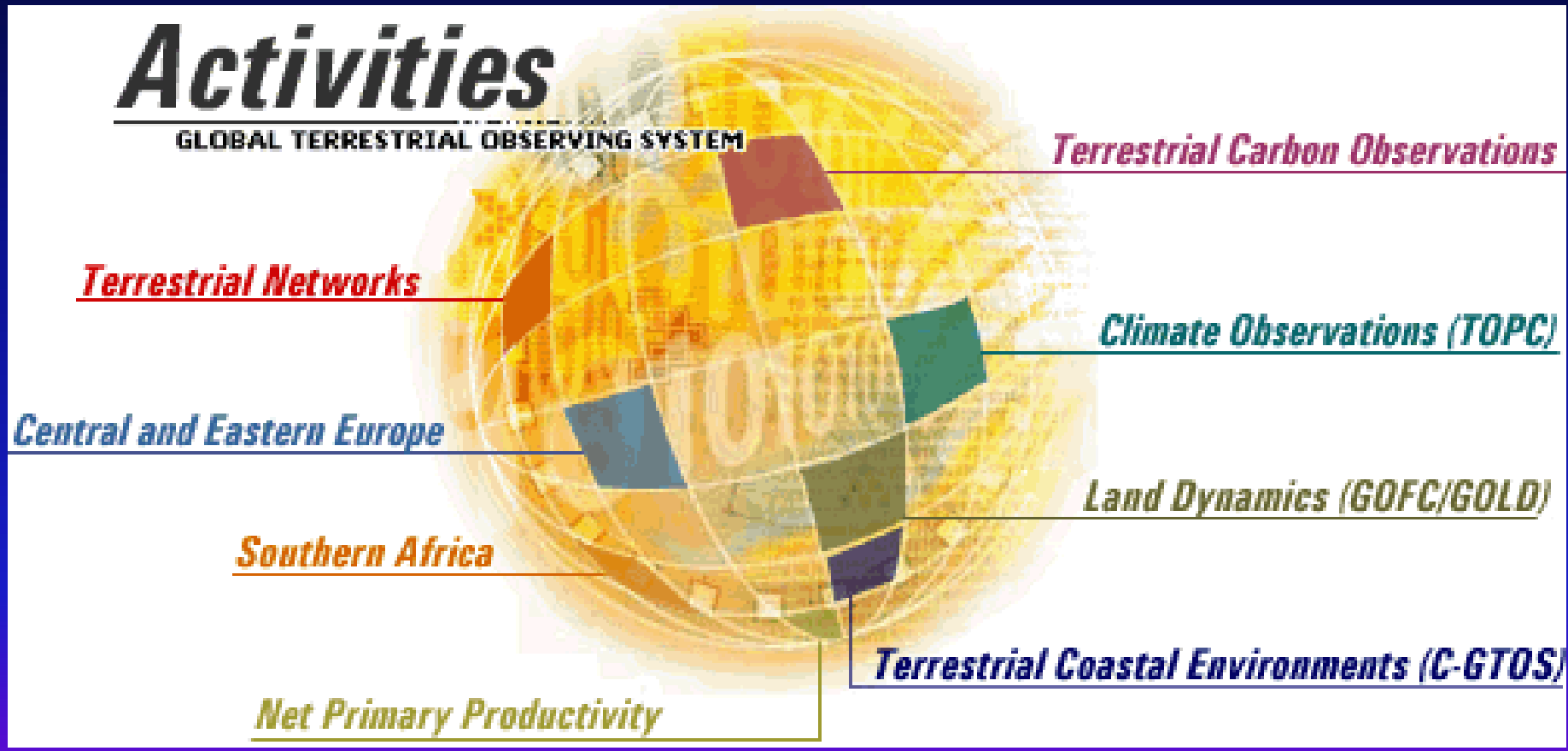
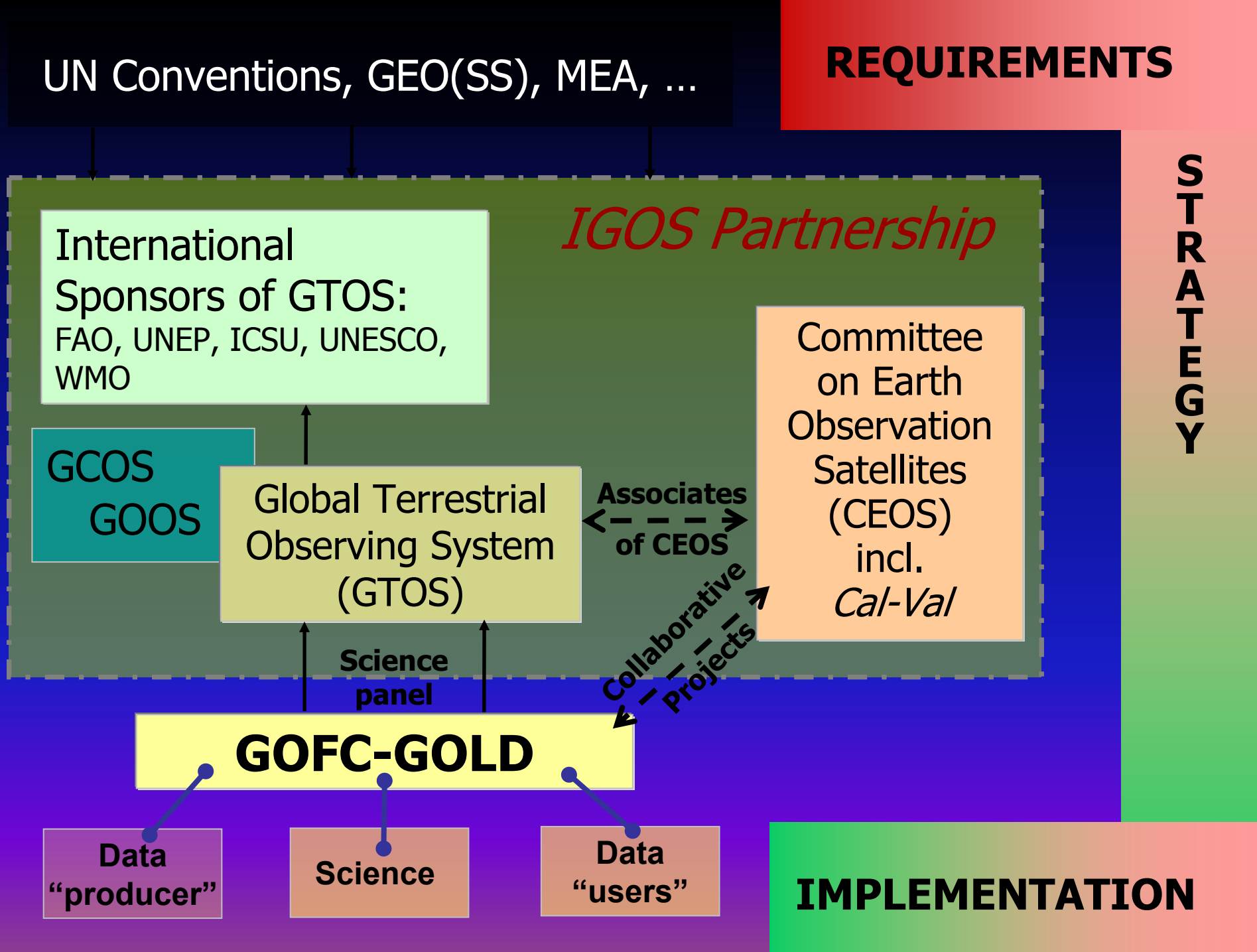
GOFC-GOLD Fire: an overview

