aerosol, BDRF effects, cloud screening)**
- **identification of the noise level over the year for each pixel**
- **detection of the values not related to the noise background**
- **temporal and spatial filtering**

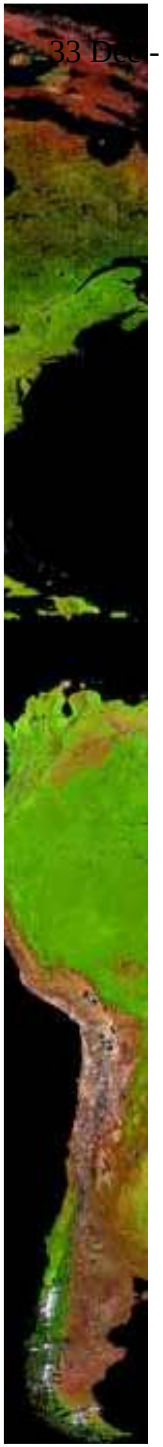


Change detection

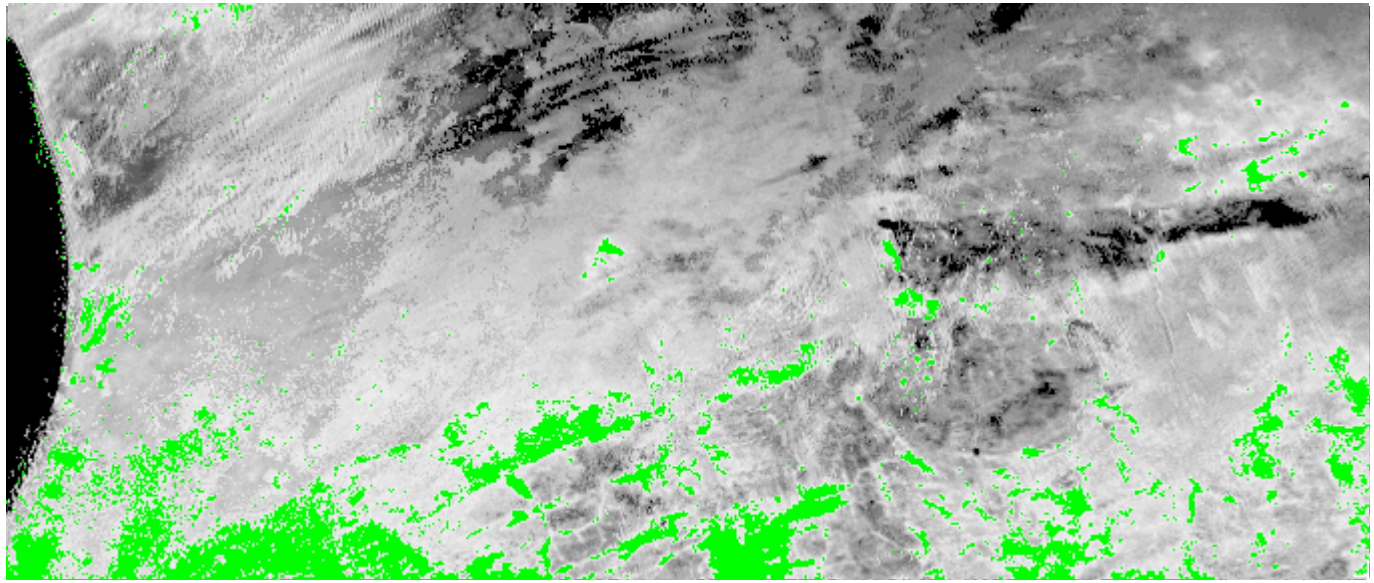
Different levels of sensibility (n STD) of the detection method

