Land Biosphere ECV products from Copernicus Climate Change Service (C3S): Surface albedo, LAI, fAPAR, Land Cover and Fire

Climate Change

ESA Living Planet 2019

Iskander Benhadj

Climate Change

Outline

- ✓ Service overview
- ✓ Products genertation
- ✓ Quality control
- ✓ Products distribution

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Copernicus Service Components

C3S Components

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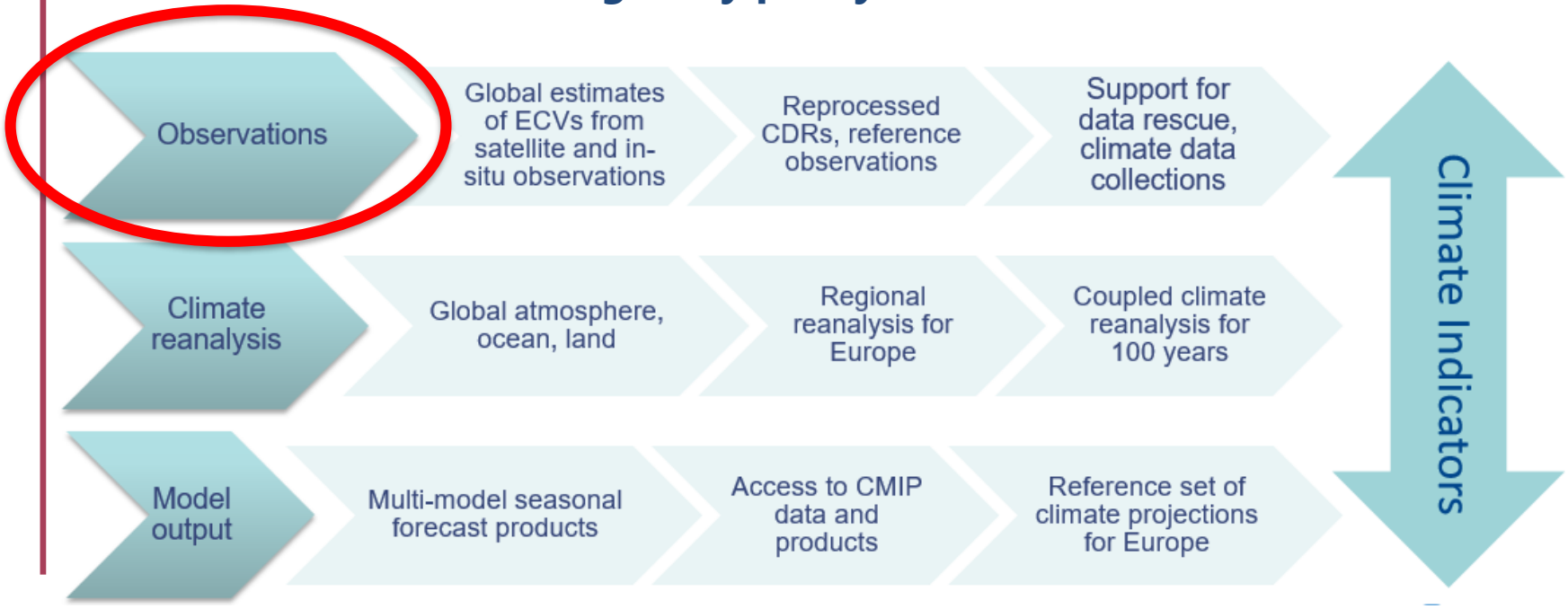
Implemented by ECMWF as part of The Copernicus Programme

Climate Change Service

We provide authoritative information about the past, present and future climate, as well as tools to enable climate change mitigation and adaptation strategies by policy makers and businesses.



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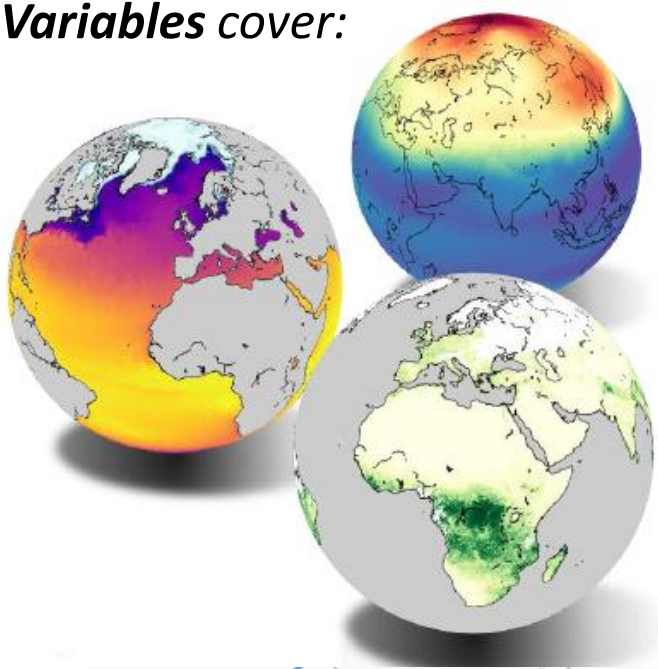
Satellite observations