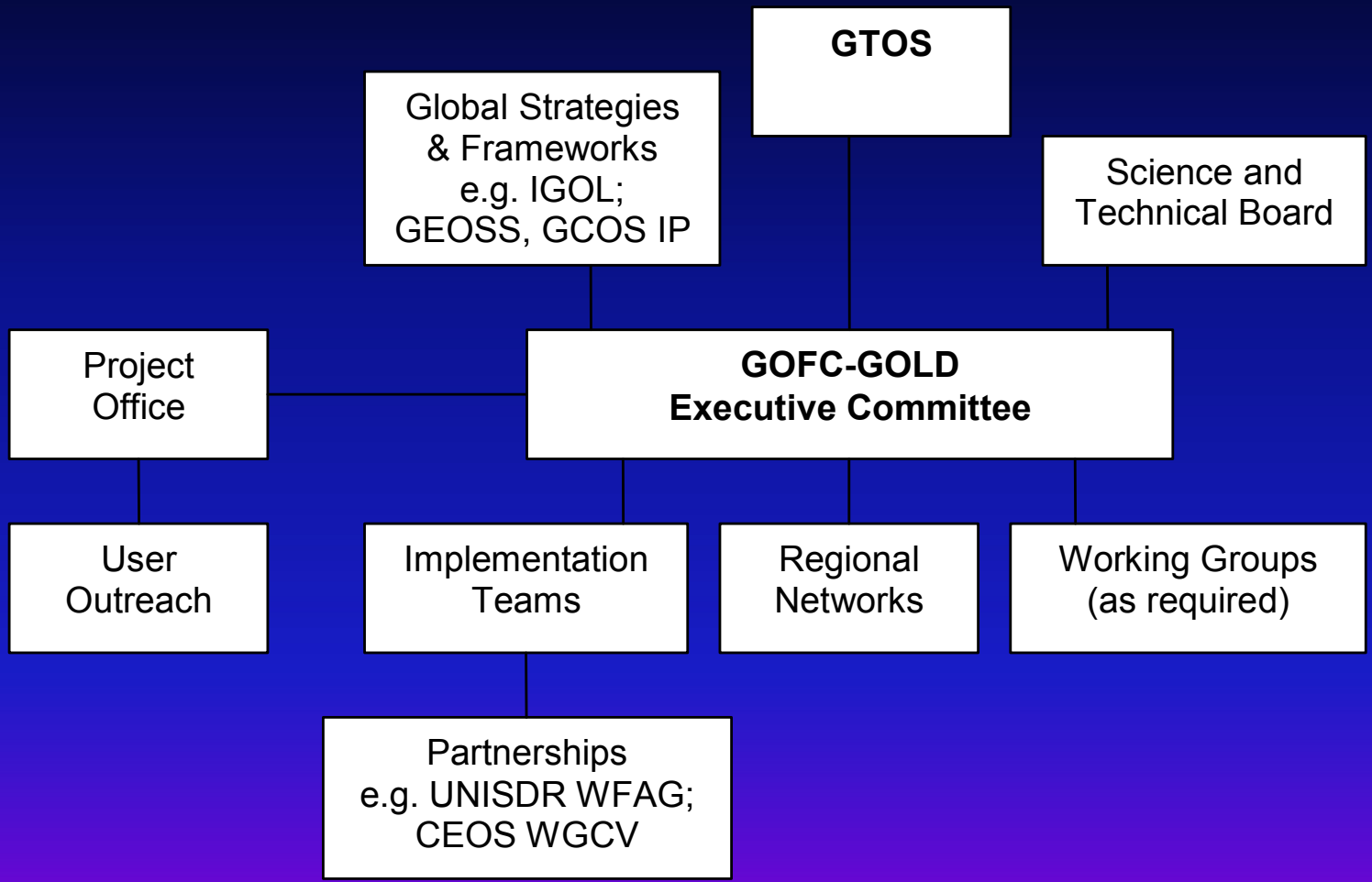
with contribution from J. Townshend, M. Brady, C. Justice, J. Goldammer, D. Roy, J. Morisette, I. Csiszar and others

GTOS


Activities
GLOBAL TERRESTRIAL OBSERVING SYSTEM
Terrestrial Carbon Observations
Terrestrial Networks
Climate Observations (TOPC)
Central and Eastern Europe
Land Dynamics (GOFC/GOLD)
Southern Africa
Terrestrial Coastal Environments (C-GTOS)
Net Primary Productivity


UN Conventions, GEO(SS), MEA, …
REQUIREMENTS
STRATEGY
IGOS Partnership
International Sponsors of GTOS: FAO, UNEP, ICSU, UNESCO, WMO
GCOS
GOOS
Global Terrestrial Observing System (GTOS)
Associates of CEOS
Committee on Earth Observation Satellites (CEOS) incl. Cal-Val
Collaborative Projects
Science panel
GOFC-GOLD
Data "producer"
Science
Data "users"
IMPLEMENTATION

GOFC-GOLD Management Structure



Functions of GOFC-GOLD

1. Specifying requirements for products
2. Assessing algorithms and data assimilation procedures
3. Ensuring the availability of observations
4. Harmonization and the development of protocols and standards
5. Ensuring that operational products meet accuracy requirements
6. Capacity building and the role of regional networks
7. Creating GOFC-GOLD products and services
8. Providing information to support international assessments
9. Advocacy role, especially in relation to the continuity of observations and validation

International coordination

- Committee on Earth Observation Satellites (CEOS)
  - Increasing the use of and support for satellite observations
  - *Need to engage users*
- Integrated Global Observing System
  - Space agencies with UN operational partners – WMO, FAO, etc
  - Recognizes the need to integrate space and in-situ observations
  - GCOS- climate, GOOS-ocean, GTOS-land
  - IGOS Themes – Carbon, Water, GeoHazards, Coastal Zones
  - **IGOS Land Theme = IGOL**
    - Landcover, Land Use, Agriculture, Forestry, Soils, Biodiversity, etc
    - Defining the necessary Land Observation improvements – 06 report
  - *Need to engage donors (nations)*
- Global Earth Observations System of Systems: GEOSS
  - Ministerial support / national commitments
  - Focus on Societal Benefits – Disasters, Agriculture/Forestry etc
  - Established workplan tasks for 06

GCOS Implementation Plan

Essential Climate Variables (ECV)

Table 1. Essential Climate Variables that are both currently feasible for global implementation and have a high impact on UNFCCC requirements.