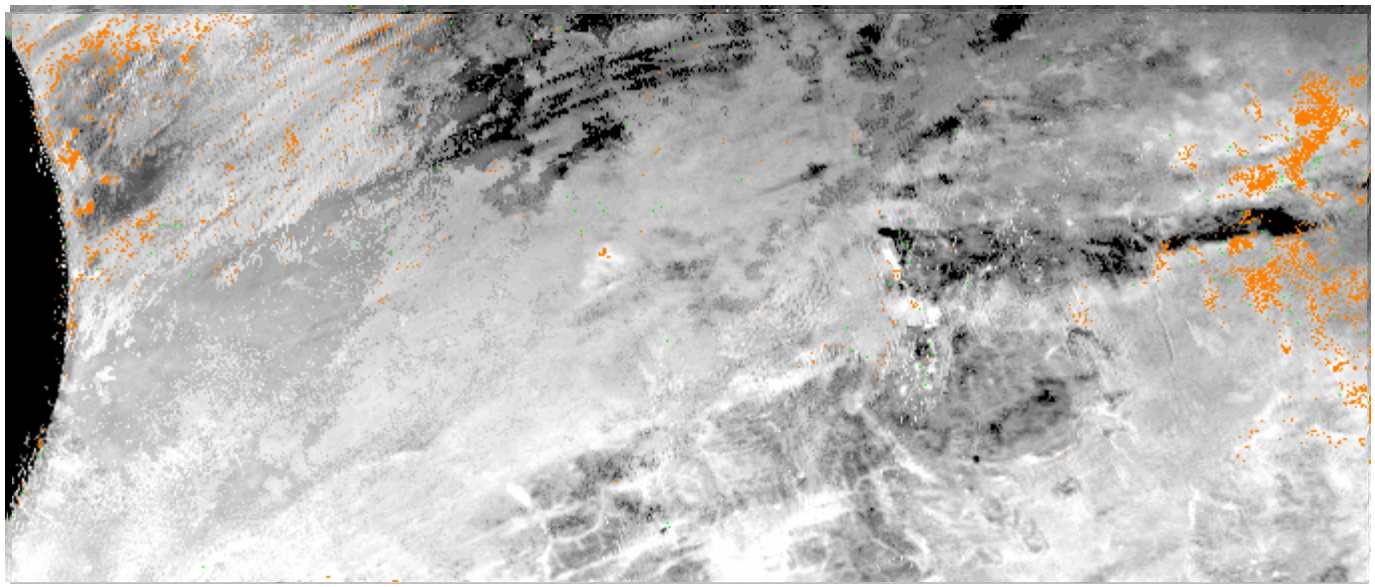






33 Dec - 99 34 Dec - 99 35 Dec - 99 36 Dec - 99 01 Dec - 00 02 Dec - 00 03 Dec - 00 04 Dec - 00 05 Dec - 00 06 Dec - 00

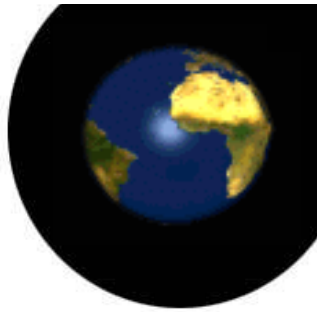




Change detection

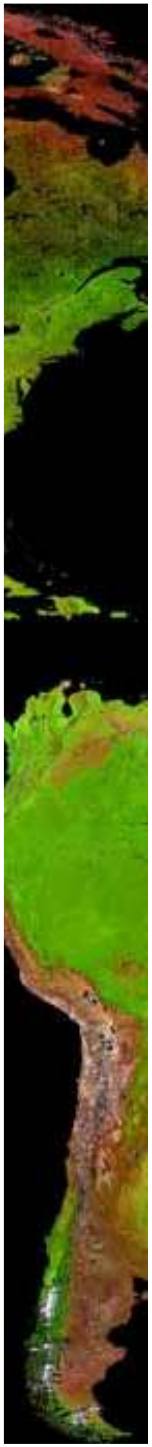
Early Warning

Monitoring of the habitat of the desert locust



Schistocerca gregaria
(Forskal, 1775)