Observations

***Observational records of Essential Climate Variables** cover:*

- ❑ Atmospheric physics
- ❑ Atmospheric composition
- ❑ Ocean
- ❑ Land hydrology and cryosphere
- ❑ Land biosphere



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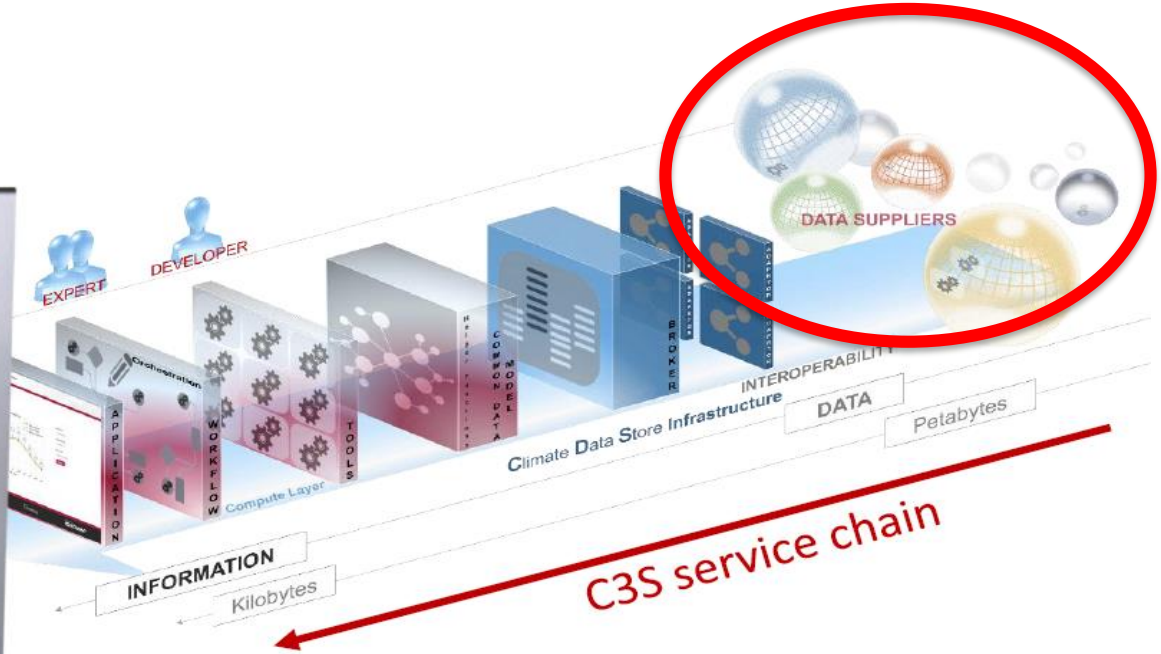
Climate Data Store



Quality assured information and tools for scientists, consultants, decision makers.

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C3S Land Biosphere objective

The objective of the project is to provide the longest possible, consistent and mature CDRs at the global scale for the following ECVs (GCOS reqs)

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The Consortium

The consortium is composed of 10 partners from 5 European Member States:

- **VITO, the Service Manager** (Belgium)
- Brockmann Consult (Germany)
- EOLAB (Spain)
- FastOpt (Germany)
- HYGEOS (France)
- King's College London (UK)
- METEO-France (France)
- University of Alcala (Spain)
- Université Catholique de Louvain (Belgium)
- University College London (UK)