Domain	Essential Climate Variables	
Atmospheric (over land, sea and ice)	**Surface:**	Air temperature, Precipitation, Air pressure, Surface radiation budget, Wind speed and direction, Water vapour.
	Upper-air:	Earth radiation budget (including solar irradiance), Upper-air temperature (including MSU radiances), Wind speed and direction, Water vapour, Cloud properties.
	Composition:	Carbon dioxide, Methane, Ozone, Other long-lived greenhouse gases[2], Aerosol properties.
Oceanic	**Surface:**	Sea-surface temperature, Sea-surface salinity, Sea level, Sea state, Sea ice, Current, Ocean colour (for biological activity), Carbon dioxide partial pressure.
	Sub-surface:	Temperature, Salinity, Current, Nutrients, Carbon, Ocean tracers, Phytoplankton.
Terrestrial[3]	River discharge, Water use, Ground water, Lake levels, Snow cover, Glaciers and ice caps, Permafrost and seasonally-frozen ground, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (fAPAR), Leaf area index (LAI), Biomass, Fire disturbance.	

13 land ECV's (some including multiple products)

Terrestrial ECVs largely dependent on satellite observations (10): Lakes, Snow cover, Glaciers and ice caps, Albedo, Land cover (including vegetation type), fAPAR, LAI, Biomass, Fire disturbance, Soil moisture

GOFC-GOLD Product Specifications for Terrestrial ECVs

Variable	Product
Land cover	- Moderate resolution land cover type - High resolution land cover type for land cover change - Land cover change history
Fire disturbance	- Burnt area - Active fire (suppl.) - Fire radiative power (suppl.)
Biomass?	- *Biomass/NPP*

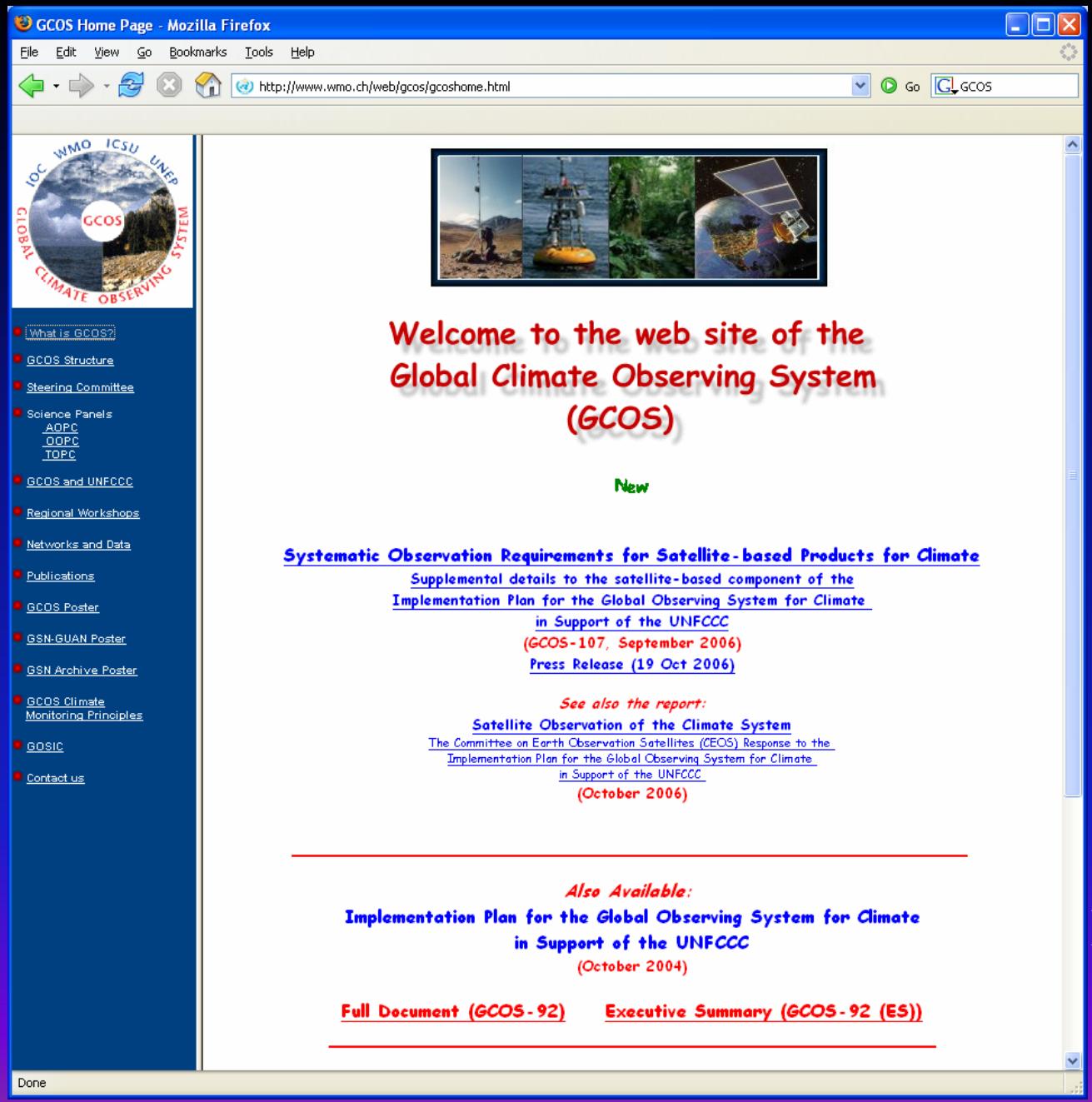
2005 Progress Report

Selected Terrestrial Variables of the GCOS Implementation Plan

- Land Cover actions:
  - standards and specifications for land-cover characterization maps (T22)
  - methods for land-cover map accuracy assessment (T23)
  - continuity of fine resolution datasets (T24)

- Fire Disturbance actions:
  - reanalyze historical fire disturbance data (T32)
  - generation of active fire and burnt area products (T33)
  - apply CEOS WGCV and GOFC-GOLD validation protocol to fire disturbance data (T34)
  - make gridded fire and burnt area products available through a single International Data Centre (T35)

