GOFC-GOLD Fire – An Overview

GOFC-GOLD GLOBAL OBSERVATION FOR FOREST AND LAND COVER DYNAMICS

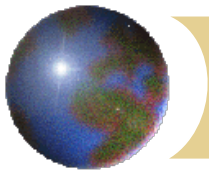*Providing the International Coordination needed for Global Observation of Forest, Fire and Land Cover Dynamics.*

Krishna Prasad Vadrevu
GOFC Fire Implementation Team (IT) Executive Officer
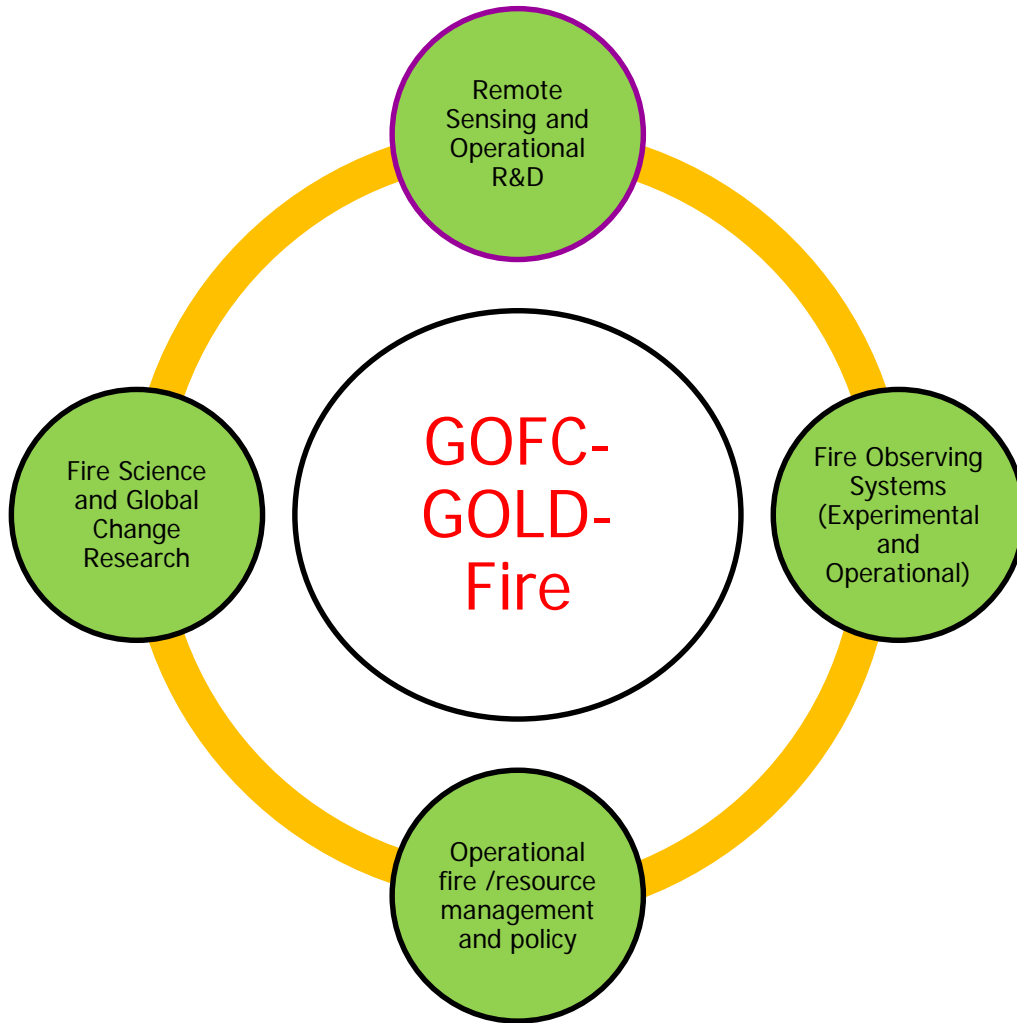**University of Maryland College Park**

NASA

CANADIAN FOREST SERVICE

Canadian Space Agency

UNIVERSITY OF MARYLAND

GOFC-GOLD Fire

Remote Sensing and Operational R&D

Fire Science and Global Change Research

GOFC-GOLD-Fire

Fire Observing Systems (Experimental and Operational)

Operational fire /resource management and policy

http://gofc-fire.umd.edu/

- GOFC-GOLD-Fire consists of 5 elements:
  - Scientific and Technical Board (STB)
  - Implementation team
  - Regional Networks
  - Project Office
  - Executive committee

GOFC-GOLD GLOBAL OBSERVATION FOR FOREST AND LAND COVER DYNAMICS

GOFC GOLD-FIRE
Fire Monitoring and Mapping ImplementationTeam

Organization of GOFC-GOLD Fire

GOFC – GOLD Executive Committee

Scientific and Technical Board

Fire Implementation Team

Co-Chairs: Chris Justice, UMd and Johann Goldammar, GFMC
Fire IT Officer: Krishna Prasad Vadrevu, Umd (Geography Dept. Project Office)
Fire IT Members: Anja Hoffmann, Antonio Martucci, Bill de Groot, Brivio Alessando, David Roy, Eckehard Lorenz, Emilio Chuvieco, Everett Hinkley, Federico Gonzalez, Garik Gutman, Guido van der Werf, Isabel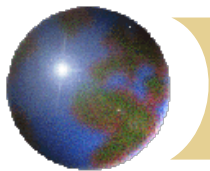 Cruz, Ivan Csiszar, Jesus San-Miguel-Ayanz, Kevin Tanxey, Louis Giglio, Luigi Boschetti, Martin Wooster, Michael Brady, Olivier Arino, Mark Paganini, Stephen Plummer, Tim Lynham, Vesileious Kalogirou, Yves Govaerts, and several others

+

Regional Networks

Anja Hoffmann, RN coordinator
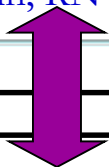
International Strategic Partnerships e.g. START, UN ISDR Wildland Fire Network, EARSEL SIG-Fire, CGMS, CEOS and LPV, ILDRCC, GEOSS
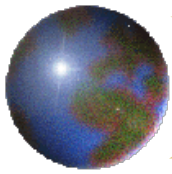
Increase user awareness and satellite data use

Establish a geostationary global fire network

Develop long-term fire data records

Secure operational polar orbiters with adequate fire monitoring capability

Enhanced user products and improved data access

GOFC Fire-IT Goals

Define product accuracies

Promote experimental fire observation systems and research

Develop a fire Early Warning System operational products
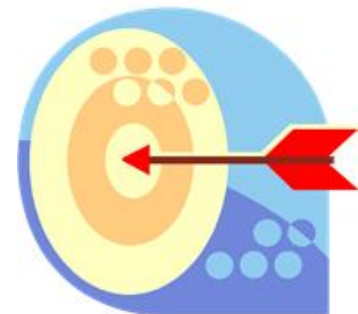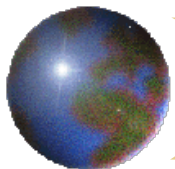
Develop fire emission product suites

Summary published in The Earth Observer, July-August, Volume 25, Issue 4. 2013
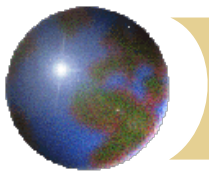
Currently Available Fire Products

- A variety of global fire products are available to researchers:
  - Active fire products (ATSR (1990-current), MODIS (2000-current), Geostationary (GOES ABBA, etc).
  - Burned area products (MODIS, Spot (L3JRC), Globcarbon (ATSR), MERIS
  - Fire Radiative Power products (MODIS, AVHRR).
  - Global Fire Emissions – GFED
  - VIIRS Active Fire product

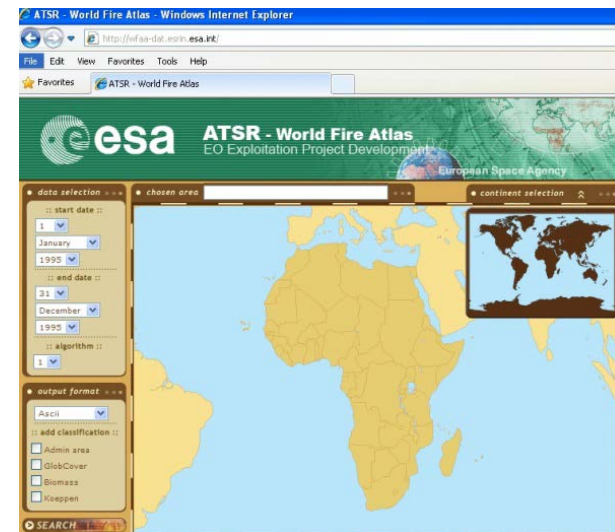- Recent results on burnt area products suggests highest accuracy for MODIS followed by Globcarbon and L3JRC. However, accuracy assessment is needed at several regions involving local scientists.

- It is important to fuse both the polar and geostationary fire products.

- Reference data library for accuracy assessments and protocols on reporting product accuracies are needed.

