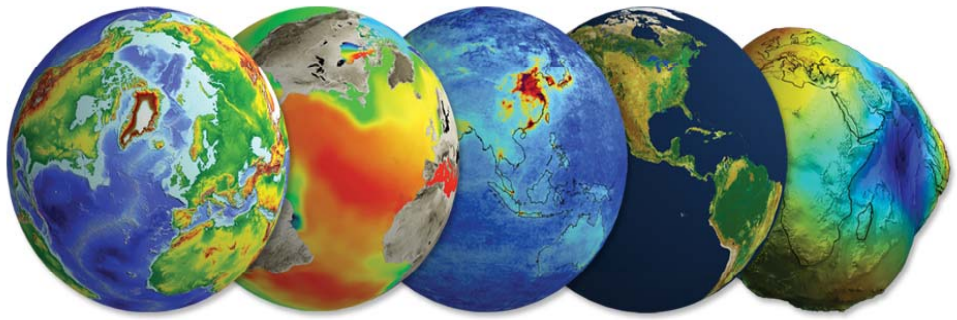
ESA report to GOFC Fire IT

GOFC Fire IT
Olivier Arino,
Stefano Casadio,
Stephen Plummer
Claus Zehner
October 2011



European Space Agency

ESA inputs to Action Items list from Frascati meeting

AI1: MERIS composite dataset for year 2009 (daily maps over Europe) were provided on 14 April 2010 to Jesus San Miguel.

AI3: ESA organised a training session on active fire detection in the context of the “ESA Advanced Training Course in Land Remote Sensing” held in Krakow (Poland) on 12-16 September 2011.

AI4: ATSR-WFA reprocessed products have been made available to public on 7 October 2011. User questionnaire for Fire-CCI and User Requirement Document have been disseminated to GOFC Fire IT partners

AI6: Two papers published on RSE

Casadio S., O. Arino and D. Serpe, 2011, “Gas Flaring Monitoring from Space Using ATSR Instrument Series”, Remote Sensing of Environment, doi:10.1016/j.rse.2010.11.022

Arino O., S. Casadio and D. Serpe, 2011, “Global Night-Time Fire Season Timing and Fire Count Trends Using the ATSR Instrument Series”, Remote Sensing of Environment, doi:10.1016/j.rse.2011.05.025

AI8: Fire_cci international collaboration through round robin and validation DB sharing.

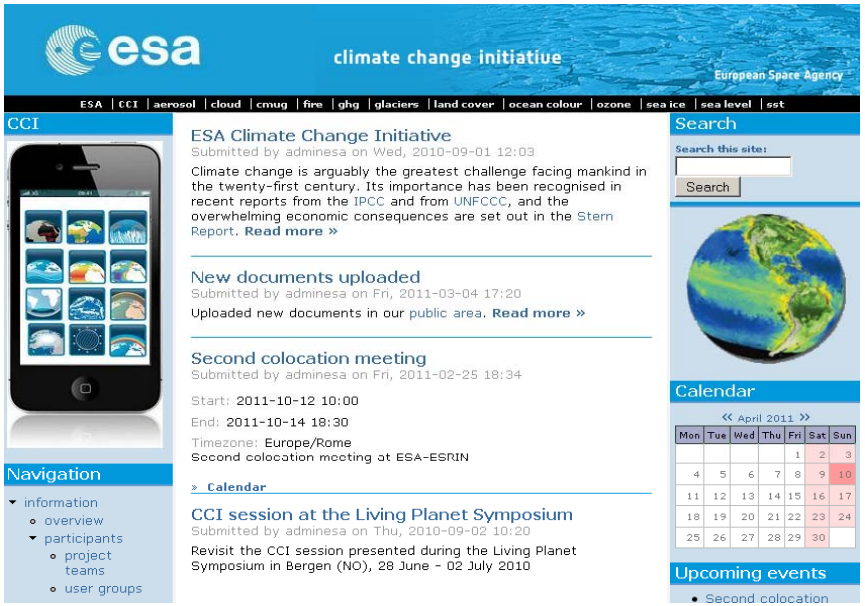
AI9: Continuous liaison with S3 development team for dedicated fire channels.