GCOS



Satellite Requirements

CEOS response

Implementation Plan

http://www.wmo.ch/web/gcos/gcoshome.html

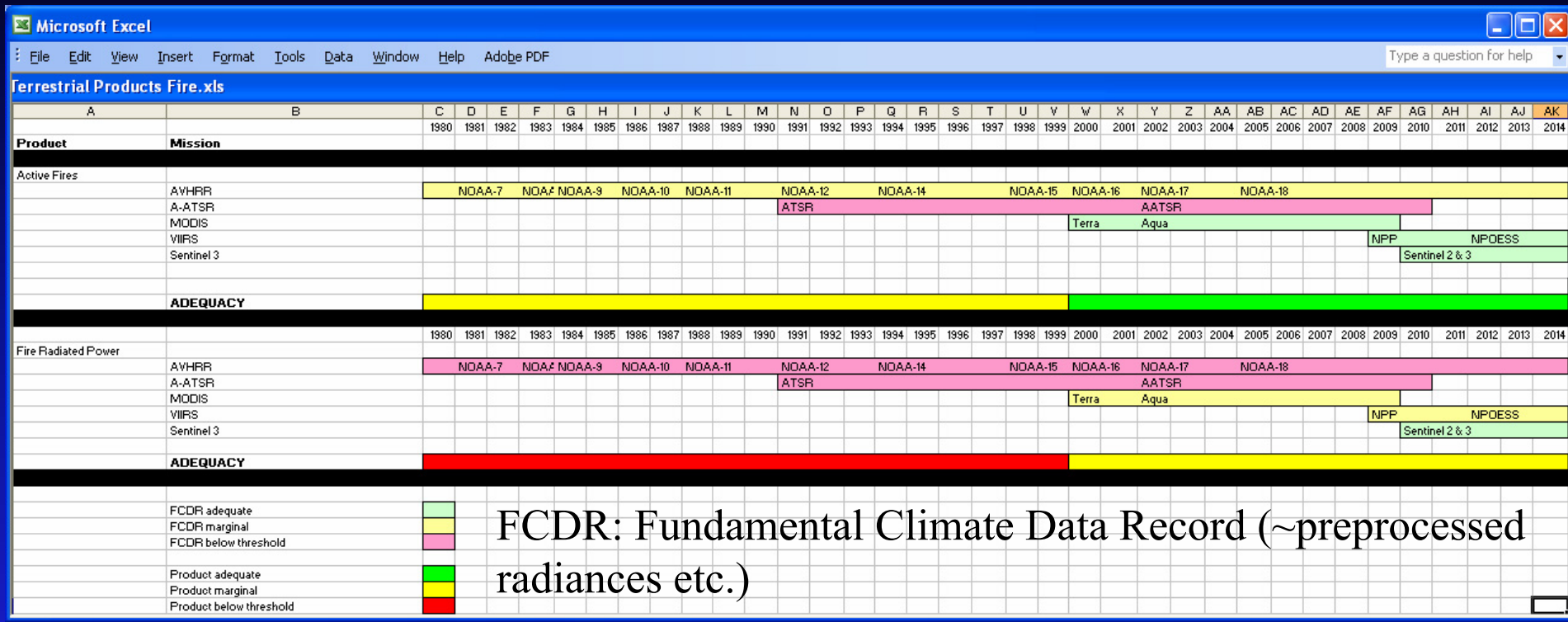
GCOS Climate Monitoring Principles (satellite measurements)

- Constant sampling within the diurnal cycle (minimizing the effects of orbital decay and orbit drift) should be maintained.
- A suitable period of overlap for new and old satellite systems should be ensured for a period adequate to determine inter-satellite biases and maintain the homogeneity and consistency of time-series observations.
- Continuity of satellite measurements (i.e., elimination of gaps in the long-term record) through appropriate launch and orbital strategies should be ensured.
- Rigorous pre-launch instrument characterization and calibration, including radiance confirmation against an international radiance scale provided by a national metrology institute, should be ensured.
- On-board calibration adequate for climate system observations should be ensured and associated instrument characteristics monitored.

GCOS Climate Monitoring Principles (satellite measurements)

- Operational production of priority climate products should be sustained and peer-reviewed new products should be introduced as appropriate.
- Data systems needed to facilitate user access to climate products, meta-data and raw data, including key data for delayed-mode analysis, should be established and maintained.
- Use of functioning baseline instruments that meet the calibration and stability requirements stated above should be maintained for as long as possible, even when these exist on de-commissioned satellites.
- Complementary *in situ* baseline observations for satellite measurements should be maintained through appropriate activities and cooperation.
- Random errors and time-dependent biases in satellite observations and derived products should be identified.

CEOS Assessment: active fire example



Microsoft Excel

File Edit View Insert Format Tools Data Window Help Adobe PDF — Type a question for help

Terrestrial Products Fire.xls

Product	Mission	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Active Fires																																				
	AVHRR		NOAA-7		NOAA	NOAA-9		NOAA-10		NOAA-11			NOAA-12			NOAA-14				NOAA-15		NOAA-16		NOAA-17			NOAA-18									
	A-ATSR												ATSR											AATSR												
	MODIS																					Terra		Aqua												
	VIIRS																														NPP			NPOESS		
	Sentinel 3																															Sentinel 2 & 3				
	ADEQUACY																																			
Fire Radiated Power																																				
	AVHRR		NOAA-7		NOAA	NOAA-9		NOAA-10		NOAA-11			NOAA-12			NOAA-14				NOAA-15		NOAA-16		NOAA-17			NOAA-18									
	A-ATSR												ATSR											AATSR												
	MODIS																					Terra		Aqua												
	VIIRS																														NPP			NPOESS		
	Sentinel 3																															Sentinel 2 & 3				
	ADEQUACY																																			

FCDR adequate
FCDR marginal
FCDR below threshold

Product adequate
Product marginal
Product below threshold

FCDR: Fundamental Climate Data Record (~preprocessed radiances etc.)

Current formal climate data record evaluation based on polar orbiters only: potential of geostationary data listed in detailed assessment.