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QA4ECV

LAI

fAPAR

Surface Albedo

C3S 312b Lot5

Land Cover

climate change initiative

Fire Radiative Power

Fire Burnt Areas

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Climate Change Service

Global Land Service

SENTINEL 3

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Work Packages

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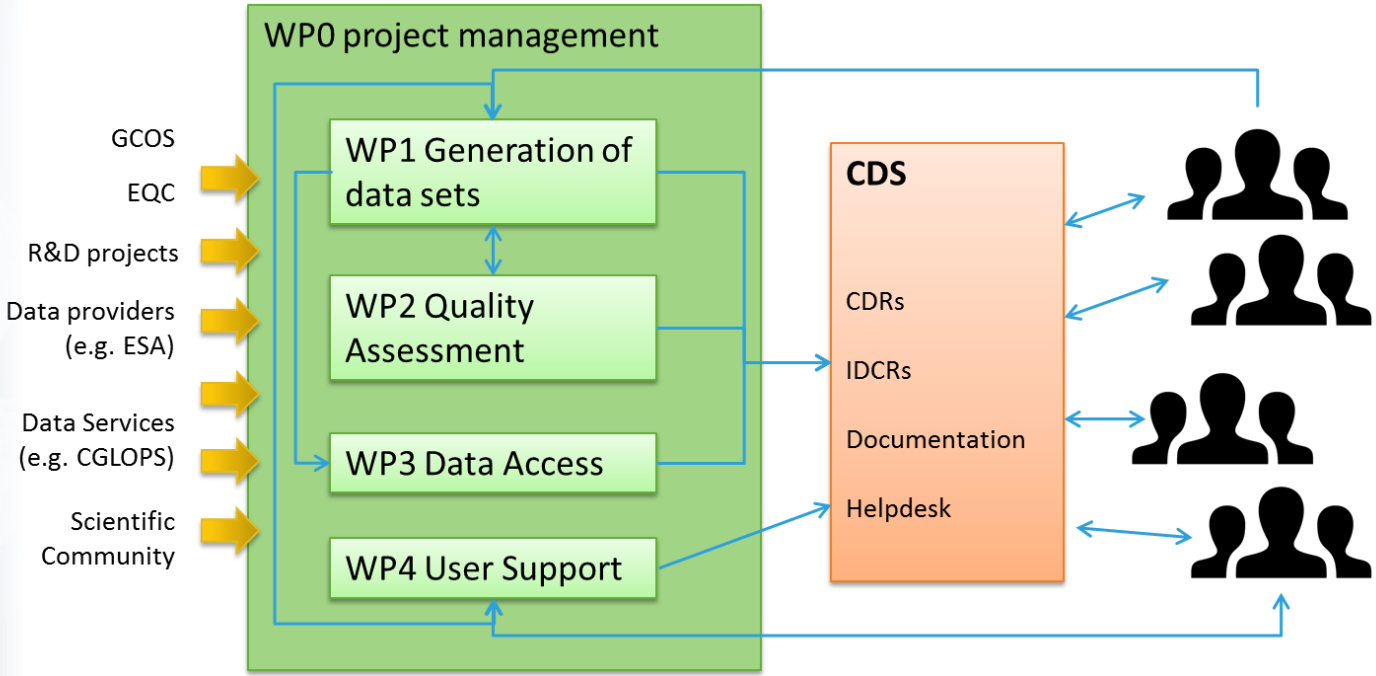
CDS: Climate Data Store
EQC: Evaluation and Quality Control



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Product generation approach

ECV	Processing/Approach
Surface Albedo	**Toward Multi-sensor Albedo (**NOAA-AVHRR, SPOT-VGT, PROBA-V) From 1982- 2019 3 steps: per sensor evolution, • pre-processing harmonisation • multi-sensor BRDF- and SRF-normalisation • Error propagation
LAI/FAPAR	Use of **Two Inversion Package (TIP)** model →consistency with the Surface Albedo **Toward Multi-sensor LAI**
Land Cover	• Broker CCI LC 1992-2015 • **Produce LC 2016→2019** (PROBA-V and/or Sentinel-3)
Fire Burned Areas	• Broker MODIS FireCCI50 and FireCCI51 • **Produce Sentinel3 BA 2017→2020**
Fire Radiative Power	Based on Sentinel-3 SLSTR algorithm of operational processing chain (2016-2021)