	Monday 12 September	Tuesday 13 September		Wednesday 14 September		Thursday 15 September			Friday 16 September		
8:30 - 9:00	Registration	Light Optical 1 (M. Potuckova)	Basic SAR 1 (TL Toan)	Optical properties (J. Moreno)	SAR properties (TL Toan)	Urban mapping (S.vd Linden)	Terrain motion in SAR (R. Hanssen)	Hot-spot dection (C.Kuenzer)	Pt 1. Forest mapping using SAR (C. Schmullius) Pt 2. Forest biomass (T. Le Toan)		
09:00 - 09:30	Opening session			Adv. optical (J. Moreno)	Adv. SAR 1 (E. Pottier)						
09:30 - 10:00											
10:00 - 10:30	*Photo call & break*	*Coffee break*		*Coffee break*		*Coffee break*			*Coffee break*		
10:30 - 11:00	Course Intro. (20 mins)	Light Optical 2 (M. Potuckova)	Basic SAR 2 (R. Hanssen)	Adv. thermal (Bob Su)	Adv. SAR 2 (I. Hajnsek)	Urban mapping (S.vd Linden)	Terrain motion in SAR (R. Hanssen)	Hot-spot dection (C.Kuenzer)	Land Use, Land Cover and Change detection (K.Ostapowicz)	Agriculture SAR - C. Schmullius	Object oriented classification S. Lewinski (combined)
11:00 - 11:30	ESA Programmes (YL Desnos)										
11:30 - 12:00	Access to ESA data (A. Zmuda)	Basic thermal (Bob Su)	Basic SAR (E. Pottier)	Active fire detection (S. Casadio)	POLInSAR Exploitation (I. Hajnsek)						
12:00 - 12:30	*LUNCH*	*LUNCH*		*LUNCH*		*LUNCH*			*LUNCH*		
12:30 - 13:00											
13:00 - 13:30											
13:30 - 14:00	ESA Sentinel Missions (TBD)								Land Use, Land Cover and Change detection (K.Ostapowicz)	Agriculture SAR - C. Schmullius	Regional Drought Case study Poland K. Dabrowska-Zielinska
14:00 - 14:30	National EO missions TerraSAR-X ASI/CSK DMC DEIMOS	[Optical & thermal gp.] Optical tool 1 BEAM (A. Zmuda / S. Casadio)	[SAR gp.] POLSARPRO Intro. (E. Pottier)	[Optical & thermal gp.] Image Classification (M. Caetano)	[SAR gp.] POLSARPRO Advanced (E. Pottier)	Water availability (Bob Su)	Floods / lakes monitoring (H. Yeso)	Fire detection exploitation (S. Casadio)			
14:30 - 15:00											
15:00 - 15:30											
15:30 - 16:00	*Coffee break*					*Coffee break*			*Coffee break*		
16:00 - 16:30	ESA Climate Change initiative (M. Doherty)	*Coffee break*		*Coffee break*		Water availability (Bob Su)	Floods / lakes monitoring (H. Yeso)	Active fire detection (S. Casadio)	Q & A Session		
16:30 - 17:00		[Optical & thermal gp.] POLSARPRO Intro. (E. Pottier)	[SAR gp.] Optical tool 1 BEAM (A. Zmuda / S. Casadio)	[Optical & thermal gp.] (16:45-18:45) Advanced optical - classification (M. Caetano)	[SAR gp.] (16:45 - 18:45) Intro. to NEST for SAR (A. Minchella)				CLOSING CEREMONY 16:30 - 16:50 Summary 16:50 - 17:15 Certificates & Poster awards 17:15 - 17:20 Close		
17:00 - 17:30	Regional Environmental change (J.Kozak)										
17:30 - 18:00											
18:00 - 18:30	*Ice-breaker*										
18:30 - 19:00		POSTER SESSION									
EVENING						*Social event - all*					