Assessment part of the work towards generating the report “Satellite Observation of the Climate System – the Committee on Earth Observation Satellites (CEOS) Response to the Global Climate Observing System (GCOS) Implementation Plan (IP)” - statement presented at UNFCCC COP 12 (Nairobi, Kenya November 2006)

2006 GEOSS Implementation Plan

- Contribute to 8 tasks (agriculture, disasters, climate, biodiversity, ecosystems)
- Co-lead 5
  - warning system for fire and monitoring for forest conversion
  - establishing continuity for near real-time, 30-m (or better) resolution, multi-spectral remote-sensing coverage
  - assessment on forests and forest changes utilizing ongoing land cover mapping projects
  - production of a high-resolution global land-cover change dataset
  - develop a network of organization-networks for ecosystems

GTOS/GOFC-GOLD Tasks for GEO

GEO Comm.	GEO Task (and role)	Priority* (HML)
ADC	DI-06-13 Initiate a globally coordinated warning system for fire and monitoring for forest conversion, including the development of improved information products and risk assessment models. (co lead with Portugal)	H
ADC	AR-06-09 Advocate establishing continuity for near real-time, 30-m (or better) resolution, multi-spectral remote-sensing coverage everywhere on the Earth's surface, including support for the launch of a Landsat-equivalent follow-on mission. (co lead with CEOS, USGS)	M
ADC	AG-06-04 Initiate an international assessment effort on forests and forest changes utilizing ongoing land cover mapping projects (e.g. GLOBCOVER). Ensure application of standardized classifications and harmonization of existing datasets. (co lead with GTOS, FAO & USGS)	M
UIC	US-06-02 Initiate pilot communities of practice to identify and further refine users' needs, in particular on cross-cutting areas, building upon the initial experience of community of practice and on information provided by national, regional and project-level surveys. (contribute)	H
UIC	DI-06-09 Expand the use of meteorological geostationary satellites for the management of non-weather related hazards. (contribute)	M
STC	AG-06-03 Utilizing global and regional high resolution land-cover datasets (e.g. GLOBCOVER) and earlier 1-km resolution land cover data sets (e.g. Global Land Cover 2000), implement production of a high-resolution global land-cover change dataset and report. Propose mechanisms for regular analysis and reporting on land cover change building on current efforts and promulgate the use of these products, especially in developing countries. (co lead with USGS)	H
CBC	EC-06-07 Build upon existing initiatives (e.g. ANTARES in South America for oceans and GOFC-GOLD regional networks for terrestrial domains) to develop a global network of organization-networks for ecosystems, and coordinate workshops to strengthen observing capacity in developing countries. (co lead with POGO, USGS)	M
CBC	DI-06-12 Initiate a knowledge-transfer programme to developing countries, to ensure basic capacity to utilize Earth observations for disaster management. (contribute)	L

ADC: Architecture and Data; CBC: Capacity Building; STC: Science and Technology; UCI: User Interface

Fire Mapping and Monitoring

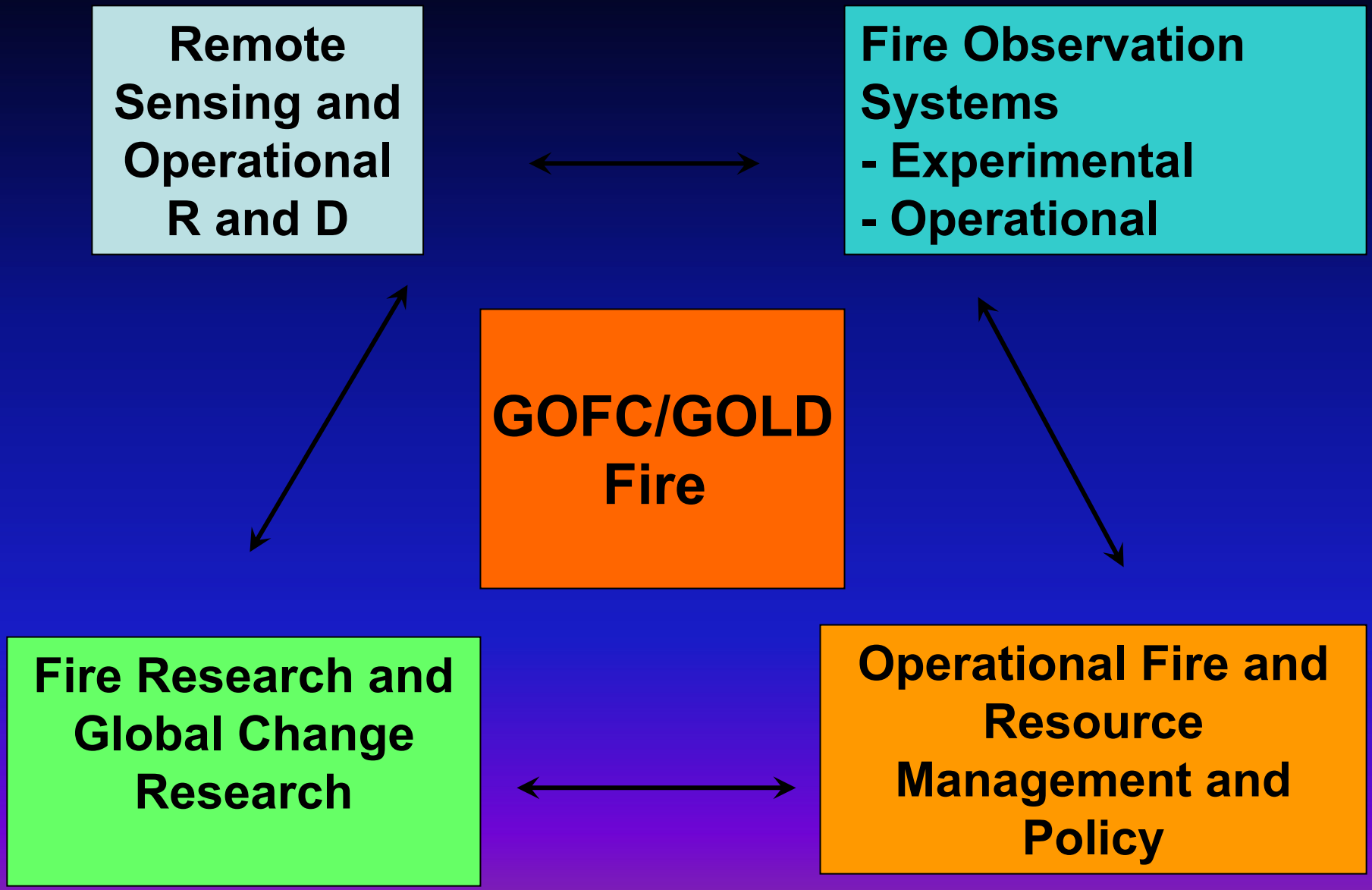
The Fire Mapping and Monitoring theme focuses on refining international requirements for fire-related observations and making the best possible use of fire products from existing and future satellite observing systems to support fire management, policy decision-making, and global change research.

Key goals are to ensure enhanced operational fire monitoring from space and ground measurements, better access and use of data, and standard products of known accuracy.