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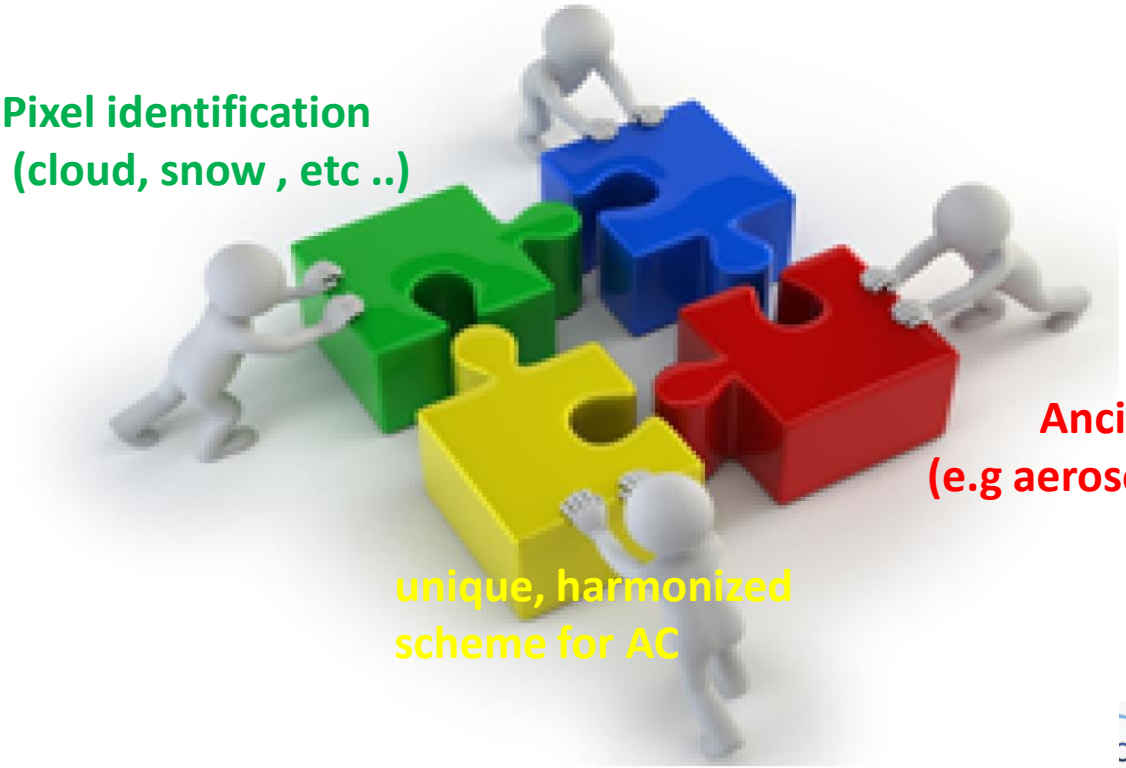
Harmonisation of pre-processing

Pre-processing methods → cross-CDR consistency



Pixel identification (cloud, snow , etc ..)

Ancillary layers (e.g aerosols, ozone, etc …)