- It is important to make product accuracy information comprehensible to non-scientists.
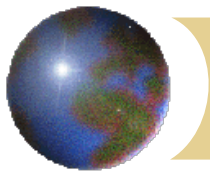
European Space Agency (Climate Change Initiative)

Re-processing ex archive (e.g. calibration)

"Gather"

ECV generation (e.g. validation & bias)

"Deliver"

FEEDBACK LOOP:

ECV assimilation & assessment

"Exploit"

OUTPUT TO

International Climate Programmes
EC & MS R&D Programmes
IPCC Process, UNFCCC

Education & Awareness

"Show"
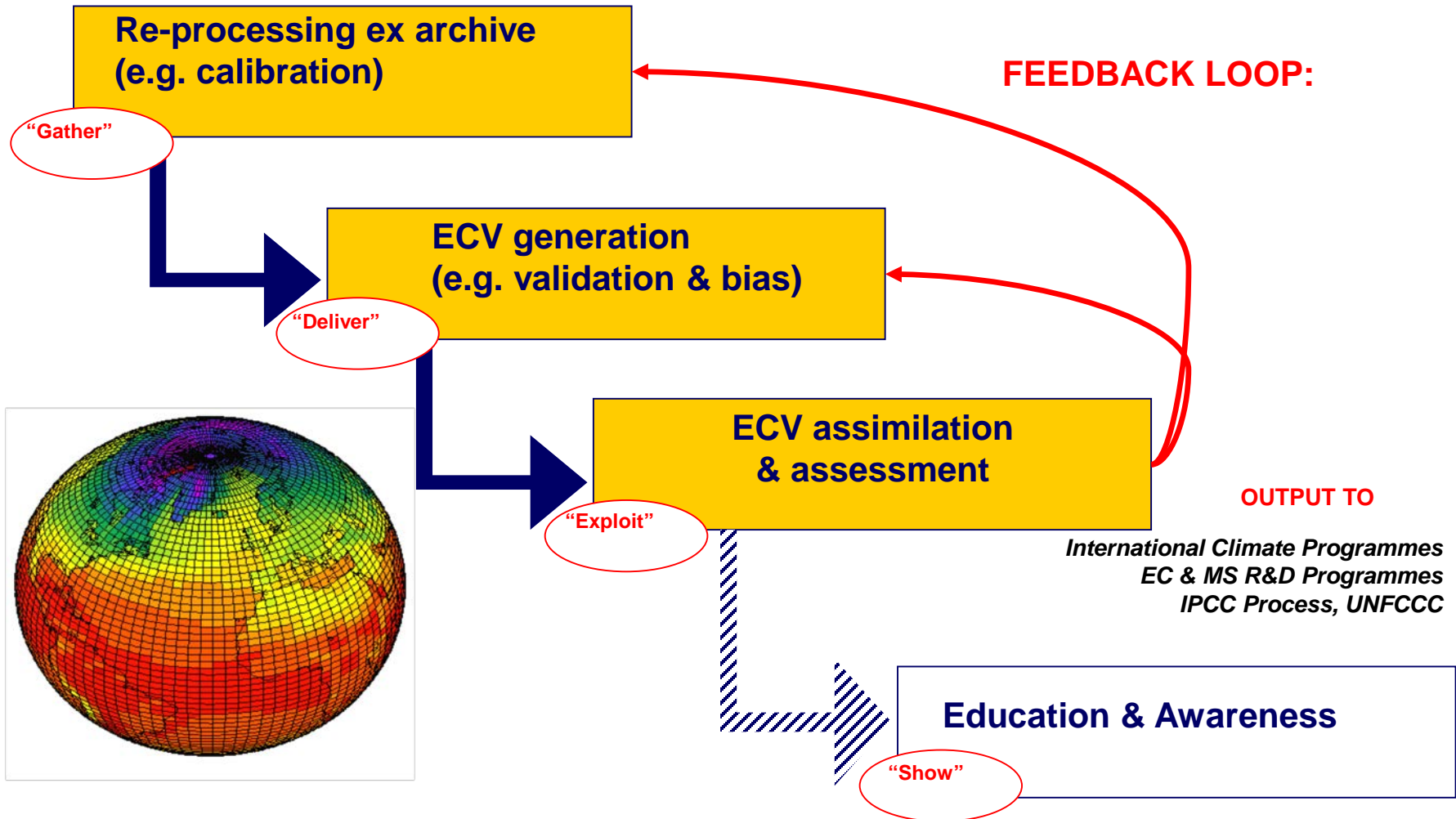
ESA is partnering with several international agencies to gather, deliver and exploit the data useful for climate change research.

Fire CCI Project – Global Burned Areas

1. Fire-CCI aims to refine definition of user requirements.
2. Improve current estimations of global burned area (based on European sensors: VGT-(A)ATSR-MERIS).
3. Strong emphasis on validation.
4. Intercomparison with existing BA global products.
5. Test improvements of climate-vegetation-carbon models with new BA data.
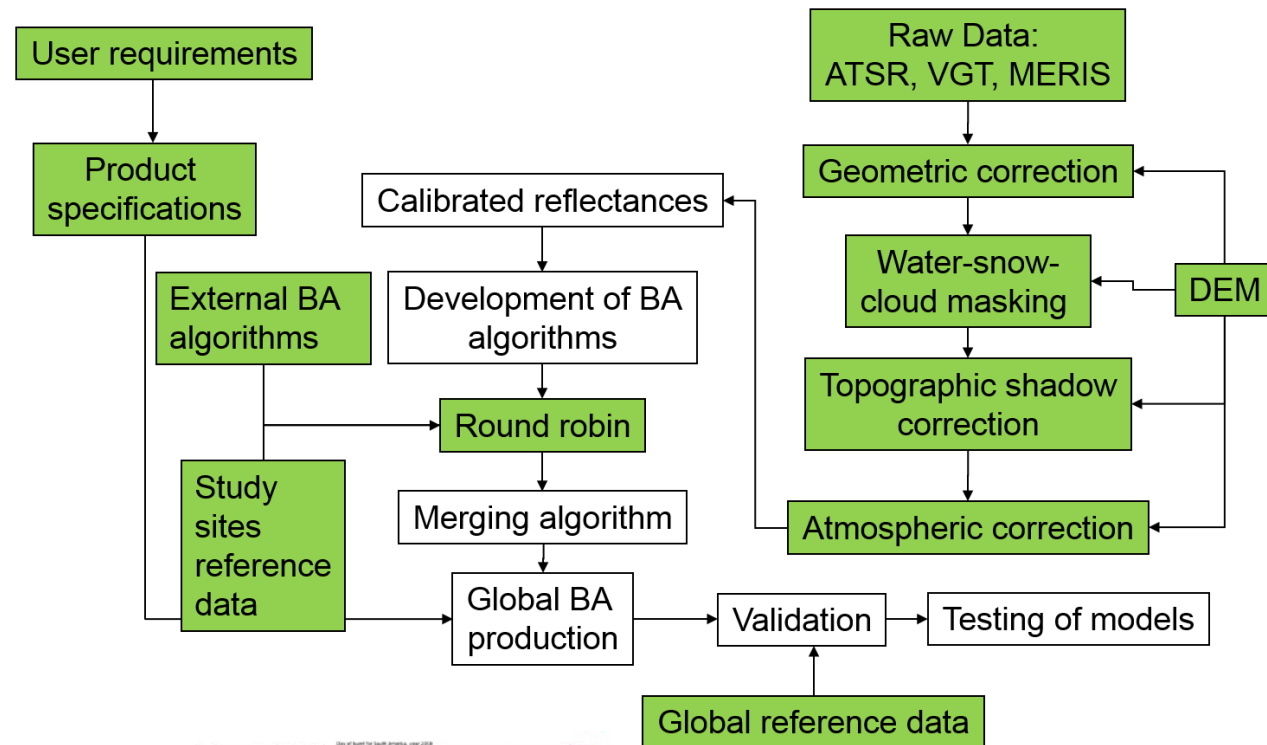
fire_cci

Climate Change Initiative

European Space Agency
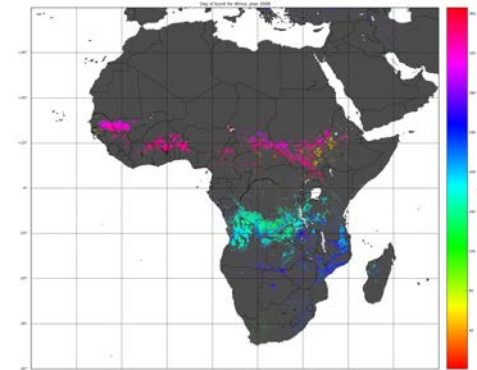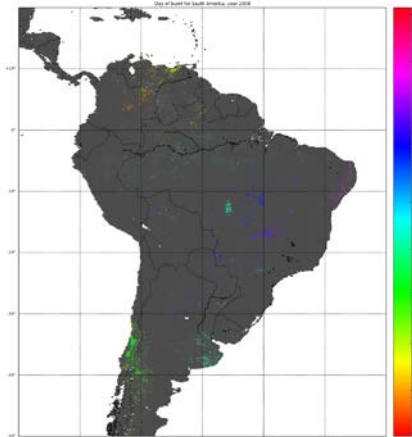
VIIRS Active Fire Products available since October, 2012
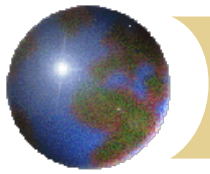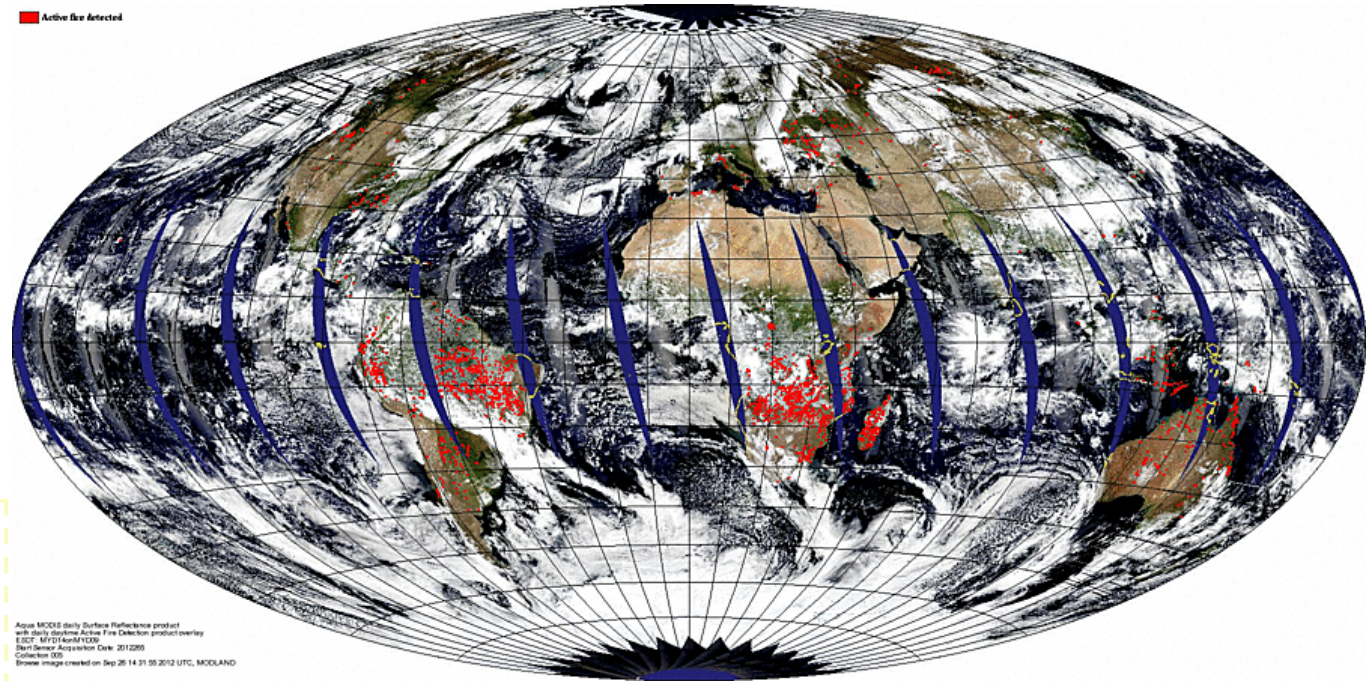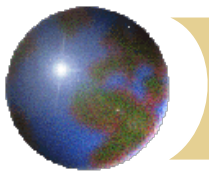
VIIRS Fire Bands

