*Download shortened print version of ECV factsheet (pdf) **here**.*

Data Sources ECV Products and Requirements

Fire

Fires have impacts on several identified radiative forcing agents. While they can be a natural part of many ecosystems, they have a strong human control, particularly in Tropical ecosystems. Fires contribute to the build-up of CO2 through deforestation and forest degradation, emissions from peatland fires, and alterations of fire regimes(more frequent, larger or more severe fires). They also emit CH4, and are a major source of aerosols, CO and oxides of nitrogen, thus affecting local and regional air quality. Estimates of greenhouse gas emissions due to fires are essential for realistic

Background

- Kevin Tansey was the Fire rapporteur for the previous GCOS report.
- Kevin suggested my name to WMO to be Fire Steward in Feb. 2019.
- I was asked to review the Fire ECV and Requirements.
- I have been reviewing requirements and action list since then.
- Appointed as member of the Terrestrial Observation Panel for Climate (TOPC) in August, 2020.

GCOS-200 (GCOS-214) Actions 2016

Action T60:	Historic fire data
Action	Reanalyse the historical fire disturbance satellite data (1982 to present).
Benefits	Climate modelling communities.
Timeframe	By 2020.
Who	Space agencies, working with research groups coordinated by GOFC-GOLD Fire By 2020.
Performance Indicator	Establishment of a consistent dataset, including the globally available AVHRR data record.
Annual Cost	1-10M US$

Action T61:	Operational global burned area and FRP
Action	Continue the production of operational, global burned area active fire (with associated FRP) product with metadata and uncertainty characterizations that meet threshold requirements and have necessa product back-up to ensure operational delivery of products to users.
Benefits	Climate modelling communities. space agencies, civil protection services, fire mangers, other users
Timeframe	Continuous.
Who	Space agencies, Copernicus Global Land Service, Copernicus Atmospheric Monitoring Service, GOF GOLD.
Performance Indicator	Availability of products that meet user needs.
Annual Cost	1-10M US$

Action T62:	Fire maps
Action	Consistently map global burned area at < 100m resolution on a near daily basis from combinations of satellite products (Sentinel-2, Landsat, Sentinel-1, PROBA). Furthermore, work towards deriving consistent measures of fire severity, fire type, fuel moisture, and related plant fuel parameters.
Benefits	Climate modelling communities , space agencies, civil protection services, fire managers, other users.
Timeframe	By 2020.
Who	Space agencies, Research Organisations, International Organisations in collaboration with GOFC-GOLD Fire.
Performance Indicator	Availability of data and products.
Annual Cost	1-10M US$

Action T63:	Fire validation
Action	Continuation of validation activity around the detection of fire disturbed areas from satellites to show that threshold requirements are being met. Work to reduce the errors of commission and omission. Provide better than existing uncertainty characterisation of fire disturbance products.
Benefits	Climate modelling communities.
Timeframe	Continuous.
Who	Space agencies and research organizations, supported by CEOS LPV.
Performance Indicator	Publication of temporal accuracy.
Annual Cost	1-10M US$

Action T64:	Fire disturbance model development
Action	Continuation of joint projects between research groups involved in the development of Atmospheric Transport Models, Dynamic Vegetation Models and GHG Emission models 'the Climate Modelling and Transport Modelling community' and those involved in the continual algorithm development, validation and uncertainty characterisation of fire disturbance products from satellite data (the Earth Observation and Modelling community). Contribute to better understanding of fire risk and fire risk modelling.
Benefits	Climate modelling communities, Copernicus Programme.
Timeframe	Continuous.
Who	Space Agencies (NASA, ESA, etc.), inter-agency bodies (GOFC-GOLD, CEOS, ECMWF, Meteosat etc.), Copernicus Global Land Service, Copernicus Atmospheric Monitoring Service, GOFC-GOLD.
Performance Indicator	Projects that engage climate and atmospheric transport modellers and product development community.
Annual Cost	1-10M US$