unique, harmonized scheme for AC

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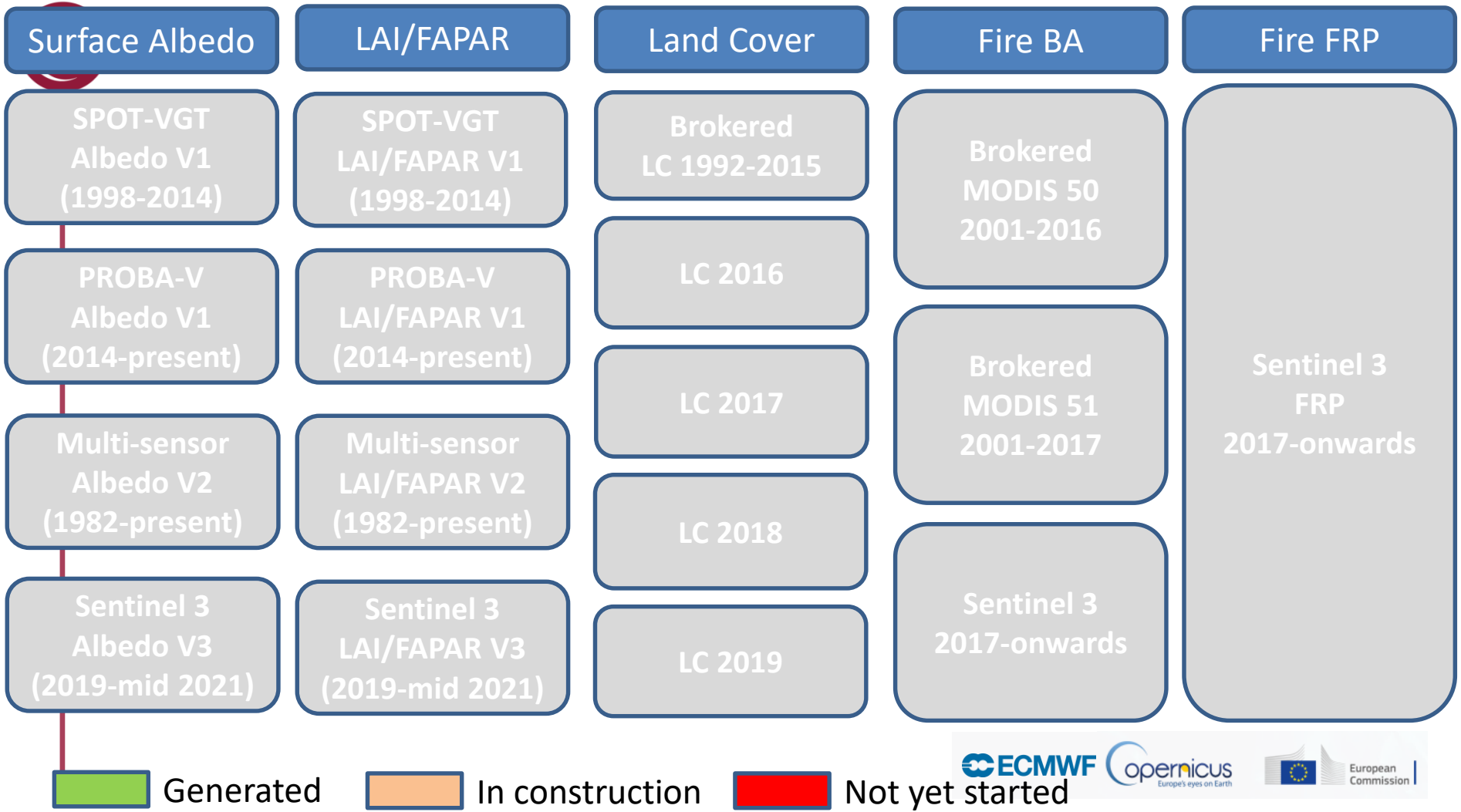
Surface Albedo
LAI/FAPAR
Land Cover
Fire BA
Fire FRP
SPOT-VGT Albedo V1 (1998-2014)
PROBA-V Albedo V1 (2014-present)
Multi-sensor Albedo V2 (1982-present)
Sentinel 3 Albedo V3 (2019-mid 2021)