VIIRS			MODIS Equivalent			AVHRR-3 Equivalent			OLS Equivalent		
Band	Range (um)	HSR (m)	Band	Range	HSR	Band	Range	HSR	Band	Range	HSR
DNB	0.500 - 0.900	750	NONE			Low light capabilities			HRD PMT	0.580 - 0.910 0.510 - 0.860	550 2700
M1	0.402 - 0.422	750	8	0.405 - 0.420	1000	NONE			Ocean Color, Aerosol		
M2	0.436 - 0.454	750	9	0.438 - 0.448	1000						
M3	0.478 - 0.498	750	3	0.459 - 0.479	500						
			10	0.483 - 0.493	1000						
M4	0.545 - 0.565	750	4	0.545 - 0.565	500						
			12	0.546 - 0.556	1000						
I1	0.600 - 0.680	375	1	0.620 - 0.670	250	1	0.572 - 0.703	1100	Imagery		
M5	0.662 - 0.682	750	13	0.662 - 0.672	1000	1	0.572 - 0.703	1100	Ocean Color, Aerosol		
			14	0.673 - 0.683	1000						
M6	0.739 - 0.754	750	15	0.743 - 0.753	1000	NONE			Atm Correction		
I2	0.846 - 0.885	375	2	0.841 - 0.876	250	2	0.720 - 1.000	1100	NDVI		
M7	0.846 - 0.885	750	16	0.862 - 0.877	1000	2	0.720 - 1.000	1100	Ocean Color, Aerosol		
M8	1.230 - 1.250	750	5	SAME	500	NONE			Cloud Particle Size		
M9	1.371 - 1.386	750	26	1.360 - 1.390	1000				Thin Cirrus		
I3	1.580 - 1.640	375	6	1.628 - 1.652	500				Snow Map		
M10	1.580 - 1.640	750	6	1.628 - 1.652	500	3a	SAME	1100	Snow Fraction		
M11	2.225 - 2.275	750	7	2.105 - 2.155	500	NONE			Cloud		
I4	3.550 - 3.930	375	20	3.660 - 3.840	1000	3b	SAME	1100	Imagery, Clouds		
M12	3.660 - 3.840	750	20	SAME	1000	3b	3.550 - 3.930	1100	SST, Fire		
M13	3.973 - 4.128	750	21	3.929 - 3.989	1000	NONE			SST, Fire		
			22	3.929 - 3.989	1000						
			23	4.020 - 4.080	1000						
M14	8.400 - 8.700	750	29	SAME	1000				Cloud Top Propoerties		
M15	10.263 - 11.263	750	31	10.780 - 11.280	1000	4	10.300 - 11.300	1100	SST, Fire		
I5	10.500 - 12.400	375	31	10.780 - 11.280	1000	4	10.300 - 11.300	1100	HRD	10.300 - 12.900 Cloud Imagery	550
			32	11.770 - 12.270	1000	5	11.500 - 12.500	1100			
M16	11.538 - 12.488	750	32	11.770 - 12.270	1000	5	11.500 - 12.500	1100	SST		
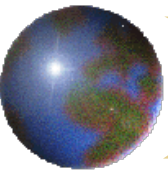
VIIRS Fire Products

VIIRS Active Fire Product Website

viirsfire.geog.umd.edu

Global Geostationary Fire Network

- Efforts are ongoing to obtain meteorological agencies support to develop the international geostationary fire network within the Coordination Group of Meteorological Satellites (CGMS). The main focus is to specify user requirements for fire detection on operational geostationary systems. Focus is also on research and product development, data sharing and validation and calibration of geostationary products.

- Geostationary Active Fire products from GOES 11,12,13 Meteosat-9 and MTSAT-1 are available from NOAA/NEESDIS.

- Operational Meteosat Active Fire Radiative Power (FRP) products subset over different regions (Europe, Northern Africa, Southern Africa, and South America), are available through EUMETCast.

- Better integration of geostationary fire products with Polar satellite data and Essential climate variables is needed.
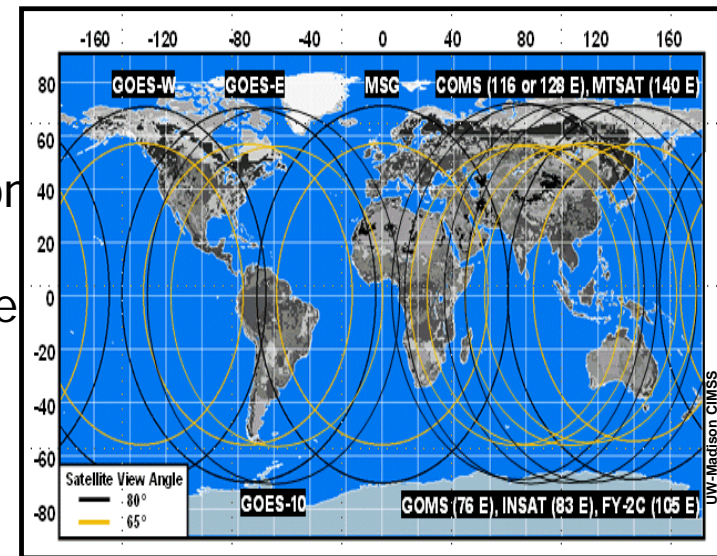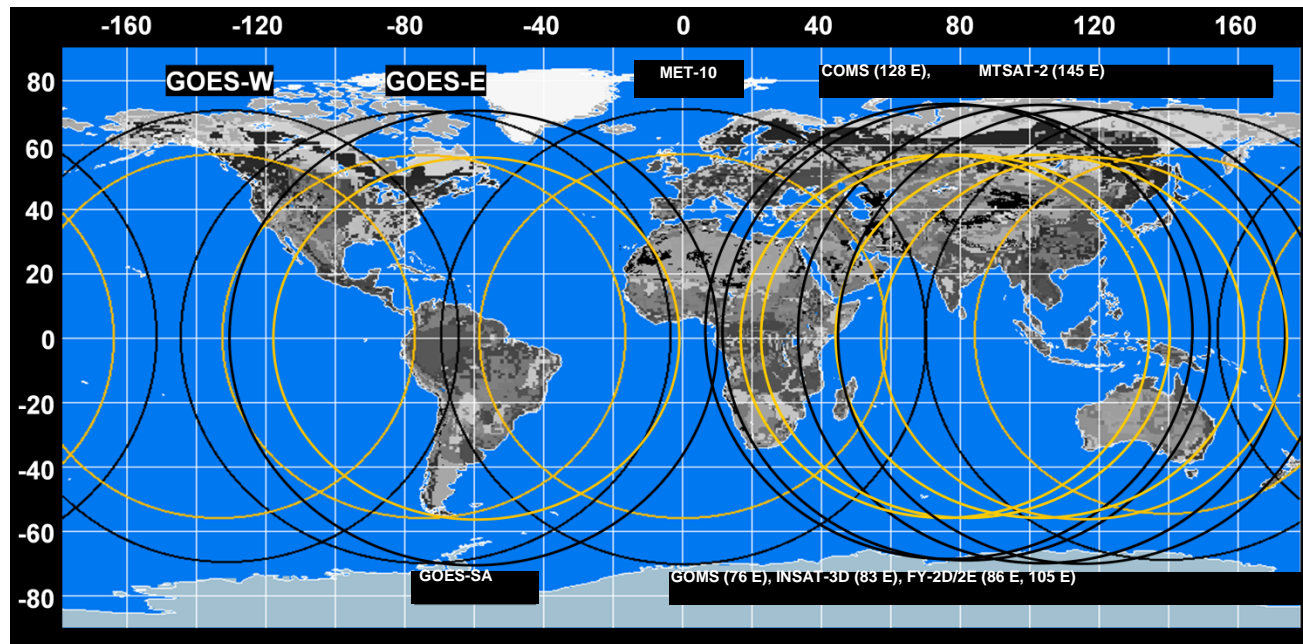
Current Operational Global Geostationary Satellites