Early Reaction



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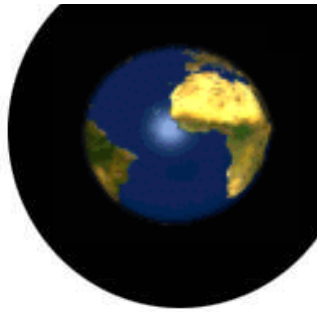
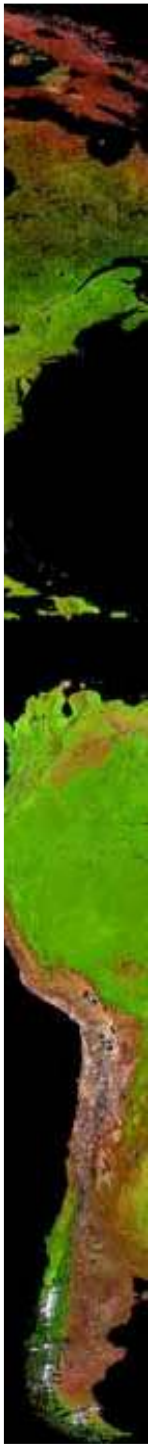
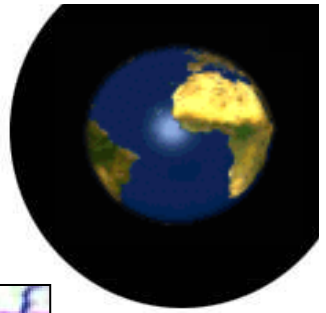
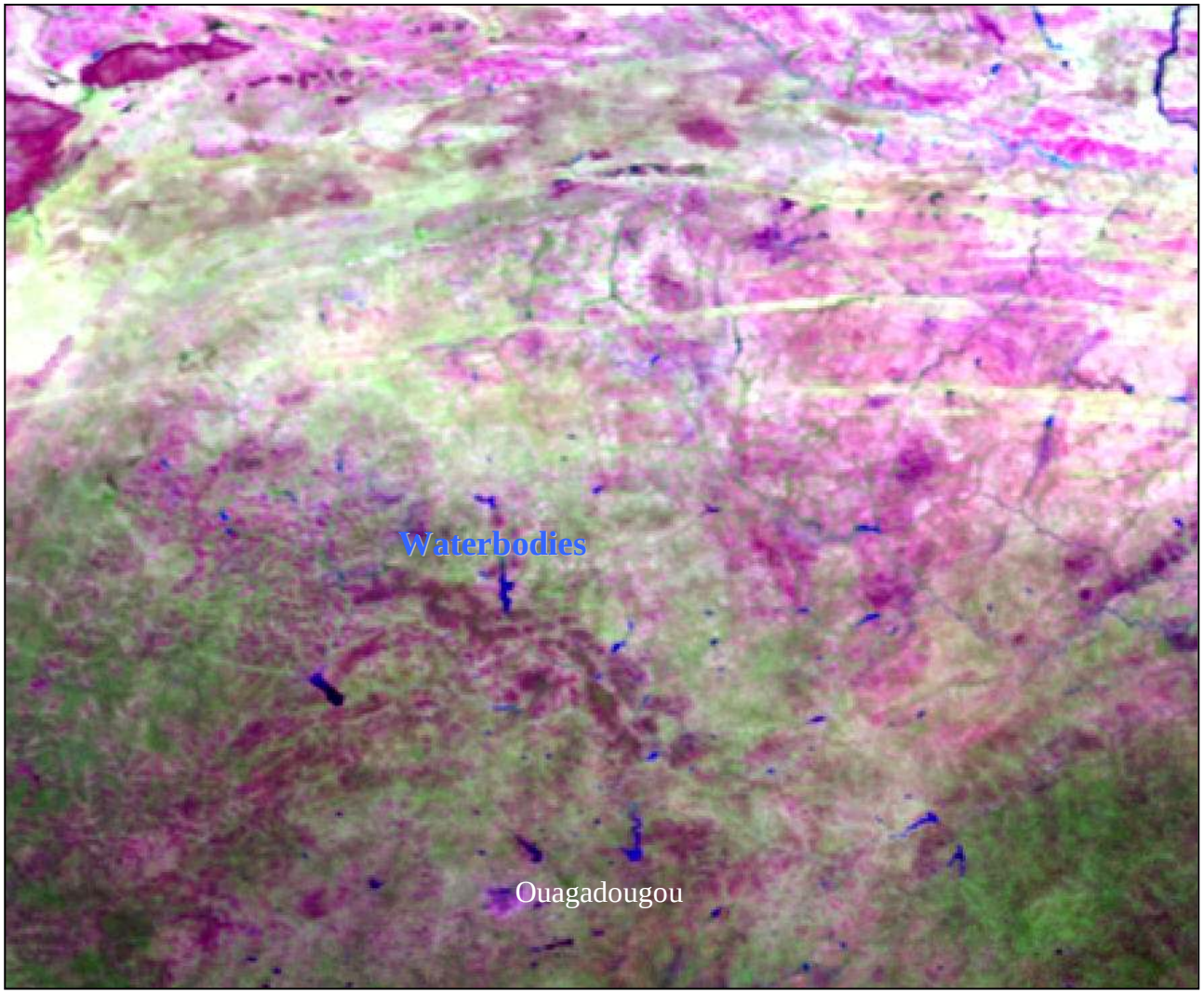