SPOT-VGT LAI/FAPAR V1 (1998-2014)
PROBA-V LAI/FAPAR V1 (2014-present)
Multi-sensor LAI/FAPAR V2 (1982-present)
Sentinel 3 LAI/FAPAR V3 (2019-mid 2021)
Brokered LC 1992-2015
LC 2016
LC 2017
LC 2018
LC 2019
Brokered MODIS 50 2001-2016
Brokered MODIS 51 2001-2017
Sentinel 3 2017-onwards
Sentinel 3 FRP 2017-onwards
Generated
In construction
Not yet started
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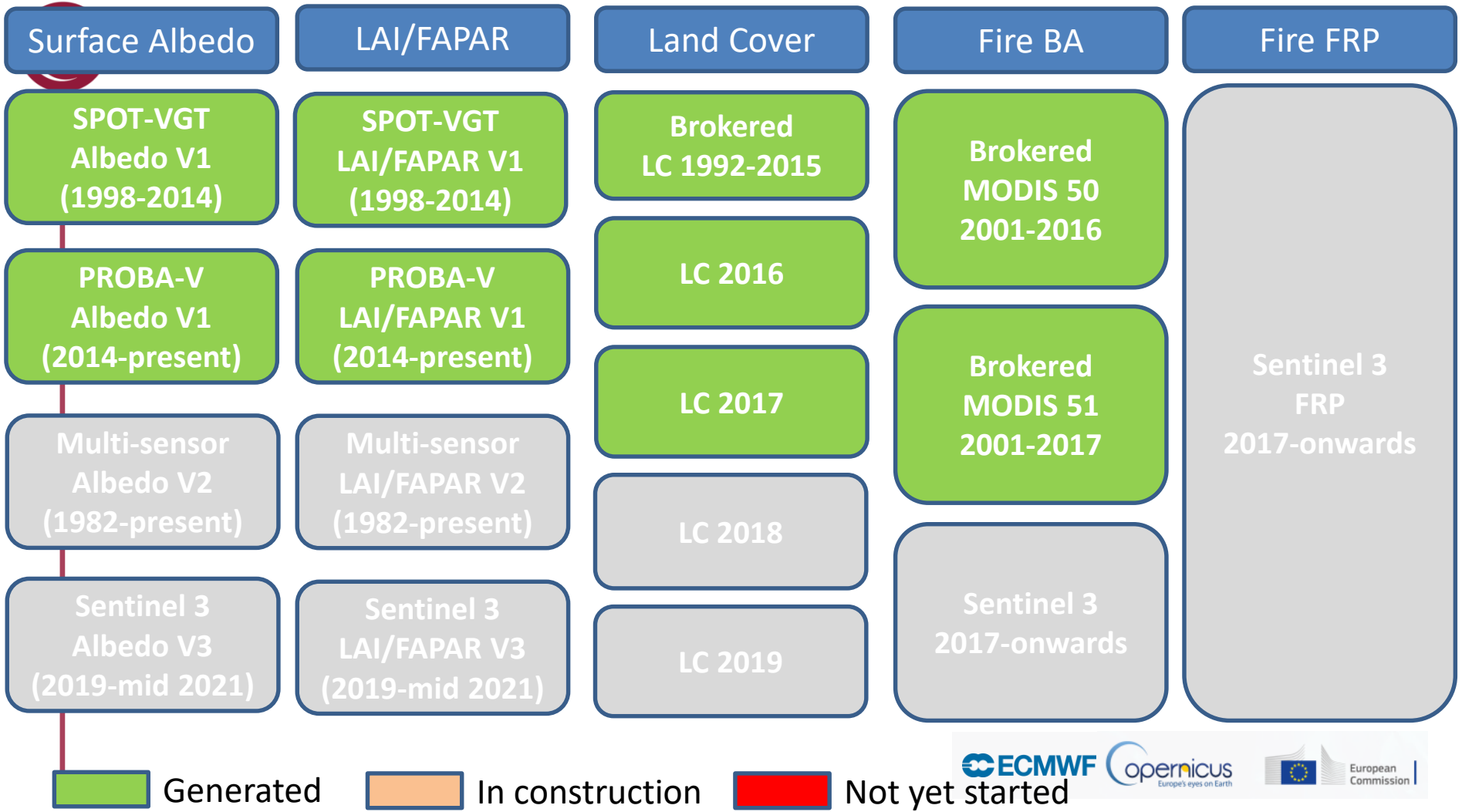
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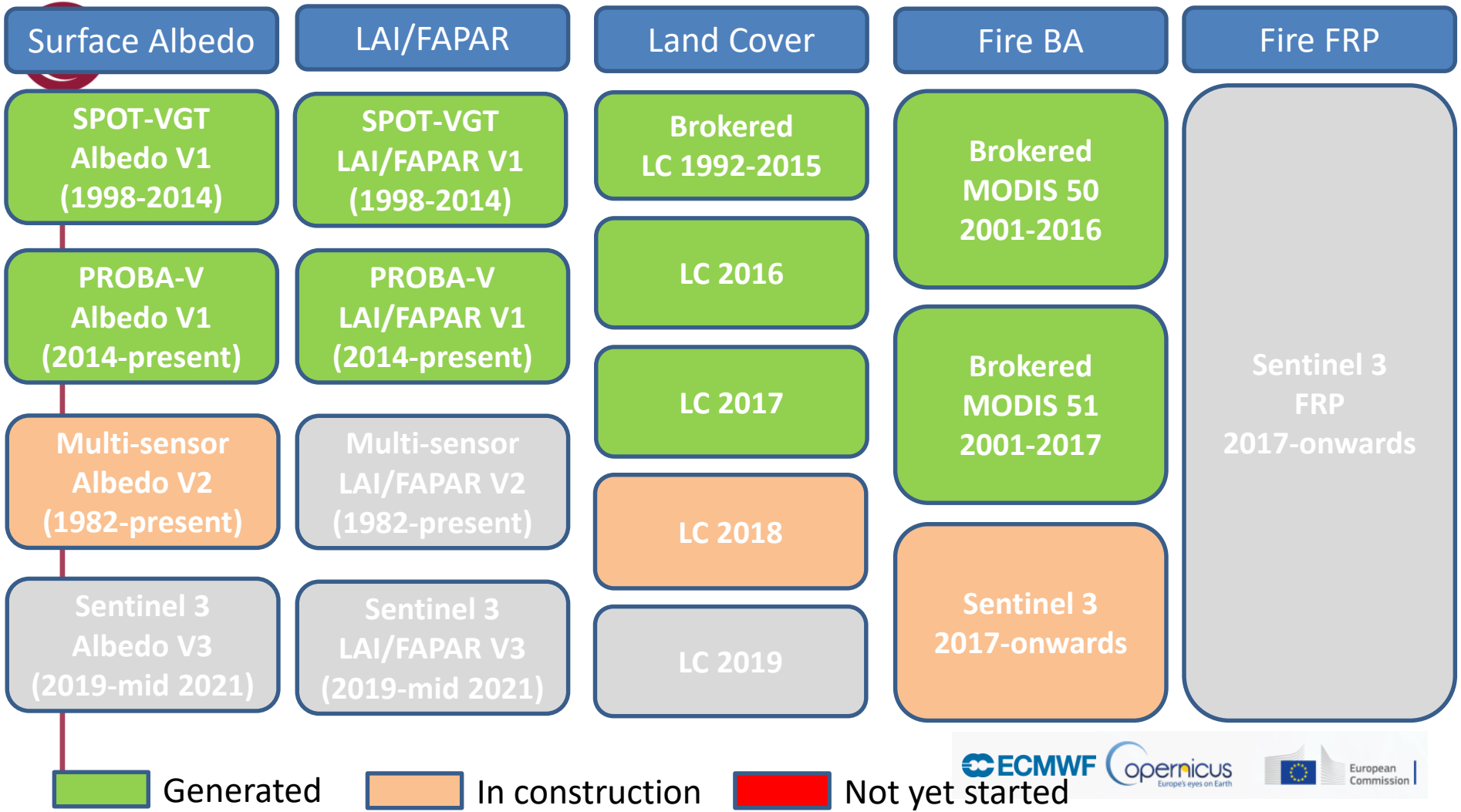
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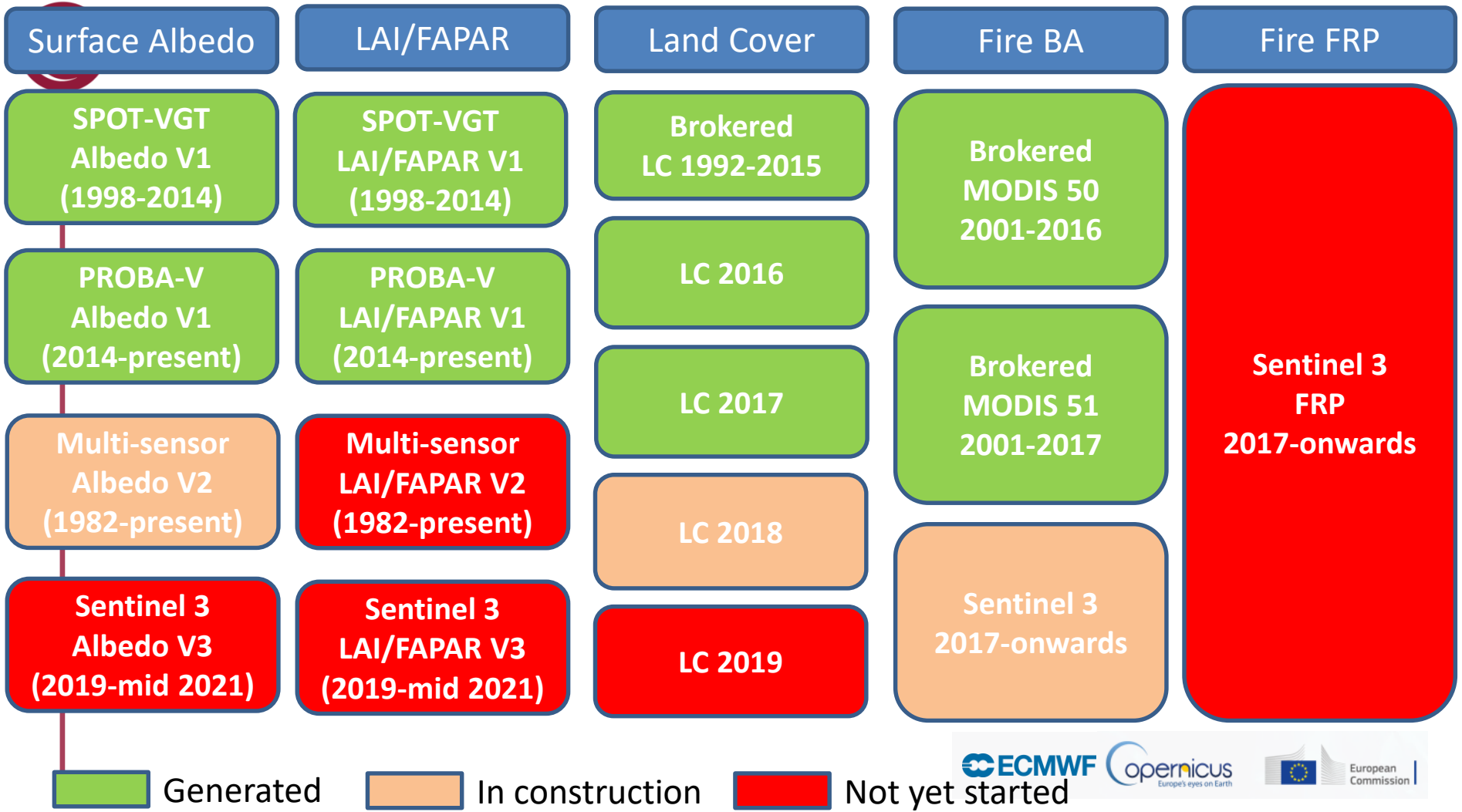