ECV Products and Requirements for Fire

*These products and requirements reflect the Implementation Plan 2016 (**GCOS-200**). GCOS is reviewing and will update the requirements until 2022. More information on: **gcos.wmo.int**.*

PRODUCT	DEFINITION	FREQ.	RES.	REQUIRED MEASUREMENT UNCERTAINTY	STAB.	REF.
Burnt Area	Burned area means the area affected by the fire, including natural vegetation and croplands. X_area means the horizontal area occupied by X within the grid cell. The extent of an individual grid cell is defined by the horizontal coordinates and any associated coordinate bounds or by a string valued auxiliary coordinate variable with a standard name of region.	24 hours	30m	15% (error of omission and commission), compared to 30 m observations		None
Active Fire Maps	Presence of a temporal thermal anomaly within a grid cell. Those thermal anomalies that are permanent should be linked to other sources of thermal emission (volcanos, gas flaring, industrial or power plants). Generally, the active fire maps are defined by the date/hour when the thermal anomaly was detected	6 hours at all latitudes from Polar-Orbiting and 1 hour from Geostationary	0.25-1 km (Polar); 1-3 km (Geo)	5% error of commission; 10% error of omission; Based on per-fire comparisons for fires above target threshold of 5 MW/km² equivalent integrated FRP per pixel (i.e. for a 0.5 km² pixel the target threshold would be 2.5 MW, for a 9 km² pixel it would be 45 MW).		None
Fire Radiative Power	Amount of energy released by area unit. Commonly it is expressed in W/m2. This variable is a function of actual temperature of the active fire at the satellite overpass and the proportion of the grid cell being burned.	6 hours at all latitudes from Polar-Orbiting and 1 hour from Geostationary	0.25-1 km (Polar); 1-3 km (Geo)	10% integrated over pixel. Based on target detection threshold of 5 MW/km² equivalent integrated FRP per pixel (i.e. for a 0.5 km² pixel the target threshold would be 2.5 MW, for a 9 km² pixel it would be 45 MW).and with the same detection accuracy as the Active Fire Maps.		None

I suggested to include combustion completeness, but not accepted yet

New implementation plan: 2019-22

- ❑ Guidelines for reviewing the GCOS ECV Product Requirements (November 2019).
- ❑Definitions: ECV, ECV Product, ECV Product definition.
- ❑Resolution:
  - ❑spatial,
  - ❑vertical,
  - ❑temporal, frequency.
  - ❑Timelines: availavility
- ❑Uncertainty: required measurement and stability.
- ❑Background information:
  - ❑Standards or papers
  - ❑Derivation

New implementation plan: 2019-22

- Three levels of requirements were introduced:
  - Threshold: The minimum requirement: the value that has to be met to ensure that data are useful.
  - Goal: The ideal requirement above which further improvements are not necessary. This is likely to evolve as applications and technologies progress.
  - Breakthrough: One or more values that enable additional uses within climate monitoring. The additional uses need to be described in the “derivation” section.

New implementation plan: 2019-22

- Calendar:
  - Fire requirements, first draft sent on December 2019.
  - Internal review until March 2020.
  - External consultation until January 2021 (suggestions received only referred to the uncertainty characterization)
  - Updates on May 2021.
  - Presentation of the GCOS Status Report at the UNFCCC COP 26 in Glasgow on November 2021.
  - Final draft, February 2022 (no additional suggestions received).
  - GCOS Implementation Plan Public Review: April-May 2022.