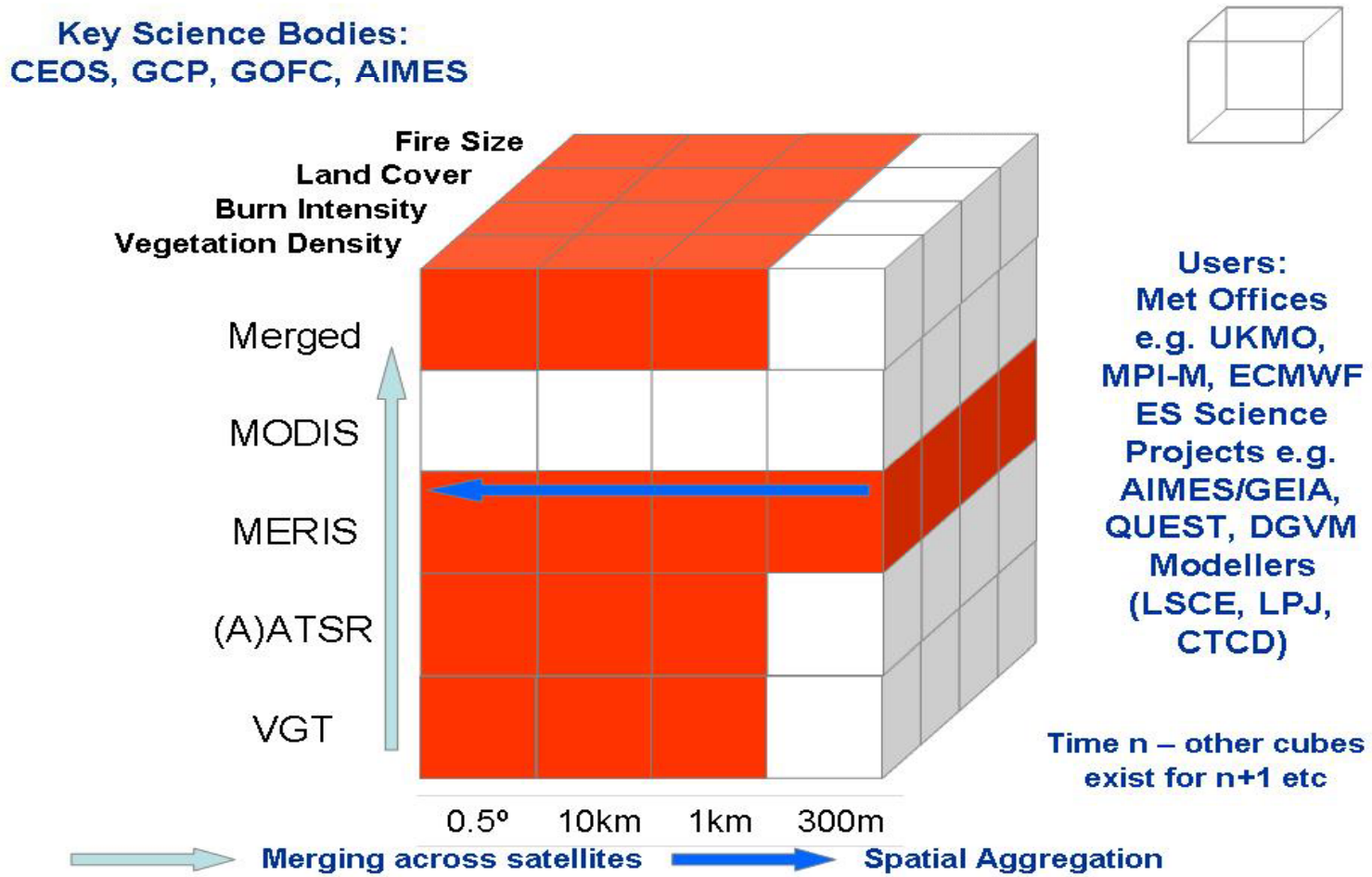
PLENARY
EO MISSIONS
THEORY
ESA TOOLS
APPLICATION THEORY
APPLICATION PRACTICAL

Fire ECV

http://www.esa-cci.org

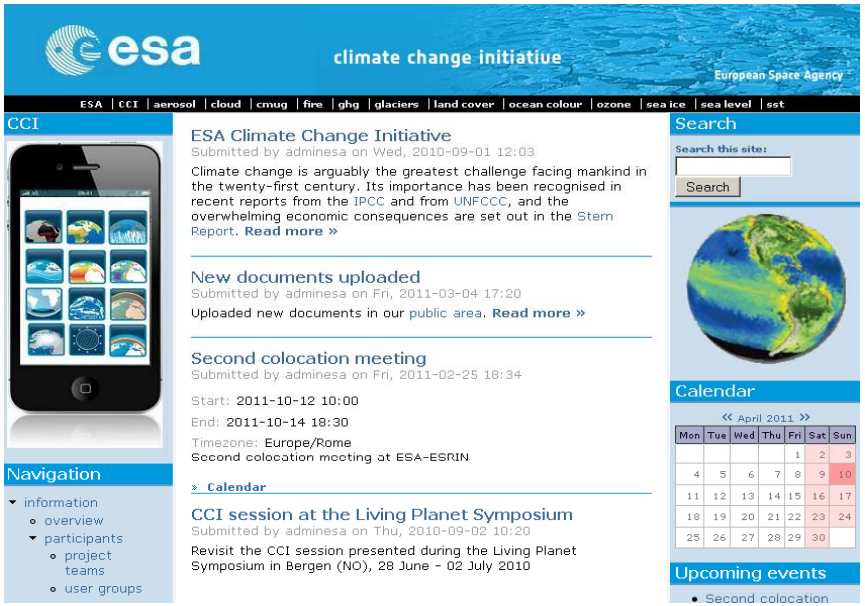


Fire Disturbance ECV



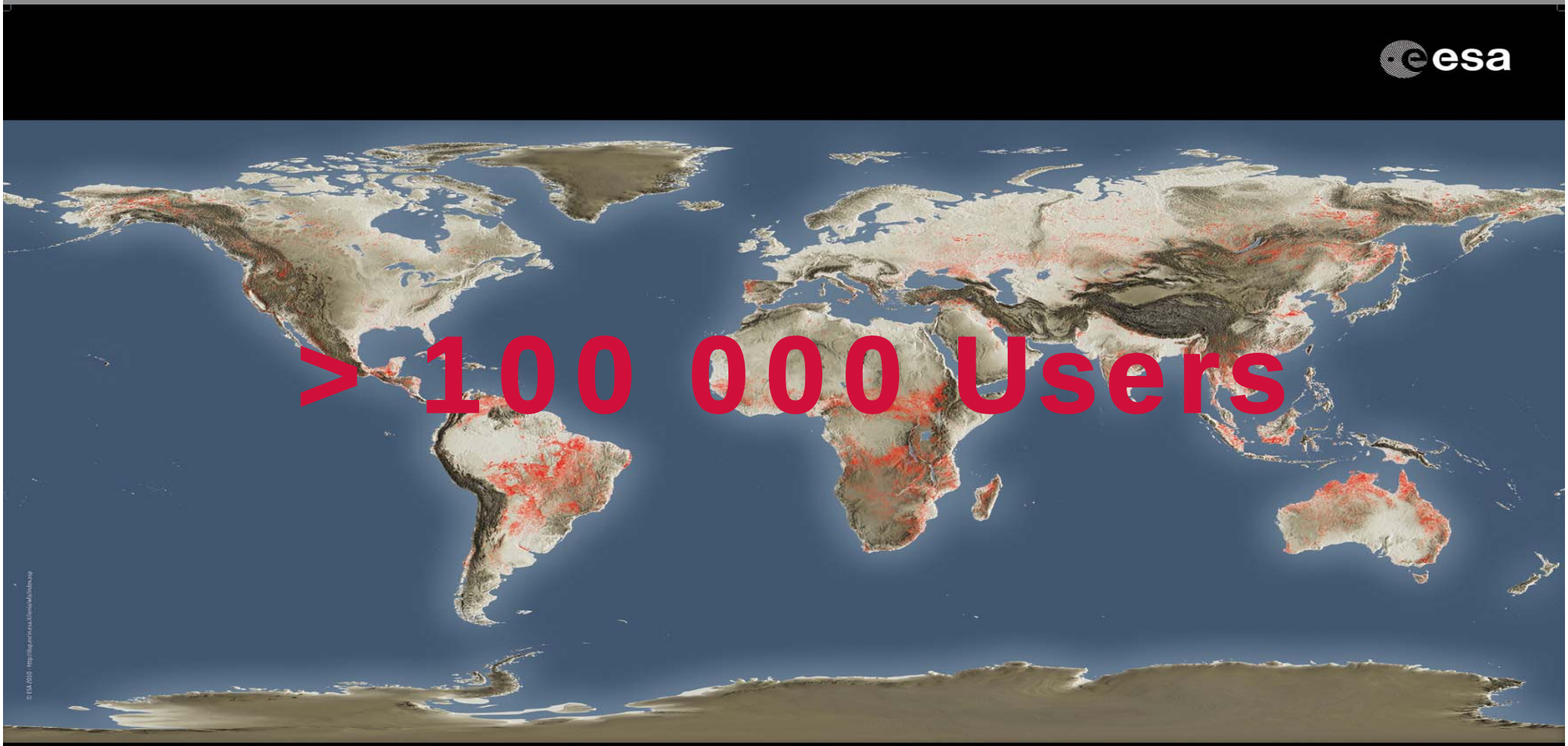
Land Cover ECV

http://www.esa-cci.org



ATSR World Fire Atlas

20 years of data



ATSR World Fire Atlas

reprocessing

European Space Agency

ATSR World Fire Atlas

note

- **Important note to ATSR-WFA users**
- **Starting from October 7 2011 the ATSR-WFA service will be updated.**
  - 1. The "Format" and "Reference" sections will be updated
  - 2. The historic data set (1995 to present) has been reprocessed using the newly produced ATSR Top of Atmosphere products (version 6.0.1). The new data set will cover a more extended time period by including the first months of ATSR-2 operation (June to October 1995) and a more extended coverage thanks to the recovery of many ATSR-2 and AATSR TOA products not previously available.
  - 3. The ALGO1 and ALGO2 data format has been harmonised: the ATSR-2 WFA products (up to December 2002) will have the same format as the AATSR products. This will simplify the readability of ATSR-WFA products.
  - 4. An off-line processing chain has been set up to ingest and analyse consolidated ATSR TOA products. These products differ from the NRT in terms of corrected geolocation and radiometric calibration and are available for processing with a delay of about two weeks from acquisition. The NRT ATSR-WFA products will be replaced by "consolidated" products on monthly basis: on the 21st of each month the off-line processing chain will produce the new monthly hot spot files and images relative to the previous month and substitute the NRT products in the web page.
  - 5. The data products filename has been renamed from *FIRE.gz.gz to *FIRE.gz

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/rse

Global night-time fire season timing and fire count trends using the ATSR instrument series