The Fire theme is carried out by an implementation team that works with the GOFC-GOLD regional networks to bring together fire data providers and users to exchange information on capabilities and needs and to promote strengthening of regional and national fire activities.

http://gofc-fire.umd.edu

Promote interaction between a number of major communities



GOFC/GOLD-Fire Goals

- **Increase user awareness and data use**
- **Establish a geostationary global fire network**
- **Secure *operational* polar orbiters with adequate fire monitoring capability**
- **Determine product accuracies**
- **Develop fire emissions product suites**
- **Develop long-term fire data records**
- **Establish enhanced user products and improved data access**
- **Promote experimental fire observation systems and related research**

CEOS LAND PRODUCT

WGCV

Working Group on Cal/Val

CEOS

Committee on Earth Observing Satellites

LPV

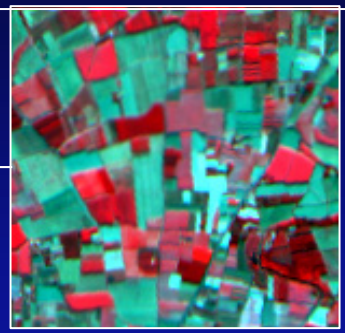
Land Product Validation Subgroup

(current chair = Jeff Morisette)

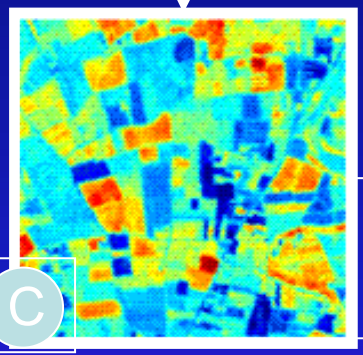
Current Validation Framework

Field data

High resolution imagery



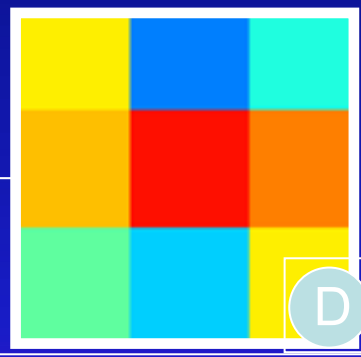
Transfer function



C

High resolution "Product"

Aggregate & Relate



D

Moderate resolution "Product"

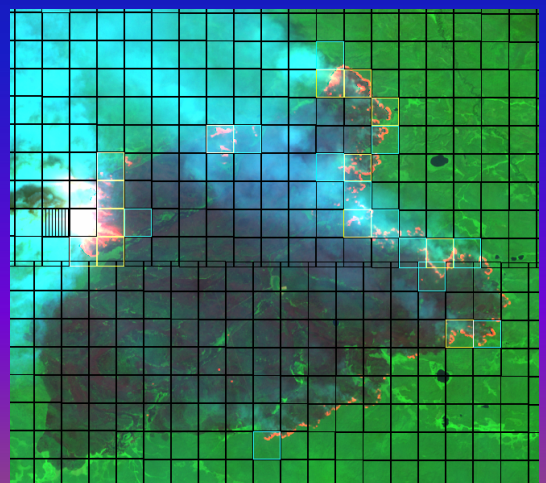
Accuracy Assessment

for one product, at one site, at one point in time

(Jeff Morisette)

MODIS active fire validation protocol

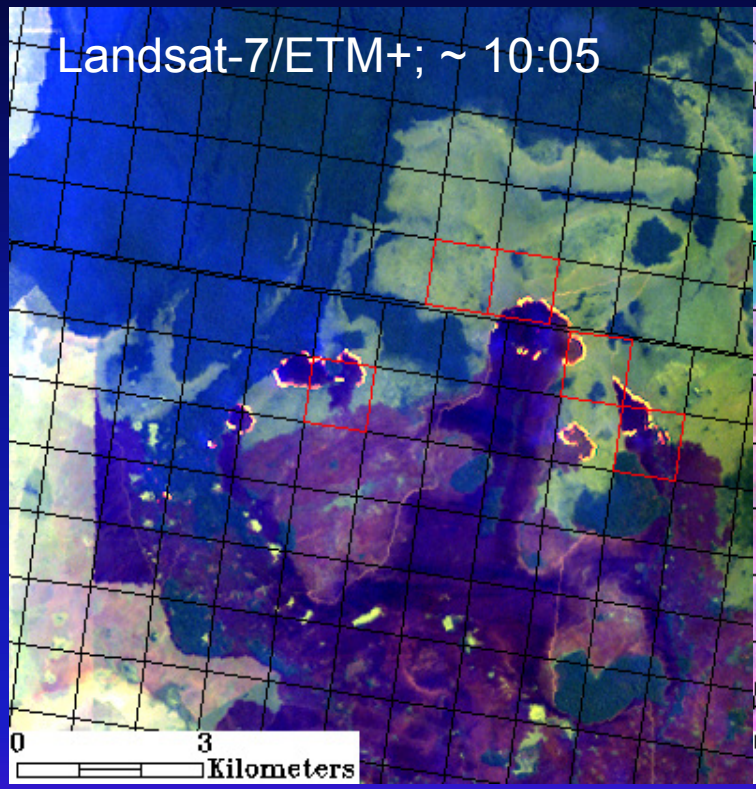
- Generate and visually verify fire masks from ASTER
- Co-register ASTER and MODIS
- Derive summary statistics of ASTER fire pixels
  - total number of fire pixels
  - average number of fire pixels in fire clusters
- Calculate detection probabilities using statistical modeling
  - currently logistic regression
- Derive accuracy assessment curve (omission error rates as a function of fire classification threshold)
- Derive commission error rate



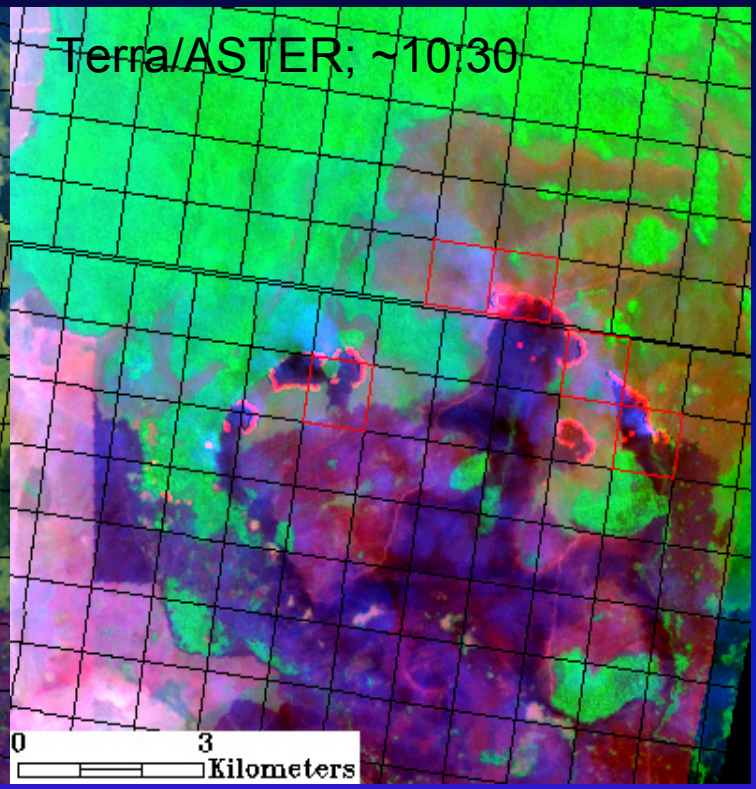
ASTER (30m)
1km MODIS grid

- Convert ASTER pixel - based statistics to physical fire/background characteristics (under development)

Multi-platform validation



RGB: 7 (2.09-2.35µm) - 5 (1.55-1.75 µm) - 2 (0.525-0.605 µm).