Active Fire Monitoring Capabilities
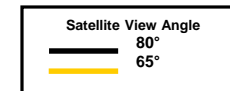
Satellite	Active Fire Spectral Bands	Resolution IGFOV (km)	SSR (km)	Full Disk Coverage	3.9 μm Saturation Temperature (K)
GOES-E/-W Imager (75ºW / 135ºW)	1 visible 3.9 and 10.7 μm	1.0 4.0	0.57 2.3	3 hours (30 min NHE and SHE)	~337-340 K (G-15) ~337-340 K (G-13)
GOES-12 Imager (South America) (60ºW)	1 visible 3.9 and 10.7 μm	1.0 4.0	0.57 2.3	3 hours (Full Disk) 15 min (SA)	>337 K (G-12)
Met-10 SEVIRI (0º)	1 HRV 2 visible 1.6, 3.9 and 10.8 μm	1.6 4.8 4.8	1.0 3.0 3.0	15 minutes	~335 K
FY-2D/2E SVISSR (86ºE / 105ºE)	1 visible, 3.75 and 10.8 μm	1.25 5.0		30 minutes	~330 K
MTSAT-2 Imager (HRIT) (145ºE) Operational (2010)	1 visible 3.7 and 10.8 μm	1.0 4.0		1 hour	~320 K
GOMS Elektro-L N1 MSU-GS (76ºE) (2011) GOMS Elektro-L N2 MSU-GS (76ºE) (12/2013)	3 visible 3.75 and 10.7 μm	1.0 km 4.0 km		30 minutes	TBD
COMS MI (128ºE)	1 visible 3.9 and 10.7 μm	1.0 km 4.0 km		3 hours	~350 K
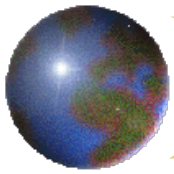
EUMETSAT Meteosat Second Generation (MSG)
3.9 micron Fire Observations in Africa
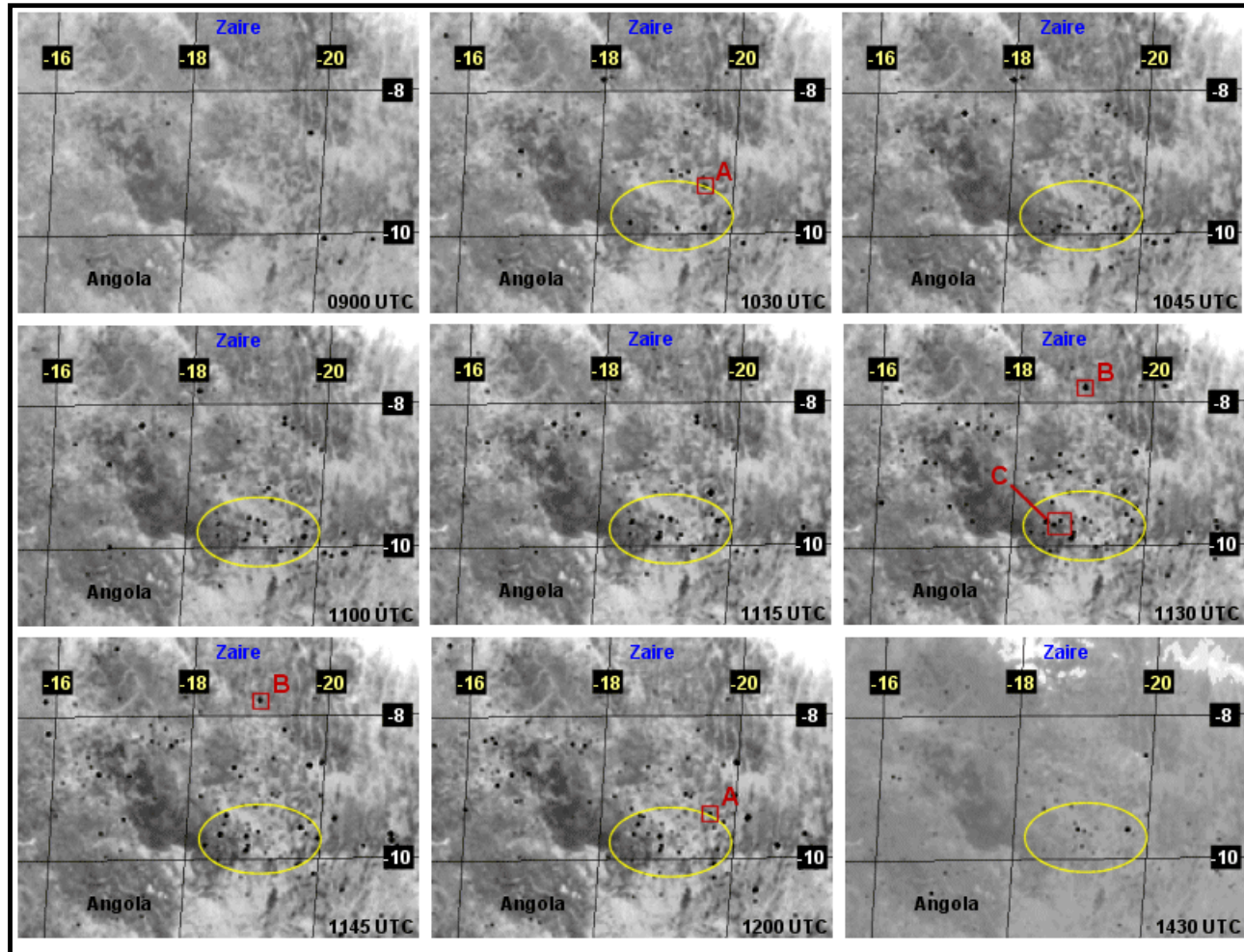
Providing 15-30 minute observations – tracking the diurnal variability of fire

GOES Wildfire ABBA Fire Composite Web Distribution

Animations of Wildfire ABBA composite image products are being provided via anonymous ftp and the web every half-hour at: http://cimss.ssec.wisc.edu/goes/burn/wfabba.html

Displays include three overviews and 35 regional views providing coverage of the entire Western Hemisphere.

Examples of Regional View Sectors

Links to Overviews

North America GOES-8 Overview:
– loop of the last 12 Hours
– loop of the previous 12 Hours

South America GOES-8 Overview:
– loop of the last 12 Hours
– loop of the previous 12 Hours

North America GOES-10 Overview:
– loop of the last 12 Hours
– loop of the previous 12 Hours

Links to Regional Views
North America (GOES-8)

GOES-8: Western Canada
– loop of the last 12 Hours
– loop of the previous 12 Hours

GOES-8: Ontario and Western Quebec
– loop of the last 12 Hours
– loop of the previous 12 Hours

GOES-8: Northeastern US and Eastern Canada
– loop of the last 12 Hours
– loop of the previous 12 Hours

GOES-8: Western USA
– loop of the last 12 Hours
– loop of the previous 12 Hours

CIMSS
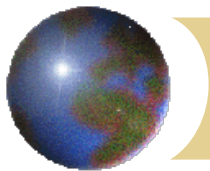
GCOS - Fire - Essential Climate Variable Requirements

- Fire disturbance ECV's their status and requirements are highlighted in GTOS T13 FAO document and NASA White Paper on Fire Earth System Data Records (ESDR).

- Fire disturbance ECV requirements include:
  - achieving accuracy of 95%, spatial resolution of 250m with temporal daily resolution.

- NASA Active fire products requirements include:
  - Middle infrared & thermal long wave sensors that will not saturate for the largest expected fires; geolocated to a fraction of a 1km pixel; address solar and viewing geometry; optically thick cloud mask; land/water mask; 24 hour detection summary Simultaneous high spatial resolution sensing (20-30 m) for active fire validation (e.g., ASTER), etc.

- NASA Burnt area product requirements include:
  - Atmospherically corrected reflectance, visible to short wave infrared, thermal; geolocated to a fraction of a 500m pixel; solar and viewing geometry; optically thick cloud mask 500 m globally (GOFC 1999 requirement); 30 m for regional and local mapping; etc.
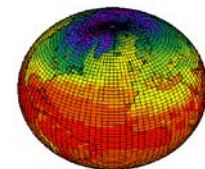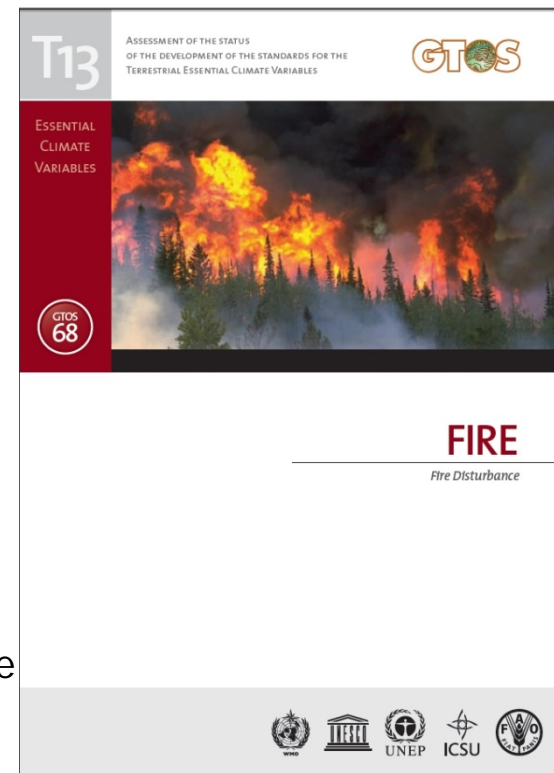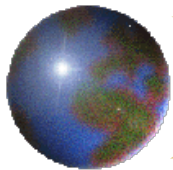
T13

ASSESSMENT OF THE STATUS
OF THE DEVELOPMENT OF THE STANDARDS FOR THE
TERRESTRIAL ESSENTIAL CLIMATE VARIABLES

GTOS

ESSENTIAL CLIMATE VARIABLES

GTOS 68

FIRE

Fire Disturbance

T35	Reanalyse the historical fire disturbance satellite data (1982 to present).
T36	Continue generation of consistent burnt area, active fire, and FRP products from low orbit satellites, including version inter-comparisons to allow unbiased, long-term record development.
T37	Develop and apply validation protocol to fire disturbance data.
T38	Make gridded burnt area, active fire, and FRP products available through links from a single International Data Portal.
T39	Develop set of active fire and FRP products from the global suite of operational geostationary satellites.

Need for the Validation of Global Fire products

- Several Global fire products are available and validation of these products is urgently needed.

- Validation is an iterative process. Feedback from users allows future improvement of fire products.

- Some important validation issues includes:
    - Generation of validation-quality reference data.
    - Transition from stage 2 (expert based selection of the sites) to Stage-3 (model based statistical sampling) to fully characterize uncertainty.
    - Developing standard accuracy reporting measures and making product accuracy information understandable to non-scientists.
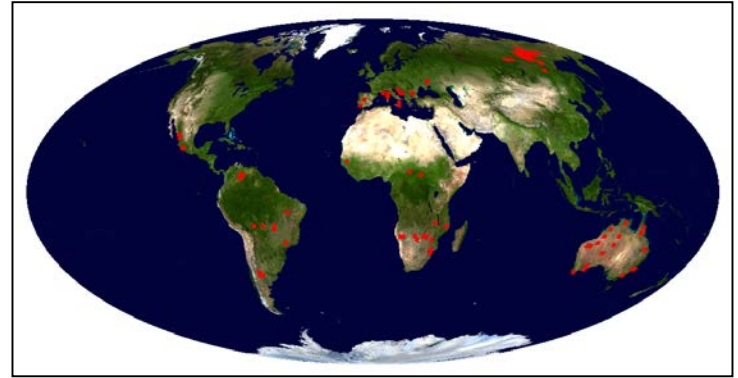
A Wiki-site devoted to land product validation is being developed. (http://lpvs.gsfc.nasa.gov/fire_background.html)
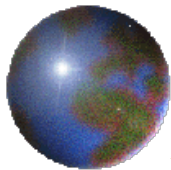
❖ GOFC source book highlights the REDD (Reducing Greenhouse Gas Emissions from Deforestation and Degradation in Developing Countries) concepts and methodologies.