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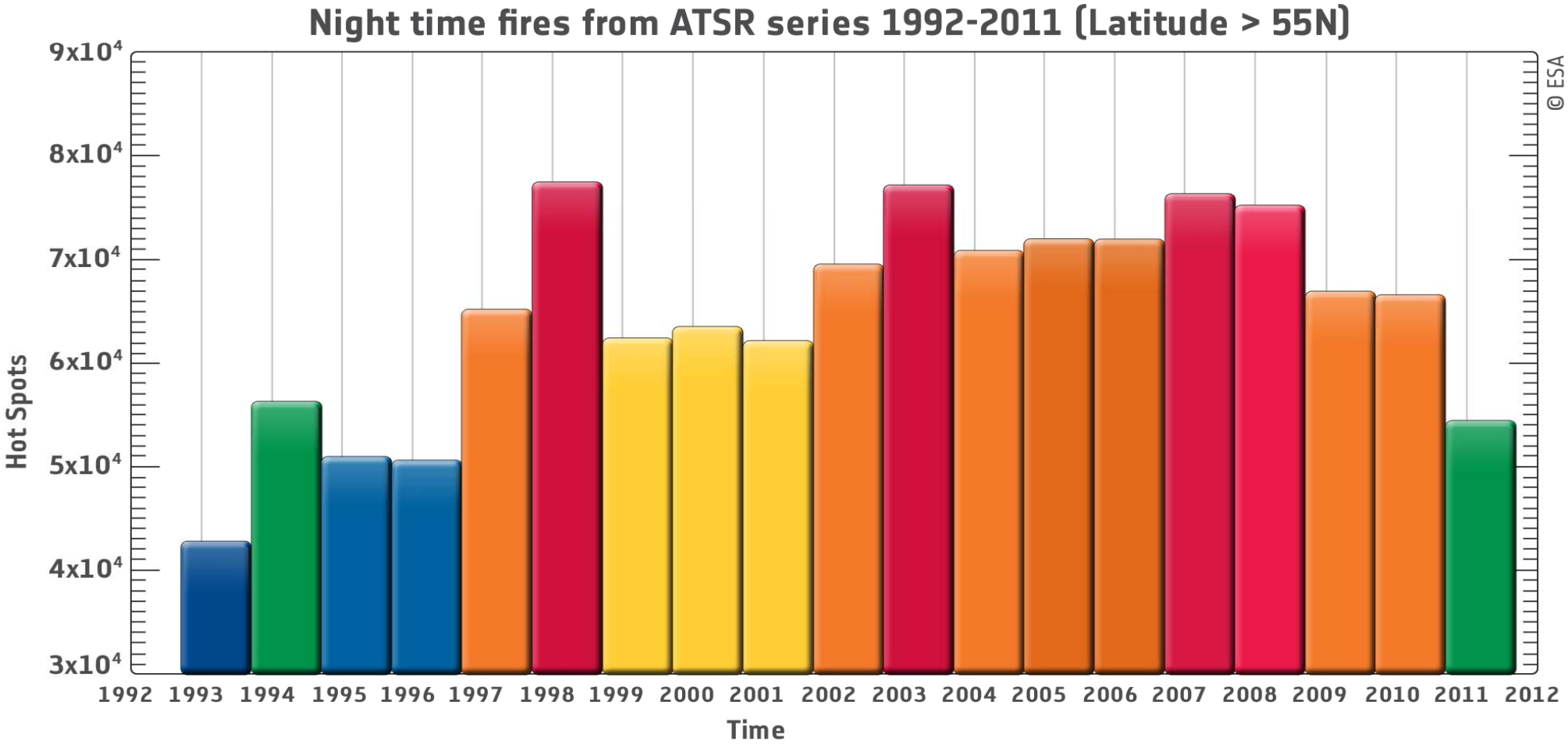
ABSTRACT

Global night-time fire counts for the years from 1995 to 2009 have been obtained by using the latest version of Along Track Scanning Radiometer Top of Atmosphere radiance products (level 1B), and related trends have been estimated. Possible biases due to cloud coverage variations have been assumed to be negligible. The sampling number (acquisition frequency) has also been analysed in detail and proved not to influence our results. The new ATSR World Fire Atlas (WFA) product continuity has been tested by comparing the partially overlapping fire counts time series from the ATSR-2 (on board ERS-2) and the AATSR (on board ENVISAT) missions which showed negligible offsets. The ATSR-WFA products show very good correlation with the TRMM-VIRS and MODIS-Aqua/Terra monthly night-time fire counts. Global night-time fire trends have been evaluated by inspecting the time series of hot spots aggregated a) at $2^{\circ}\times2^{\circ}$ scale; b) at district/country/region/continent scales, and c) globally. The statistical significance of the estimated trend parameters has been verified by means of the Mann–Kendall test. Results indicate that no trends in the absolute number of fire counts can be identified at the global scale, that there has been no appreciable shift in the fire season during the last 14 years, and that statistically significant positive and negative trends are only found when data are aggregated at smaller scales.

ATSR World Fire Atlas

Improving Algorithm: use of 1.6 micron



GlobEmission (ITT 6721)

new ESA contract for next two year started on October 11

KNMI/BIRA/FMI/TNO/VITO

Guido is a comited user

European Space Agency

Committed end users

- European Environmental Agency (EEA)
- University of Edinburgh
- Min. of Environmental Protection of China (MEP)
- Indian Inst. of Tropical Meteorology (IITM)
- South African Weather service (SAWS)
- National institute for Env. Studies Japan (NIES)

Specific user requirements:

- Species: NOx, CH_4, CO, NMVOC, SO_2, PM, O_3
- Accuracy: better than 30% - 80 %
- Spatial resolution: 1 km - 50 km
- Time resolution: daily – annual

GlobEmission: Approach

- Based on satellite observations using inversion techniques
- Complementary to bottom-up inventories (not replacing)
- Focus on a limited number of species:
  - NOx, CH_4, CO, NMVOC, SO_2, PM
- Validation with existing inventories and model results
- Goal: to demonstrate the validity of the concept

Service implementation

Dedicated services for the following four types of **emission estimates**:

1. **Global**
   - Inversion of HCHO, CHOCHO on a global domain
   - CO inventory assessment

2. **Regional**
   - NO_2 (and O_3) and SO_2 over South Africa, China, India (high resolution)

2b. High resolution Emission Maps
   - Spatial disaggregation to create high resolution maps over South Africa

3. **European**
   - Inversion of NO_x in Europe
   - Verification of SO_2 and CO inventories in Europe (and O_3)

4. **Aerosol-related**
   - Aerosol inversion over Europe, South Africa, China and Japan
   - Forest Fire emissions

Sentinel–3: Fire Mission overview

European Space Agency

Sentinel-3
Mission Highlights

Ocean & Global

Land Mission

Launch : mid 2013

Applications:

- **Sea / land colour data and surface temperature**
- **sea surface and land ice topography**
- **coastal zones, inland water and sea ice topography**
- **vegetation products**

1198 kg spacecraft mass

Sun synchronous orbit at 814.5 km mean altitude over geoid. Equatorial Crossing Descending time: 10:00

27 days repeat cycle

7 years design life time, consumables for 12 years

Sentinel-3 Core PDGS
Optical geophysical parameters list

Geophysical Product	Application Domain	Spatial Resolution	Continuity	Measurement Source
Normalised Water Surface Reflectances		300 m , 1.2 km	Envisat	OLCI
Chlorophyll Concentration for open ocean waters		300 m , 1.2 km	Envisat	OLCI
Chlorophyll Concentration for Coastal waters		300 m , 1.2 km	Envisat	OLCI
Total suspended Matter		300 m , 1.2 km	Envisat	OLCI
Diffuse attenuation coefficient		300 m , 1.2 km	GCM* (e.g. Modis)	OLCI
Coloured Detrital and Dissolved Material		300 m , 1.2 km	Envisat	OLCI
Photosynthetically active radiation		300 m , 1.2 km	Envisat	OLCI
Aerosol Optical Depth over water		300 m , 1.2 km	Envisat	OLCI
Aerosol Angstrom exponent over water		300 m , 1.2 km	Envisat	OLCI
Integrated Water Vapour Column		300 m , 1.2 km	Envisat	OLCI
Sea Surface Temperature		1 km	Envisat	SLSTR
Land Surface Temperature		1 km	Envisat	SLSTR
Surface Reflectances over Land		300 m	Envisat	OLCI+SLSTR
Aerosol Optical Depth over Land		300 m	Envisat	OLCI+SLSTR
Aerosol Angstrom exponent over Land		300 m	Envisat	OLCI+SLSTR
Vegetation-like Surface Reflectances 1 day Synthesis		1 km	Vegetation	OLCI+SLSTR
Vegetation-like Surface Reflectances 10 days Synthesis		1 km	Vegetation	OLCI+SLSTR
Vegetation Normalised Difference of Vegetation Index		1 km	Vegetation	OLCI+SLSTR