ECV requirements. Burned area ($m^{2)}$

Requirements					
Item needed	Unit	Metric	[1]	Value	Derivation and References and Standards
Horizontal Resolution	m	Minimum mapping unit to which the BA product refers	G	30	This resolution is mostly oriented towards regional studies, particularly in those regions were small fires (< 100 ha) have an important share in fire occurrence. The importance of small fires have been evidenced in recent papers (Roteta et al. 2019, among others)
			B	250	Products based on higher resolution MODIS products have shown higher sensitivity to small fires, even though coarse resolution RS products still miss most small fires (Chuvieco et al. 2018)
			T	25.000	Most climate modelers work at coarse resolution grids, 025 d is the most common. A recent review of users of RS BA products show that most of them work at this level of detail (Heil & Pettinari, 2021). A review of users of BA products can be found in Mouillot et al. 2014 and Chuvieco et al. 2019
Temporal Resolution	Day	Minimum temporal period to which the BA product refers	G	1	Mostly for atmospheric modelers. A questionnaire to atmospheric and carbon modelers done in 2011 suggested 1-2 days https://climate.esa.int/media/documents/Fire_cci_D1.1_URD_v5.2_xkSTbGK.pdf, but it was recently updated to 1 day or even 6 hours by Heil & Pettinari, 2021
			B	10	Based on a questionnaire to atmospheric and carbon modelers done in 2011: https://climate.esa.int/media/documents/Fire_cci_D1.1_URD_v5.2_xkSTbGK.pdf, updated in Heil & Pettinari, 2021
			T	30	Based on a questionnaire to atmospheric and carbon modelers done in 2011: https://climate.esa.int/media/documents/Fire_cci_D1.1_URD_v5.2_xkSTbGK.pdf, updated in Heil & Pettinari, 2021

ECV requirements. Burned area ($m^{2)}$

Requirements					
Timeliness	Day	Days when the BA product is accessible after fires occurred	G	10	Based on a questionnaire to atmospheric and carbon modelers done in 2011: https://climate.esa.int/media/documents/Fire_cci_D1.1_URD_v5.2_xkSTbGK.pdf, updated in Heil & Pettinari, 2021
			B	120	Based on a questionnaire to atmospheric and carbon modelers done in 2011: https://climate.esa.int/media/documents/Fire_cci_D1.1_URD_v5.2_xkSTbGK.pdf, updated in Heil & Pettinari, 2021
			T	360	Based on a questionnaire to atmospheric and carbon modelers done in 2011: https://climate.esa.int/media/documents/Fire_cci_D1.1_URD_v5.2_xkSTbGK.pdf, updated in Heil & Pettinari, 2021
Product Accuracy	%	Average omission and commission errors	G	5	Based on a questionnaire to atmospheric and carbon modelers done in 2011: https://climate.esa.int/media/documents/Fire_cci_D1.1_URD_v5.2_xkSTbGK.pdf, updated in Heil & Pettinari, 2021
			B	15	Based on a questionnaire to atmospheric and carbon modelers done in 2011: https://climate.esa.int/media/documents/Fire_cci_D1.1_URD_v5.2_xkSTbGK.pdf, updated in Heil & Pettinari, 2021
			T	25	Based on a questionnaire to atmospheric and carbon modelers done in 2011: https://climate.esa.int/media/documents/Fire_cci_D1.1_URD_v5.2_xkSTbGK.pdf, updated in Heil & Pettinari, 2021

Other activities

- ❑ECV status report.
- ❑Status of Climate report, 2021
- ❑Definition of reference and observation networks.

Status report on each ECV: draft submitted in May 2020.

Item		Fire Status Report
ECV Name		Fire Disturbance
ECV Products covered by this sheet (group as much as possible)		Burned Area
Adequacy of the Observational System Assessment	Class (5 – 1)	3
	short text	Omission and commission errors higher than required
Availability and Stewardship Assessment	Class (5 – 1)	5
	short text	Datasets incorporate all standards and are easily accessible.
Networks		NASA MODIS standard products ESA CCI standard products EU Copernicus Climate Change Service GOFC-GOLD Fire Implementation Team Global Wildland Information System (JRC)
Satellites		Terra-Aqua MODIS (>2000) Sentinel-3 SLSTR-OLCI (>2018) NOAA-VIIRS (>2013) NOAA-AVHRR (>1982) limited interest
Models, Reanalysis etc.		Several Fire modules within DGVM (Spitfire, GlobFIRM, CASA, CTEM, Orchidee)
Extremes		Temporal anomalies detected from comparison with 20 years historical series.
Adaptation		Limited applicability