❖ Strong emphasis on the use of satellite data for REDD has been stressed.

❖ GOFC source book is periodically updated (now COP15 version).

❖ The book provides step-by-step approach for each activity on the data requirements, methodologies and calculations.

❖ The fire chapter highlights the methods for estimating GHG emissions from biomass burning, mainly using satellite data.

❖ The book is available online: http://www.gofc-gold.uni-jena.de/redd
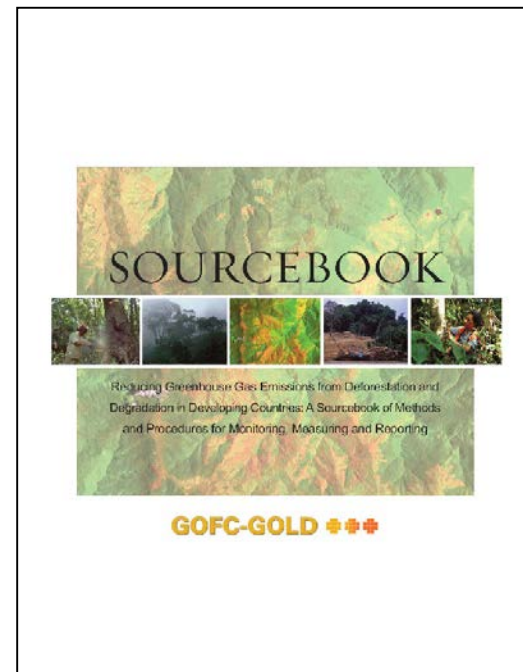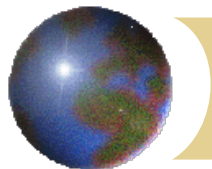
⬥ Regional network scientists can explore some of the globally available emissions products (GFED) and can assist in improving their accuracy.

Tg CO
- 0.0-0.005
- 0.005-0.01
- 0.01-0.05
- 0.05-0.1
- 0.1-0.5
- >0.5

VGT
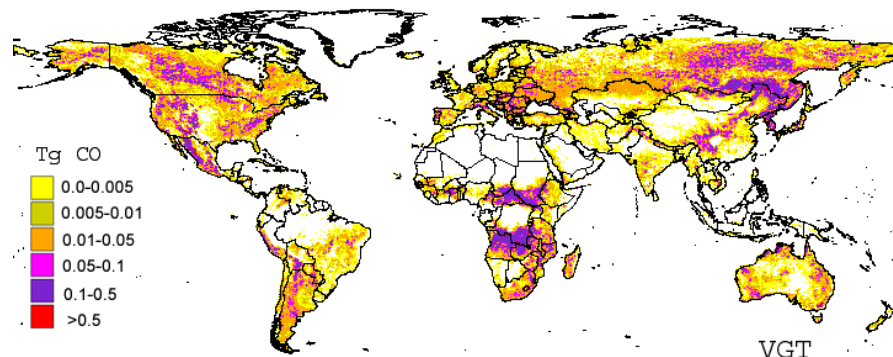
⬥ Intercomparison exercise from Burnt Biomass and Satellite Observations (BBSO) initiative in the frame of GEIA/ACCENT programs suggested:

⬥ Use of MODIS suite of products from 2000 onwards for emissions estimation. Specifically, BA products for herbaceous/shrub/boreal forest, BA/FRP for evergreen forest and AF for temporal distribution at the seasonal scale.

⬥ Error analysis based on different satellite products (AF, BA, FRP) and ecosystem types for estimating emissions is needed.

⬥ Integrated approaches involving both the top-down and bottom-up approaches are needed to address the uncertainties in biomass burning estimation.

GOFC-Fire is engaging Atmospheric Research Community to develop monitoring systems for Aerosol/GHG Emissions from fires.

European Air Quality

http://gmes-atmosphere.eu
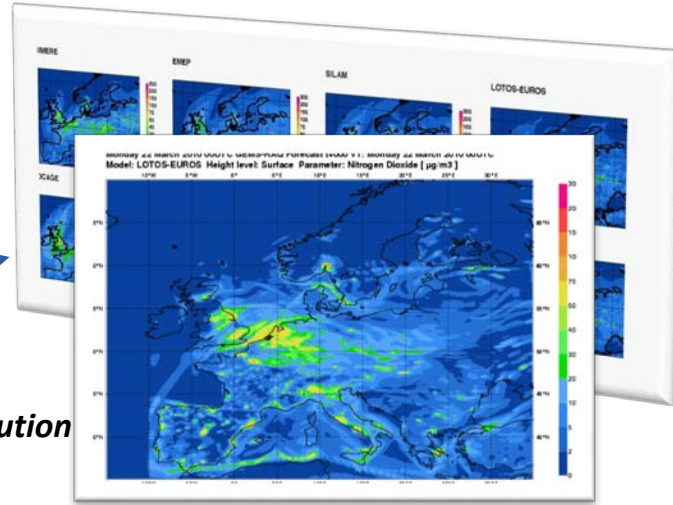
Global Pollution
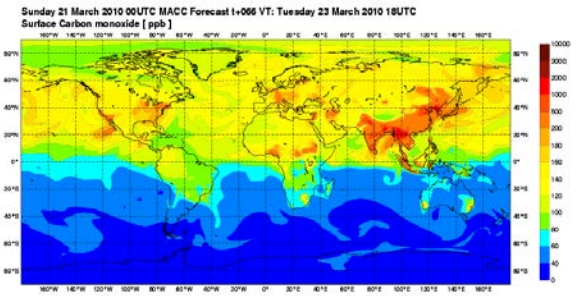
Emissions

Aerosol

Radiation
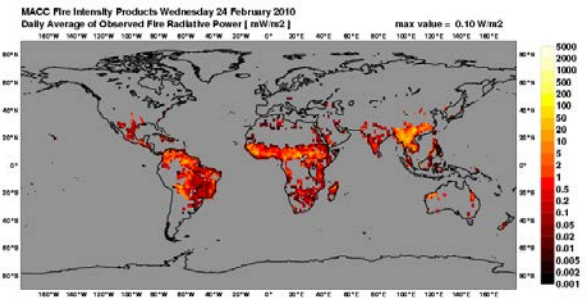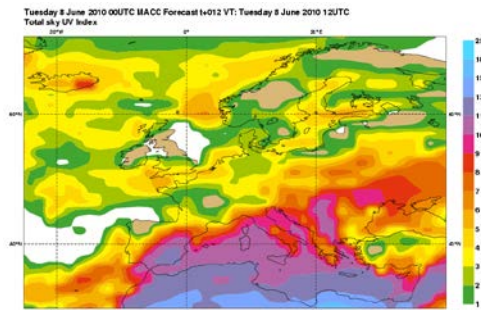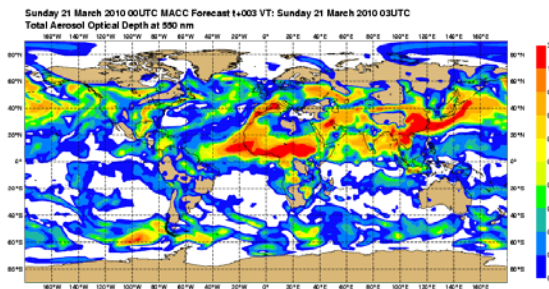
The Global Early Warning System for Wildland Fire

Legend
FFMC
- 0 - 76
- 76 - 84
- 84 - 88
- 88 - 91
- 91 - 100
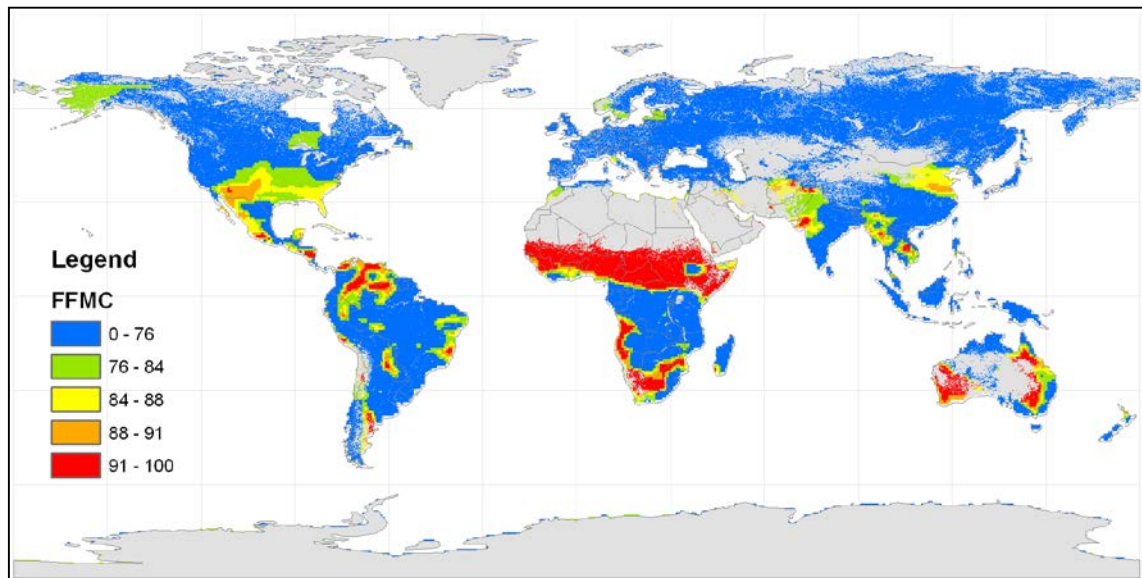
Regional EWS Prototype:
Central and South America