- In close collaboration with the FAO Field campaign



Waterbodies and wetlands detection

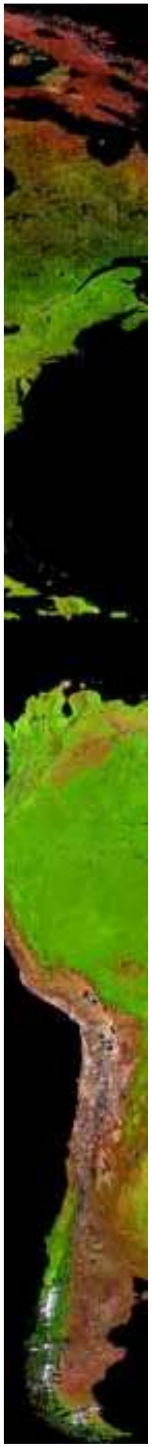




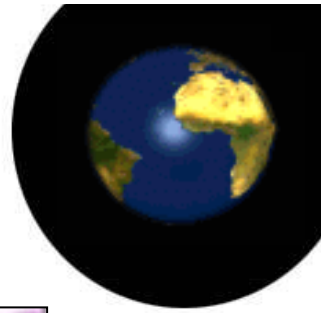
SPOT VGT

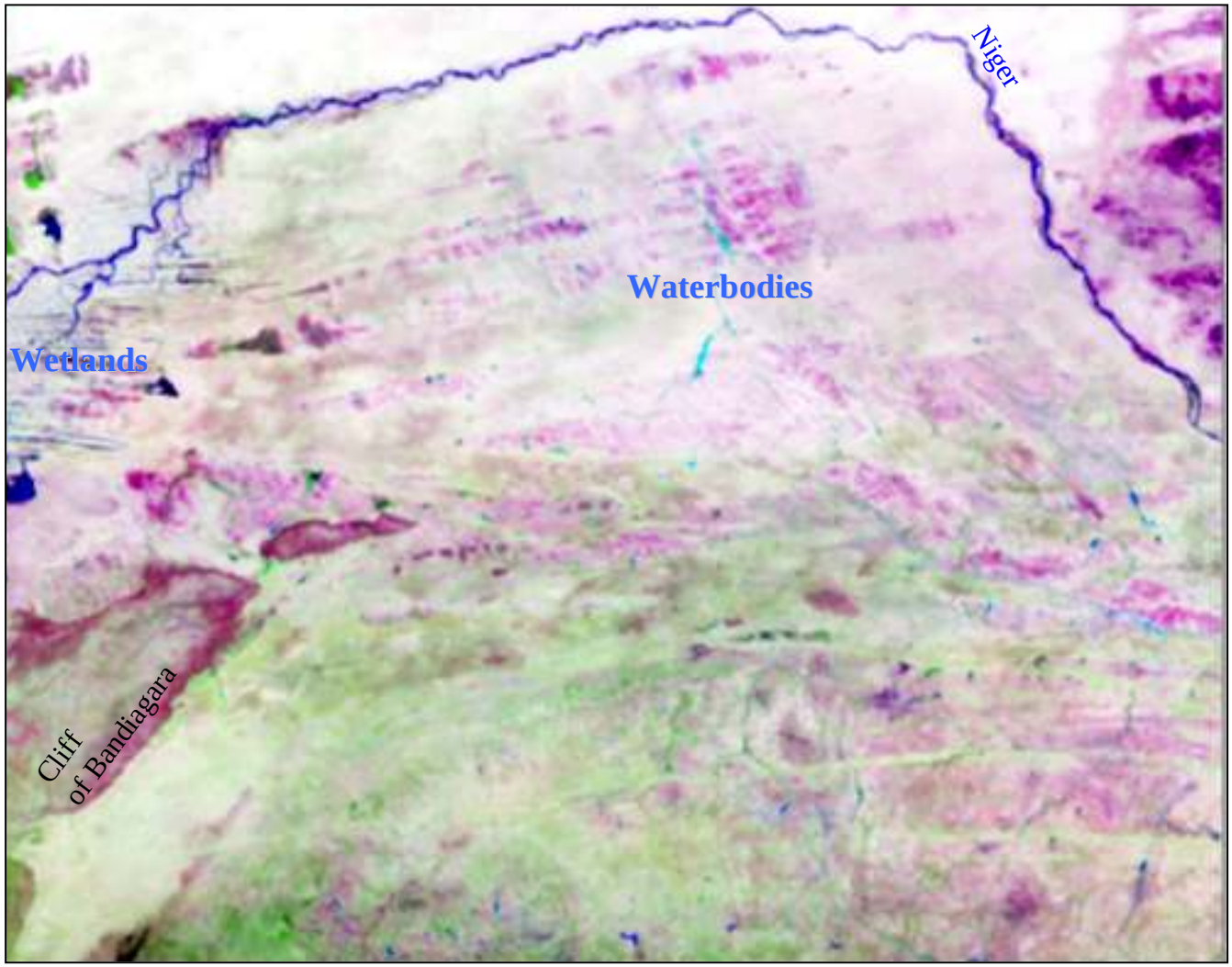
seasonal composite

2000



Waterbodies and wetlands detection

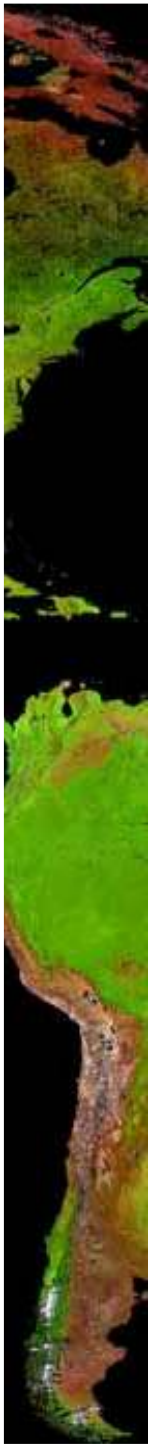




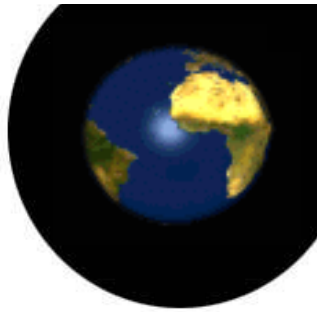
SPOT VGT

seasonal composite

2000

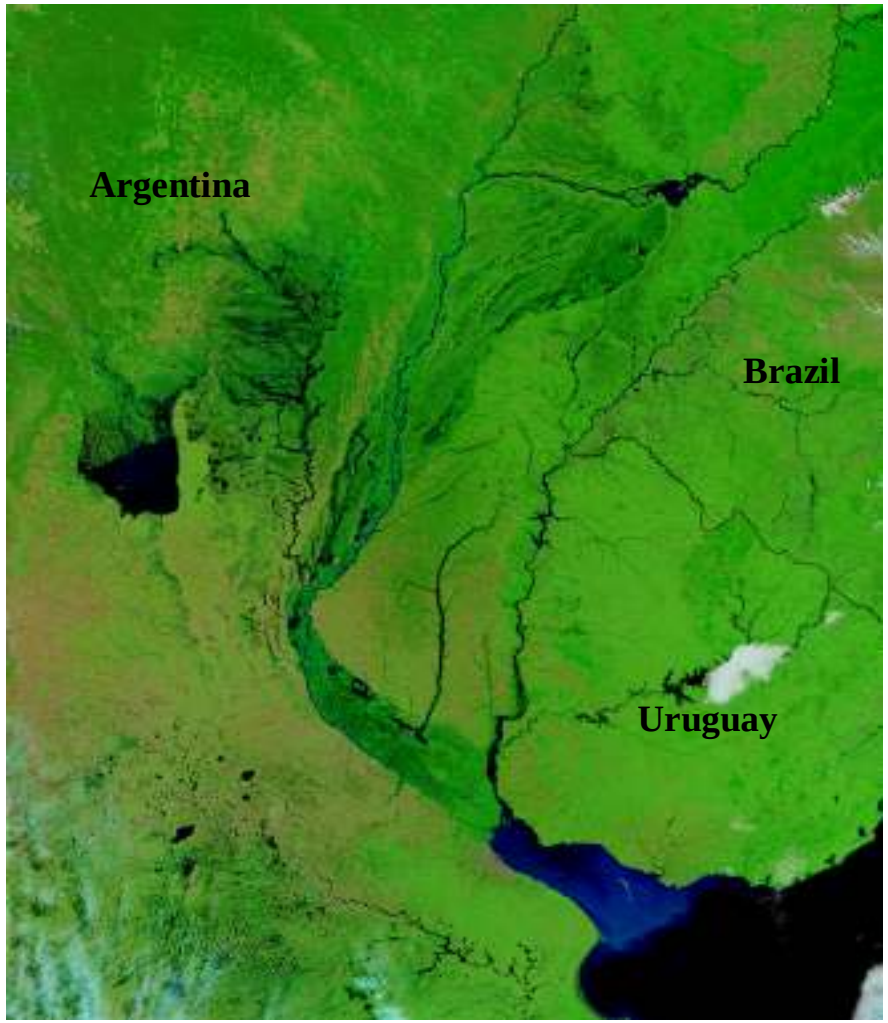


Flooding early detection



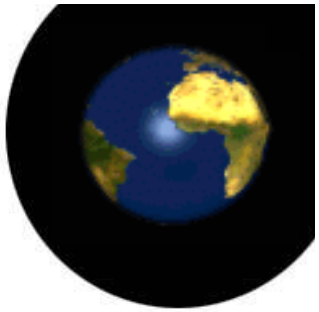
Floods in Argentina

In May 2003, heavy rains in Argentina led to devastating floods that displaced 35,000 people and killed over 25 people in the province of Santa Fe. The floodwaters can be seen in these image acquired on May 8, 2003, by MODIS.
All the rivers and tributaries in this region are much more swollen than normal.



Tropical Forest Watching

(Logging)