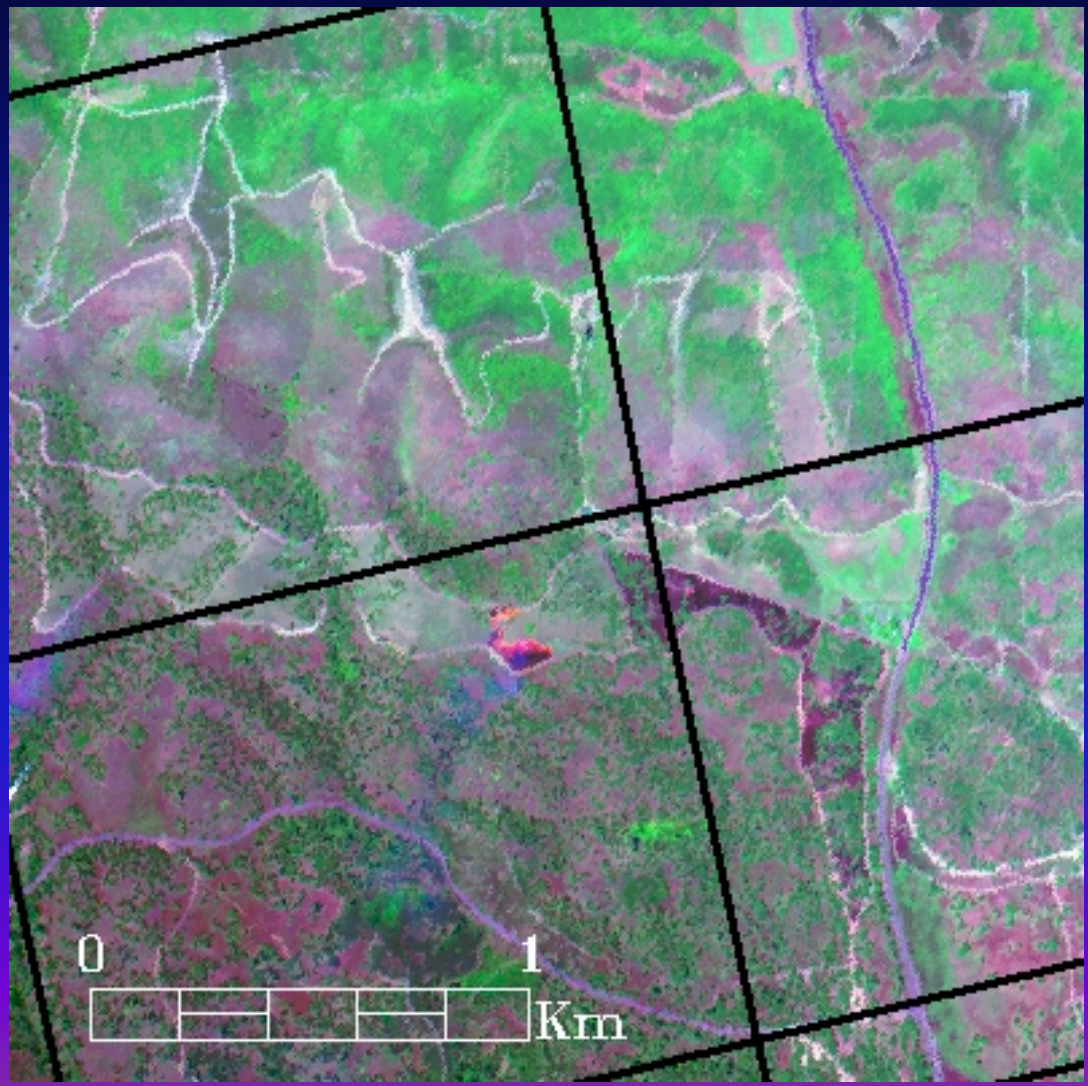


RGB: 8 (2.235 - 2.285 µm) - 3 (0.76 - 0.86 µm) - 1 (0.52 - 0.60 µm).

What is the impact of the time difference between the product to be validated (here MODIS) and the reference data (here Landsat-7/ETM+)?

Airborne observations

June 6 2006 at 20:53 UTC.