Ignition Potential
(based on FFMC and hot spots)
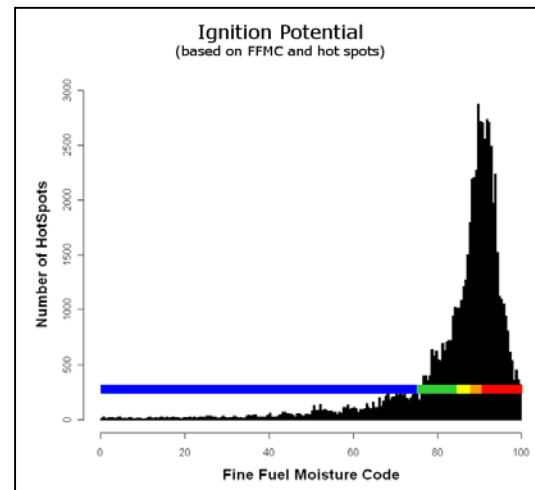
- Global EWS provides 1-7 day forecast fire danger at a coarse scale and regional EWS at a fine scale.
- Global EWS Indicates regional fire 'hot spots' and global trends in fire danger
- Global EWS designed for making large-scale decisions
- Provides early warning to national and international agencies for fire management and disaster management (including UN/ISDR, FAO, WHO, UNEP)

The Fire Early Warning System is useful for pre-suppression and planning

Head Fire Intensity
August 1, 2008
Grass Fuel Type

Legend
- MODIS hotspots
- Sahara Desert
- Sub-Saharan Countries

Head Fire Intensity
- 0 - 250
- 250-1250
- 1250-2500
- 2500-5000
- >5000

Fine Fuel Moisture Code
August 15 2009

Legend
FFMC
- 0 - 76
- 77 - 84
- 85 - 88
- 89 - 91
- > 91
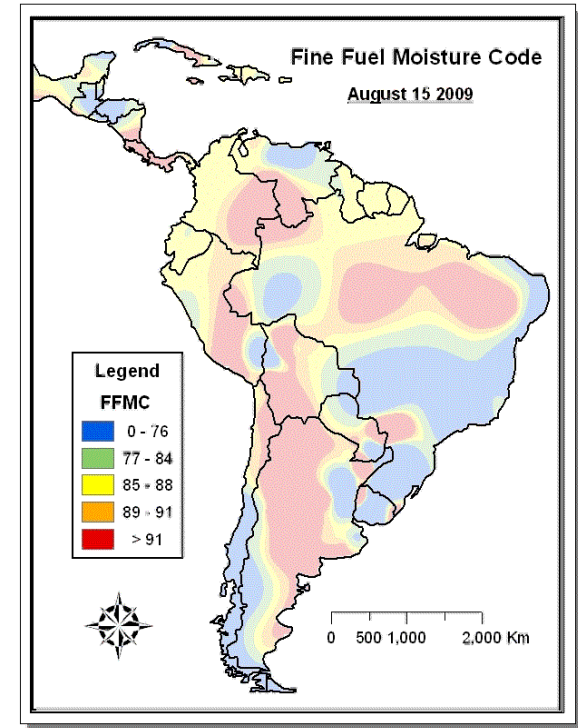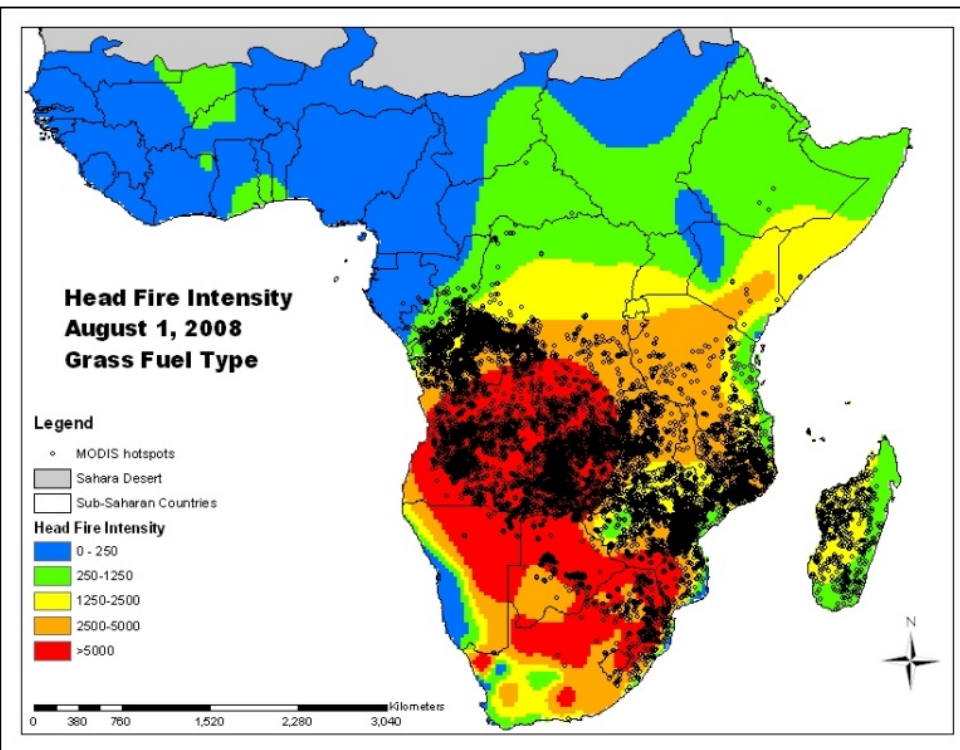
Wildfire Threat Level		Resources on Standby	Alert Period	Dispatch Time
Low		crews, hand tools	mid-day	60-min
Moderate		crews, hand tools	all day	30 min
		pumps, water tanks	mid-day	60 min
High		crews, hand tools	all day	15 min
		pumps, water tanks	all day	30 min
		control line-building equipment	mid-day	60 min
Extreme		crews, hand tools	all day	15 min
		pumps, water tanks	all day	15 min
		control line-building equipment	all day	30 min
		aircraft, burnout equipment	mid-day	60 min

SAFNET

SAFNET became a regional network of GOFC-GOLD during 2002 to provide a forum for users and researchers operating in Southern Africa. It represents a link between national agencies, user groups and the global user/producer community.

Goals: Provision of satellite based fire products; Systematic fire monitoring and management; National to Regional Fire monitoring; Regional validation of fire products; Capacity building and training.
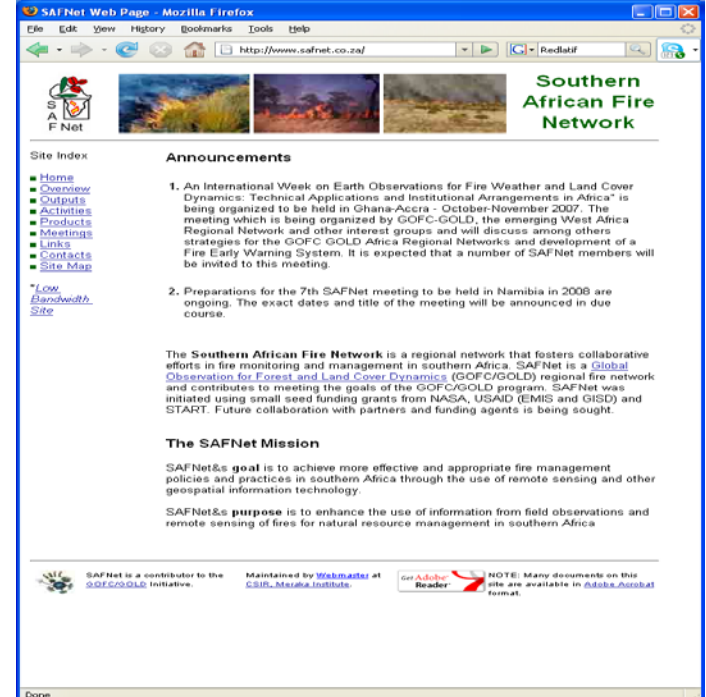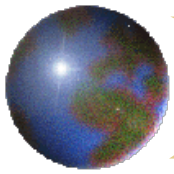
AFIS viewer
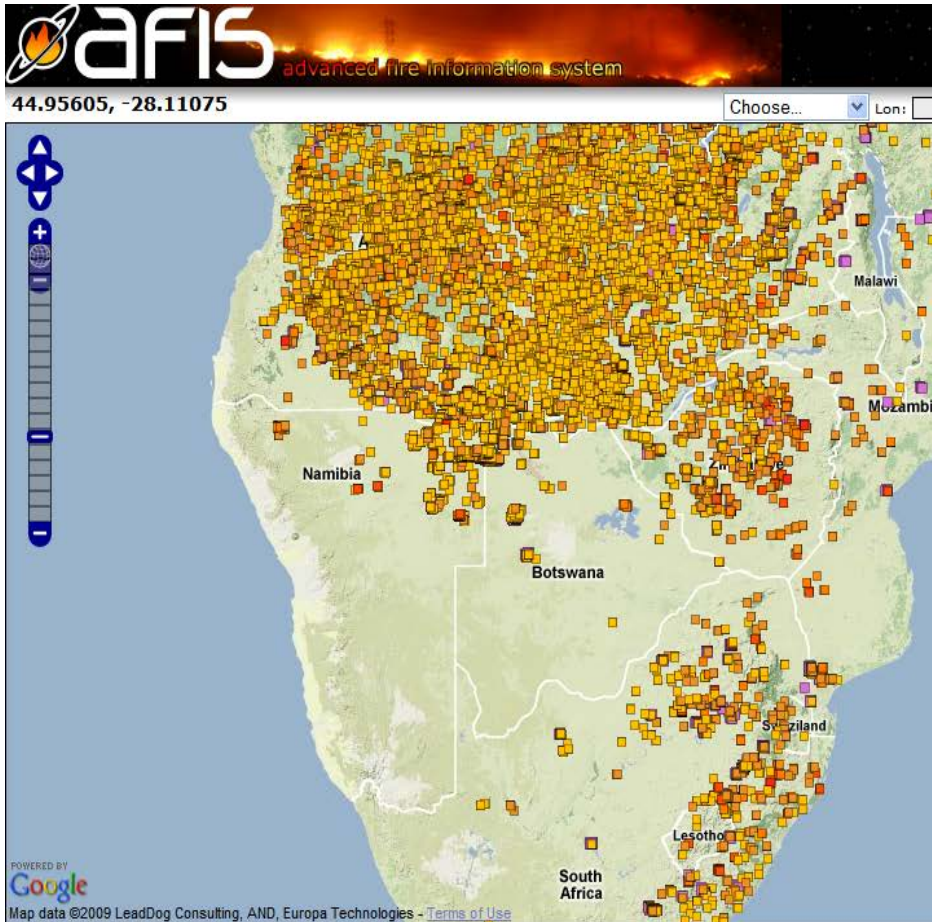
AFIS viewer includes:

Free access to all

MODIS active fires

MSG active fires every 15 min

MODIS BD burned area data

Automated weather stations

Fire Danger Predictions

False colour composites

www.wamis.co.za

EFFIS – European Forest Fire Information System
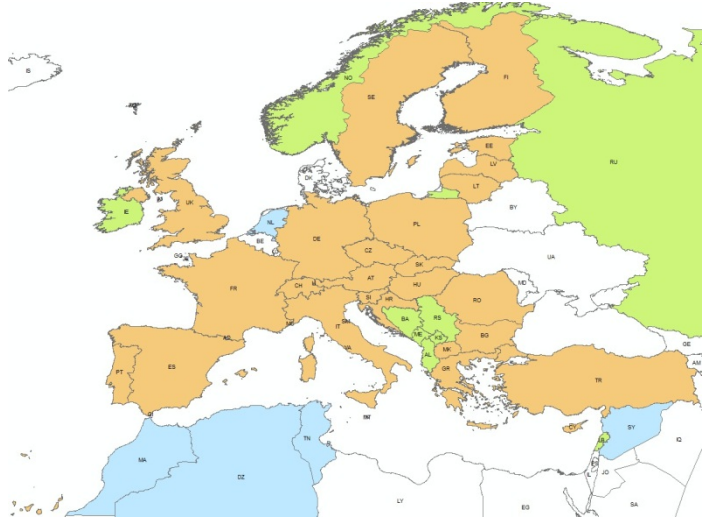
- Joint effort of national and EC services
- Network of 33 Countries, over 2 million records
- On-going extension to MENA countries in collaboration with FAO

- **Global Fire Information System to build on the work in EFFIS in collaboration with national and International organizations under the GOFC Fire IT umbrella.**

- **The European Forest Fire Information System (EFFIS) has <u>been established by the Joint Research Centre (JRC) and the Directorate General for Environment (DG ENV)</u> of the European Commission (EC, CFS and the GOFC Fire IT community in close collaboration with the Member States and neighbor countries, and national/regional networks.**

- **EFFIS aims at providing up-to-date, reliable information on forest fires at the European level, providing <u>European/Global level assessments during both pre-fire and post-fire phases, thus supporting fire prevention, preparedness, fire fighting and post-fire evaluations</u>.**

http://www.earthobservations.org/ts.php?id=222

DI-01-C4: Global Wildfire In... ✕

File   Edit   View   Favorites   Tools   Help

Send Ad Hoc Email

GROUP ON EARTH OBSERVATIONS

Component Sheet

| Component Sheet | Report Generator (beta) |

Export to Word:

Sign in

Email address   Password

[   ]   [   ]   Go

(forgot password? - reset it here)

Show Component Sheet update info

DI-01–C4

Introduction
Expected Achievements by 2015
Outputs and Activities

DI-01-C4: Global Wildfire Information System

[V 0] Last updated on:

Introduct

DI-01-C4 is a Co

The DI-01 Task

The Point of
miguel@jrc.ec.eu
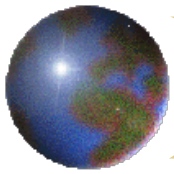
Related Comm
Community of Pr

Supporting Documents and Links

Participation

Role	Member or PO	Implementing Entity	Contact Name	Email Address
Lead (PoC)	GTOS	GOFC-GOLD	Jesus San Miguel-Ayanz	jesus.san-miguel@jrc.ec.europa.eu
Lead	Canada	Canadian Forest Service	Bill de Groot	bill.degroot@nrcan.gc.ca
Lead	European Commission	EC-JRC	Jesus San Miguel-Ayanz	jesus.san-miguel@jrc.ec.europa.eu
Lead	GTOS	GOFC-GOLD/UMD/NASA	Chris Justice	justice@hermes.geog.umd.edu
Lead	South Africa	CSIR	Karen Steenkamp	ksteenkamp@csir.co.za
Lead	United States	NASA	Vince Ambrosia	vincent.g.ambrosia@nasa.gov
Contributor	China	CEODE	Fang Chen	fangchen@ceode.ac.cn
Contributor	European Commission	EC-JRC	Andrea Camia	andrea.camia@jrc.ec.europa.eu
Contributor	Italy	CIMA	Paolo Fiorucci	paolo.fiorucci@cimafoundation.org
Contributor	Italy	FAO	Antonio Martucci	antonio.martucci@fao.org
Contributor	Japan	JAXA	Kazuya Kaku	kaku.kazuya@jaxa.jp
Contributor	South Africa	CSIR	Philip Frost	pfrost@csir.co.za
Contributor	United Kingdom	University of Edinburgh	Albert Simeoni	A.Simeoni@ed.ac.uk
Contributor	United States	University of Maryland	Krishna Prasad Vadrevu	krishna@hermes.geog.umd.edu

Daily global coverage with a 2~4 hour delay producing and distributing global fire detections and RGB imagery via. the Internet using FTP and ArcIMS feature server

http://rapidfire.sci.gsfc.nasa.gov
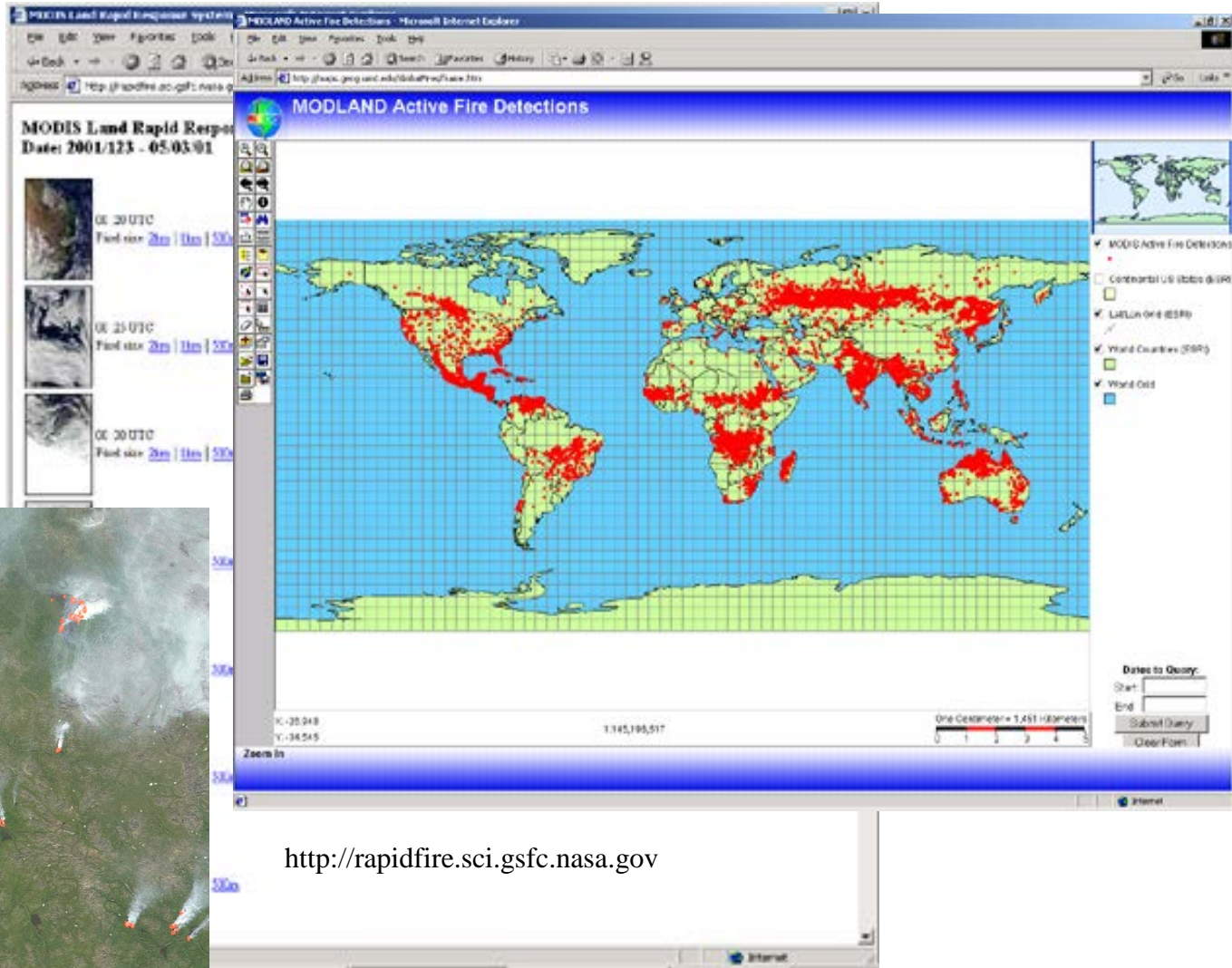
FIRMS