GCM* : GMES Contributing Mission

SLSTR Bands

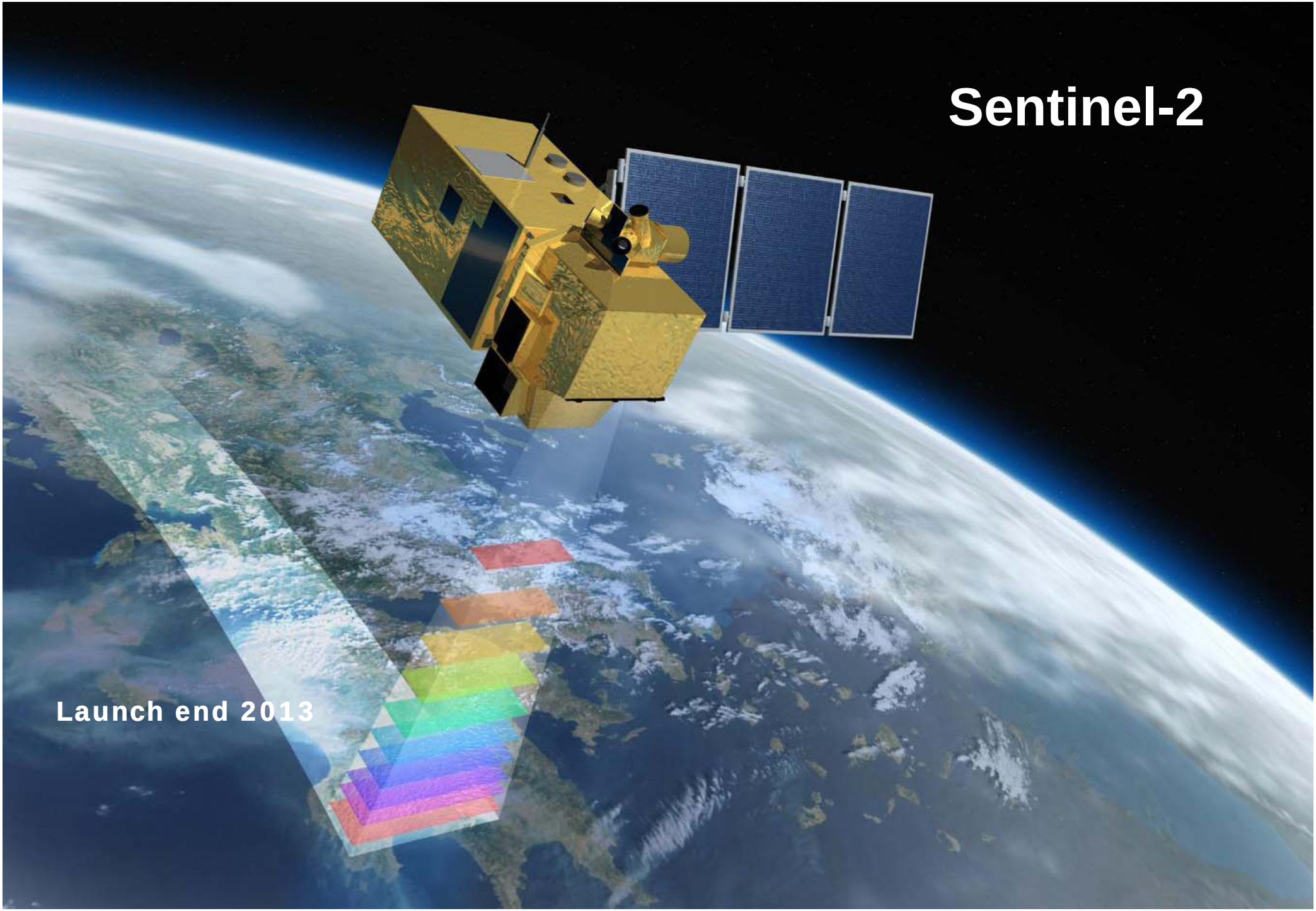
- Absolute rad. accuracy (S1–S6): <5% (EOL) <2% (BOL)
- Absolute rad. accuracy (S7/8/9): 0.2K
- Polarisation sensitivity < 0.07 (S1–S6) or < 0.10 (S7/8/9)
- Stability (S1–S6): <0.1%
- Stability (S7/8/9): <0.08K

SLSTRBand	lcenter [mm]	Dl [mm]	SNR [-] / NeDT [mK]	SSD [km]
S1	0.555	0.02	20	0.5
S2	0.659	0.02	20	0.5
S3	0.865	0.02	20	0.5
S4	1.375	0.015	20	0.5
S5	1.61	0.06	20	0.5
S6	2.25	0.05	20	0.5
S7	3.74	0.38	80 mK	1.0
S8	10.95	0.9	50 mK	1.0
S9	12	1.0	50 mK	1.0

Active Fire Band	lcenter [mm]	Dl [mm]	Tmax [K]	SSD [km]
F1	3.74	0.38	500	1.0
F2	10.95	0.9	400	1.0

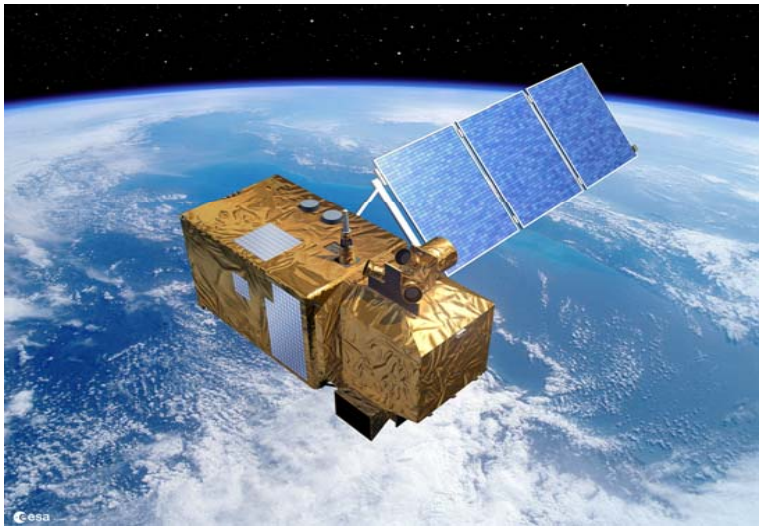
AATSR Heritage

SLSTR New Bands


Sentinel-2
Launch end 2013

Sentinel-2
Mission Highlights

Super-spectral Imaging Mission



Launch : end 2013

Applications:
- **Generic land cover maps**
- **risk mapping and fast images for disaster relief**
- **generation of leaf coverage, leaf chlorophyll content and leaf water content**

Push-broom filter based multi spectral imager with 13 spectral bands (VNIR & SWIR)