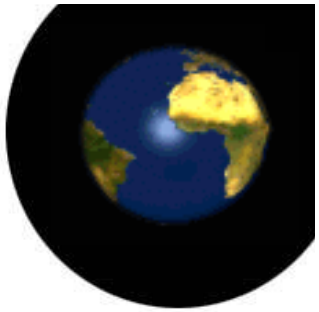


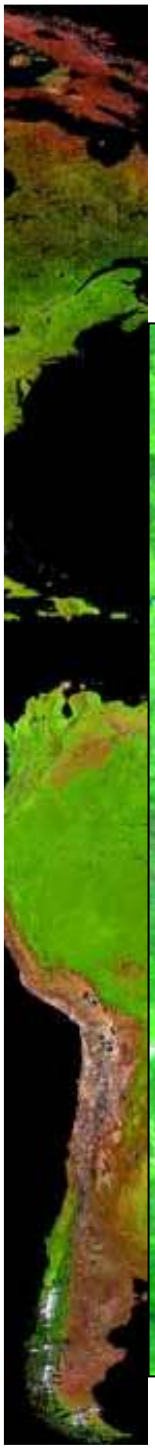
Amazonian forests

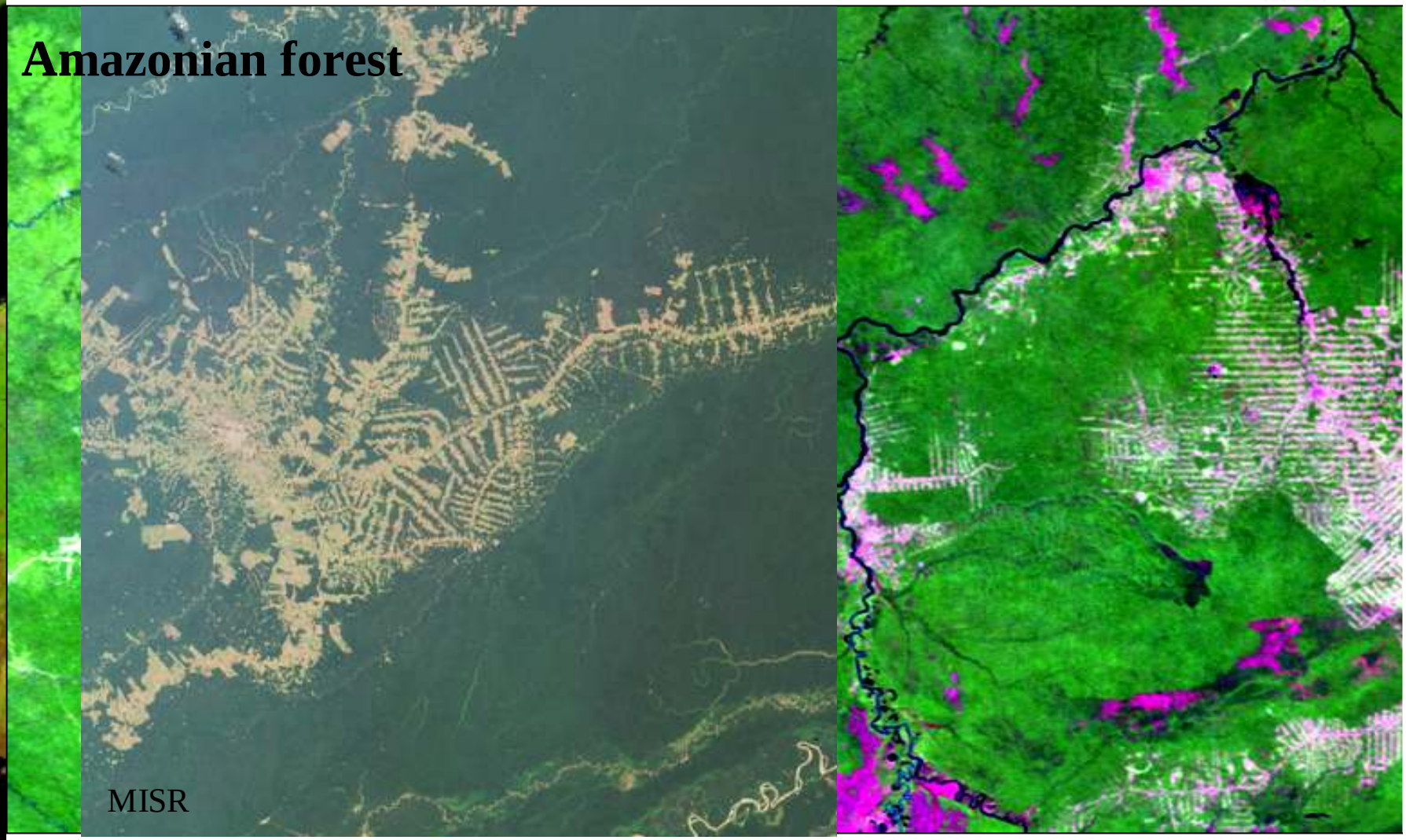
SPOT VGT - composite 2000

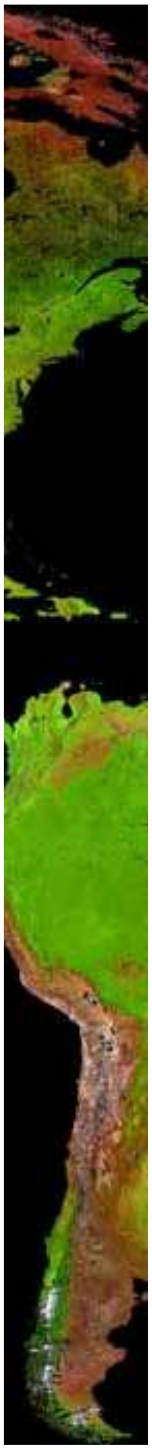
Tropical Forest Watching

(Logging)

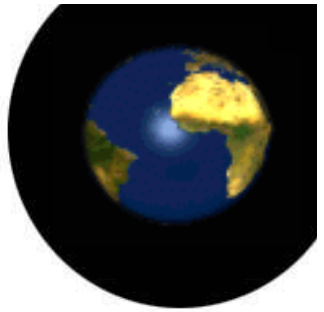








Conclusion



• Generalisation of a new operational compositing strategy,
which presents a high level of performance combined with a large flexibility

• Development of change detection tools:

- to early warn a desert locust invasion (FAO)
- to produce a map of water resources with the water availabilities during the year (West Africa)
- to early warn the extent of a flood
- to watch the tropical forests

Challenges

• Management of a large quantity of data (several terabytes)

• Management of different sources of data (different sensors with their specificities)

• Management of the regional conditions variability at the global scale