36° 02’50”N 121° 11’ 08” W

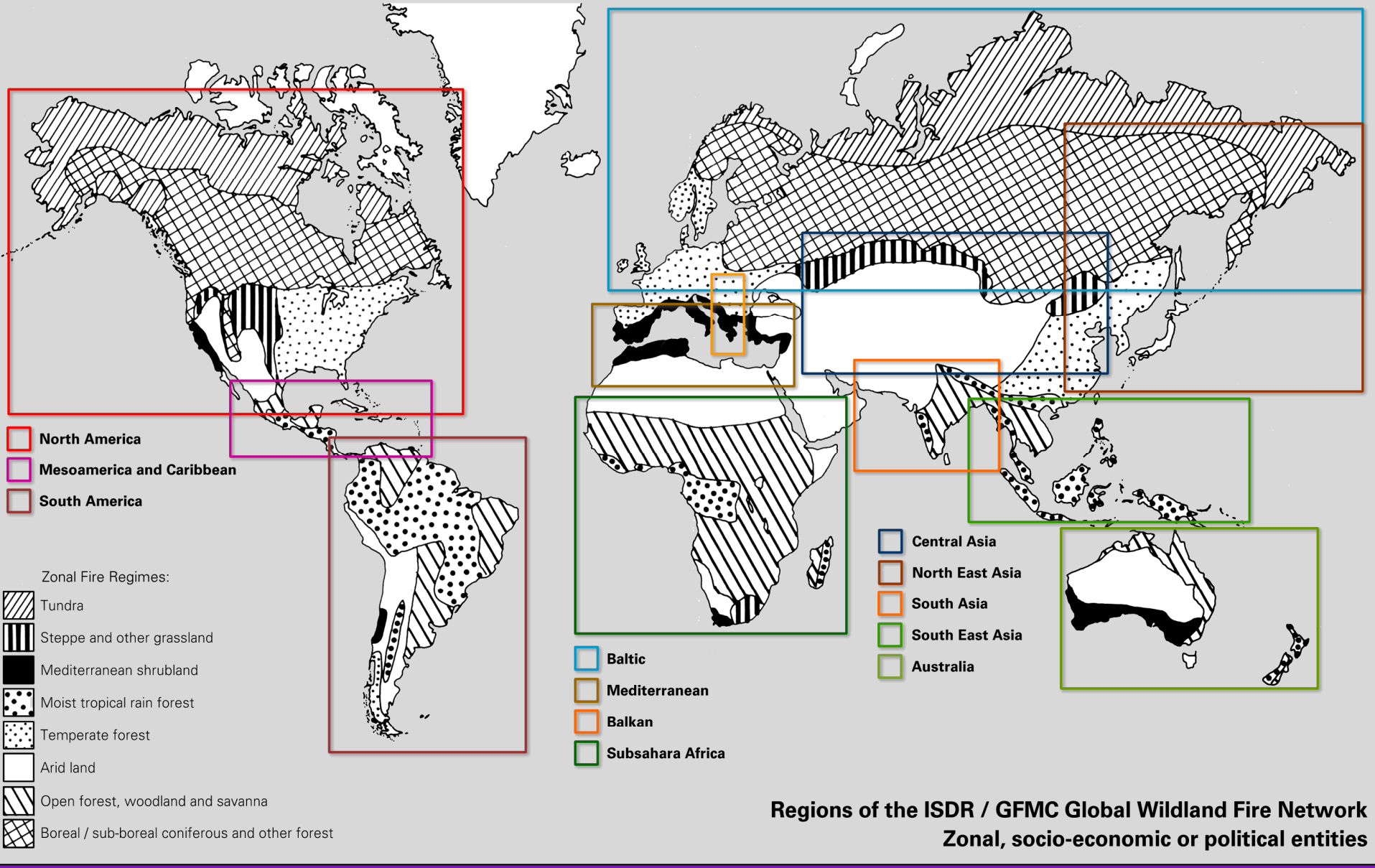
Channel 10 (2.08-2.35μm) – 8 (0.91-1.05μm) – 1 (0.42-0.45μm) red-green-blue image of a fire from the WILDFIRE scanner. The pixel size is ~ 6m. The fire front is shown in red. This image corresponds to an off-nadir scan angle of ~33.8° and a nominal pixel size of ~2.5 km^2 of Aqua MODIS. The black grid represents the boundaries of the nominal MODIS pixels.

V. Ambrosia, NASA

GOFC-GOLD SAFNet burned area validation protocol

- Compare MODIS burned area product with independent spatially explicit burned area data derived from multitemporal Landsat ETM+ data
- SAFNet field trip held to develop the mapping protocol and to discuss southern African fire information needs, Zimbabwe-Zambia, July 2000
- SAFNet members map the areas burned between 2+ Landsat acquisitions, augmented by limited fieldwork
- Consensus mapping protocol to ensure regionally consistent independent validation data
- protocol followed 2000-2002 at ~11 ETM+ scenes/year

The UN-ISDR / GFMC Global Wildland Fire Network



Regions of the ISDR / GFMC Global Wildland Fire Network
Zonal, socio-economic or political entities

Current priorities

- Geostationary network
- FAO/FRA fire
  - GOFC-GOLD Fire assessment?
- UN agenda and partnership
  - coordinated network development – South Asia
- Global early warning system
- MODIS-VIIRS continuity and harmonization with other missions (i.e. GMES Sentinel)
  - Global 1km AVHRR from METOP
- Fire characterization
- Continuing GEO participation
- Research to operations

Major planned meetings in 2007

- 4th International Wildland Fire Conference (Seville, Spain, 13-17 May)
  - regional GOFC-GOLD representation

- 32nd International Symposium on Remote Sensing of Environment (San Jose, Costa Rica, 25-29 June)
  - Fire session: fire remote sensing and Latin American network

- 6th International Workshop of the EARSeL Special Interest Group (SIG) on Forest Fires (Thessaloniki, Greece, 27 - 29 September 2007)
  - Implementation Team meeting and European network

GOFC-GOLD Fire website gofc-fire.umd.edu

GOFC-Fire Web Page - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

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

GOFC/GOLD-FIRE

GOFC/GOLD Fire Monitoring and Mapping Implementation Team

Site Index

- Home
- News
- Background
- Objectives
- Participants
- Regional Networks
- Implementation
- Projects
- Meetings
- Resources
- Site Map
- Search*

*Page under construction

- En español
- По-русски

Acknowledgments

What is GOFC/GOLD-Fire?

GOFC/GOLD (Global Observations of Forest and Land Cover Dynamics) is a project of the Global Terrestrial Observing System (GTOS) program, which is sponsored by the Integrated Global Observing Strategy (IGOS). The main goal of GOFC/GOLD is to provide a forum for international information exchange, observation and data coordination, and a framework for establishing the necessary long-term monitoring systems.

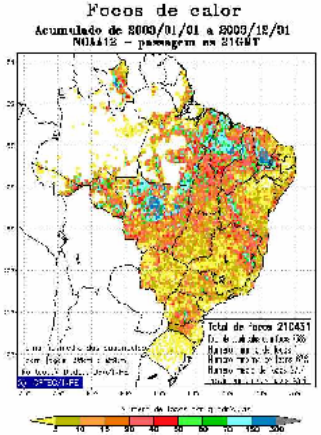
The GOFC/GOLD-Fire Mapping and Monitoring Theme is aimed at refining and articulating the international observation requirements and making the best possible use of fire products from the existing and future satellite observing systems, for fire management, policy decision-making and global change research.

GOFC/GOLD is promoting self-organized regional networks of data users, data brokers and providers, where closer linkages and collaborations are established with emphasis on an improved understanding of user requirements and product quality. GOFC/GOLD-Fire is pursuing, in a joint effort with the Committee on Earth Observing Satellites (CEOS) Working Group on Calibration and Validation (WGCV) Land Product Validation (LPV) subgroup, the coordinated validation of fire products by standardized protocols.

GOFC/GOLD-Fire is partnering with the Global Fire Monitoring Center (GFMC), and the United Nations International Strategy for Disaster Reduction (UNISDR) Wildland Fire Advisory Group / Global Wildland Fire Network

Featured contributory project

INPE Vegetation Fires



Click on the image for summary and link to project website.
Refresh this page for more projects, or go to the full list of projects.

Latest news headlines

New Indonesian fire project funded by AusAid

Latest meeting information

2nd GOFC/GOLD Workshop on Geostationary Fire Monitoring and Applications

GOFC/GOLD-Fire is one of the three themes of the overall GOFC/GOLD initiative

Maintained by Ivan Csiszar at University of Maryland

NOTE: Many documents on this site are available in Adobe Acrobat format

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