Spatial resolution: 10, 20 and 60 m

Field of view: 290 km

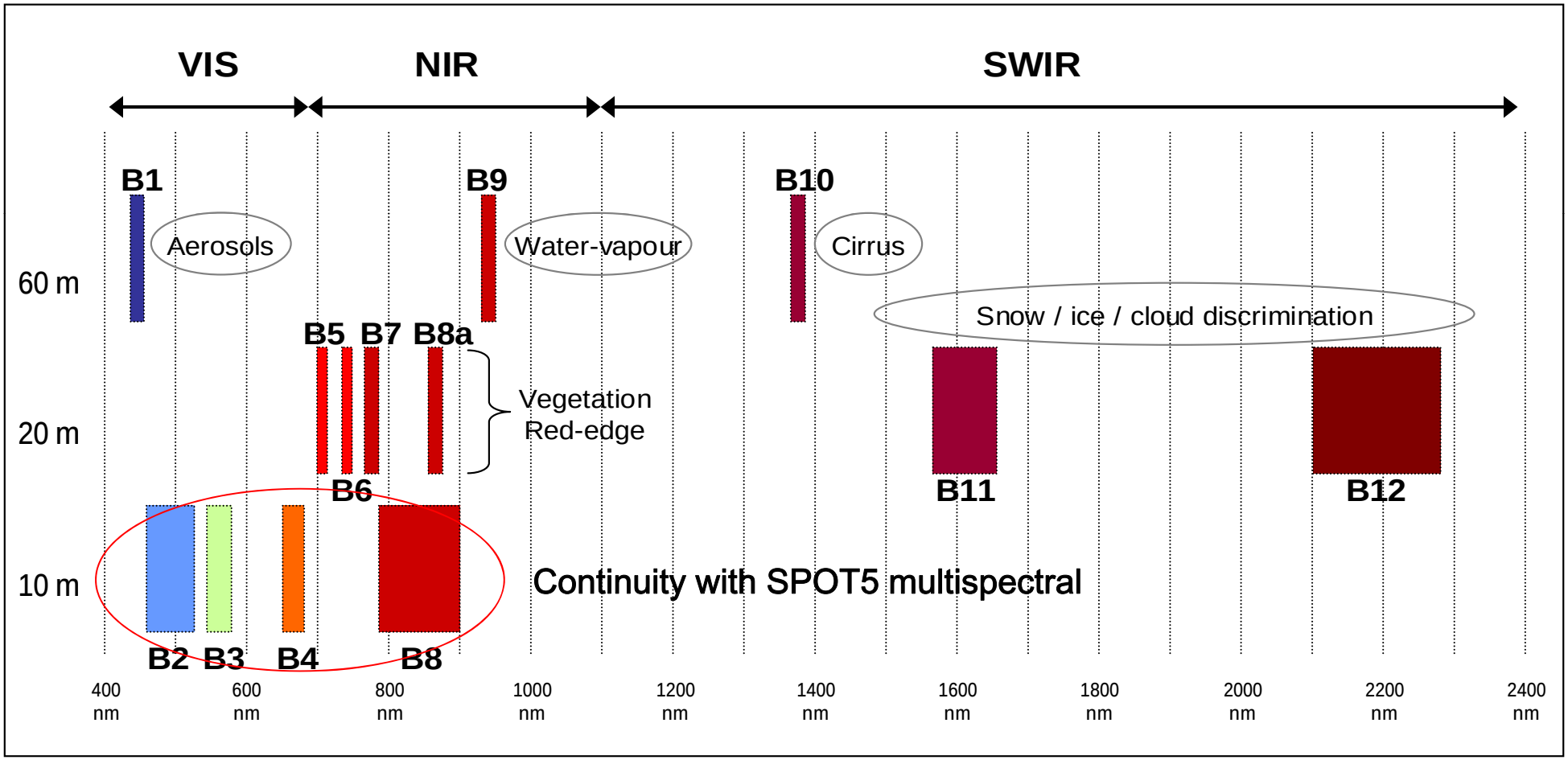
2 x 280Mbps concurrent channels
~18 min downlink required per orbit for data playback

5 days repeat cycle (in twin spacecraft configuration)

Sun synchronous orbit at 786 km mean altitude.
Equatorial Crossing Descending time: 10:00

7 years design life time, consumables for 12 years

Sentinel–2: 13 Spectral Bands



Open Discussion Points

- How to action Comprehensive validation internationally - role of GOFC and CEOS.
- How to respond to GCOS - coordination GOFC/CEOS (WG Climate for ECVs).
- How to ensure inputs to CEOS Response encompasses all activities - GOFC FIT?
- How to ensure coordination of multiple satellite launches to ensure operational continuity? A role for GOFC FIT?
- How do we reconcile approaches top-down (atmospheric inversion)-bottom-up (emissions calculation from BA e.g. GFED or active fire or FRP) and improve emissions factor determination?
- CONSISTENCY – land cover, albedo, snow, temperature, LAI, Fapar, BA. Elements under test in CCI (land cover_cci, fire_cci, globalbedo, globsnow) – GOFC wider contribution through project offices?

Objectives?

- Feed Operational Modelling Institutions
- Regionalize the Carbon Cycle
- Issue Format/Spec/Guidelines for the Fire Science Community
- Set up Harmonised Consistent and Accessible Products
- Develop, maintain and populate validation data base at GOFC-GOLD Fire Office
- Support GDAC development, population and data distribution at JRC

GOFC (GHRSST Model)