Fire Information for Resource Management System (FIRMS) providing 4 main tools for accessing fire information in easy to use formats:
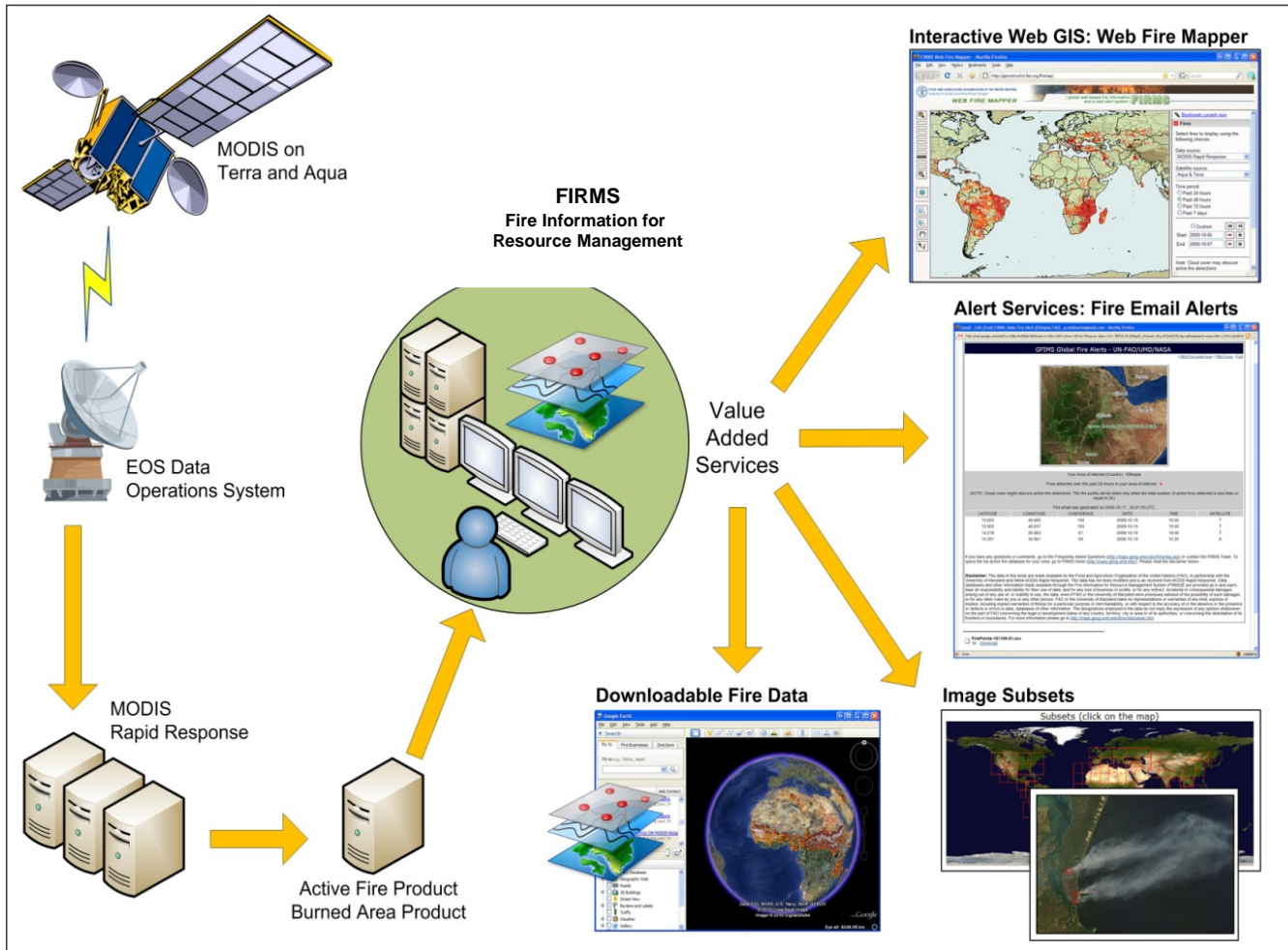
- **Interactive Web GIS**

- **Email alerts**

- **Subsets of MODIS images**

- **Active fire data downloads (KML, Shape, Text files and plug-ins for Google Earth and NASA World-Wind)**

Regional Networks

Regional Networks and Coordinators

Legend:
- Latin America
- Siberia-far-East
- Southeast Asia
- Central Asia
- Central_Africa
- West Africa
- South Africa
- India

7000   0   7000   14000 Miles

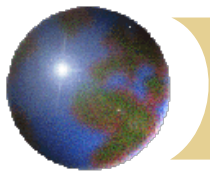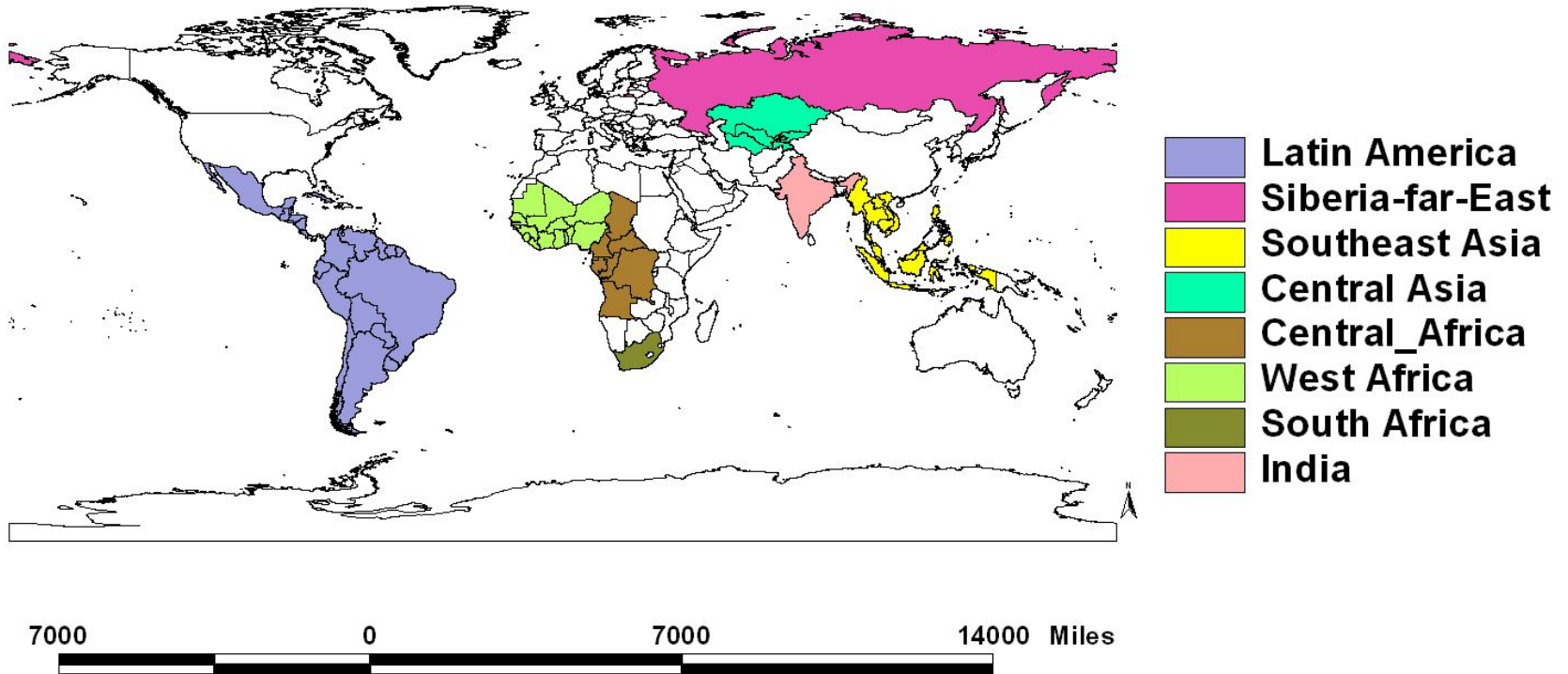*The principal role of GOFC/GOLD is to act as a coordinating mechanism for national and regional activities. To achieve its goals GOFC/GOLD has developed a number of regional networks across the world.*

Regional networks are expected to cater the regional users needs and foster lateral transfer of technology and methods within and between regions relating to Fire activities.

Regional Networks and Coordinators

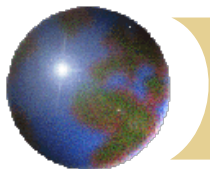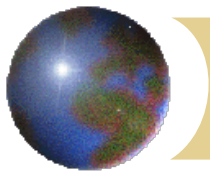| Regional Network	Coordinator	Country	Organization	Email
AMAZON RN	Souza, Carlos	Brazil	Imazon - Inst. do Homem e Meio Ambiente da Amazônia	souzajr@imazon.org.br
NERIN	Krankina, Olga	USA/Russia	Oregon State University	olga.krankina@oregonstate.edu
CARIN - Fire	Erdenetuya, M	Mongolia	Institute of Remote Sensing	m_erdenetuya@yahoo.com
OSFAC	Mane, Landing	DR Congo	OSFAC Office, Kinshasa, DRC	lmane@osfac.net
Redlatif	Cruz, Isabel	Mexico	CONABIO National Commission for the Knowledge and Use of the Biodiversity	isabel.cruz@conabio.gob.m
West Africa RN	Mbow, Cheikh	Sénégal	Université Cheikh Anta Diop	cheikh_penda@yahoo.fr
Miombo Network	Kwesha, Dominick	Mozambique	Universidade Católica de Moçambique	dkwesha2001@yahoo.co.uk
SAFNet	Frost, Philip	South Africa	CSIR-Meraka Institute	PFrost@csir.co.za
SEARRIN	*In transition*	Malaysia	Universiti Kebangsaan Malaysia	mastura@pkrisc.cc.ukm.my
East Asia RN	Pang Yong	China	Chinese Academy of Forestry	caf.pang@gmail.com

GOFC-Fire Implementation Team
Prof. Chris Justice (Fire IT co-Chair);
Dr. Krishna Prasad Vadrevu (Fire IT Executive Officer/contact)
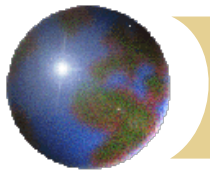**Anja Hoffman (Regional network coordinator)**

Role of Regional Networks

Latin America
Siberia-far-East
Southeast Asia
Central Asia
Central_Africa
West Africa
South Africa
India

- Strengthen involvement of local scientists for improved validation of satellite fire products.

- Play increased role in future satellite missions/products through responding to questionnaires/surveys from agencies.

- Share local data more openly and assist in product calibration and validation.

- Focus on evaluating fire regimes/products, and link with land use cover change and climate.

- Interact with the other Regional network scientists effectively to secure funding from International agencies.

- Improve and extend outreach activities through international collaborations and GOFC Fire IT.
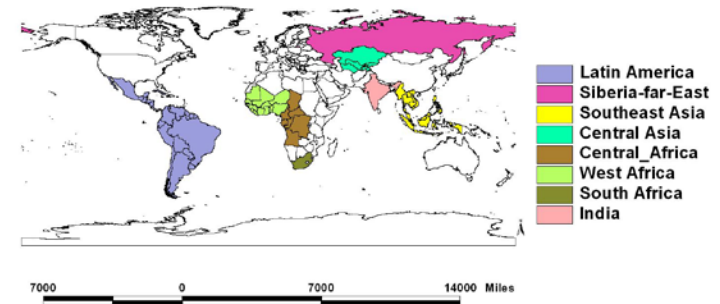
- Resources for <u>Regional Networks</u> – UN, FAO(?) ?
- Support for the International <u>Global Fire Assessment</u>
- Help <u>users understand</u> the different products
  - Product inter-comparison and regional joint validation initiatives via the GOFC / UN Fire Networks
- Putting Fire higher on the <u>agency observation priorities</u>
- Ensuring <u>continued support</u> for GOFC-GOLD Fire related activities.

- A Global Fire Monitoring System of Systems !?*!?