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Sentinel 3 LAI/FAPAR V3 (2019-mid 2021)
LC 2019
Generated
In construction
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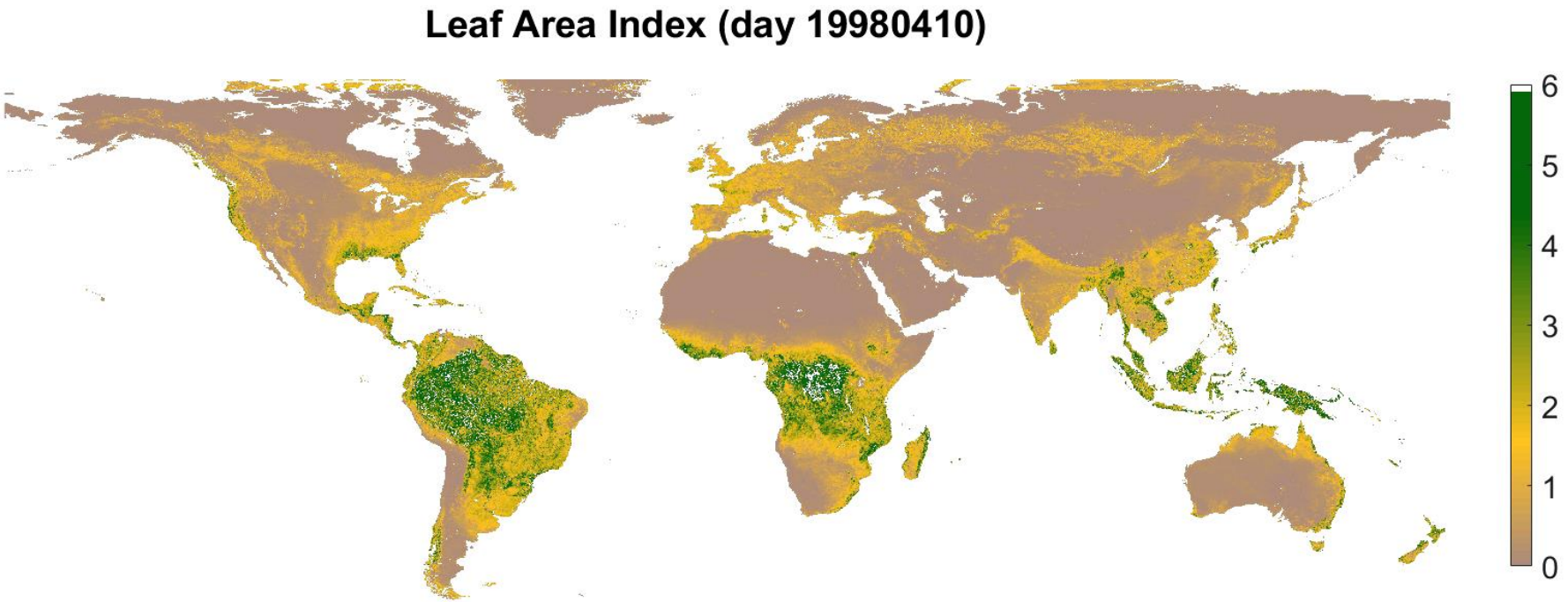
Leaf Area Index from SPOT-VEGETATION (1999-2005)



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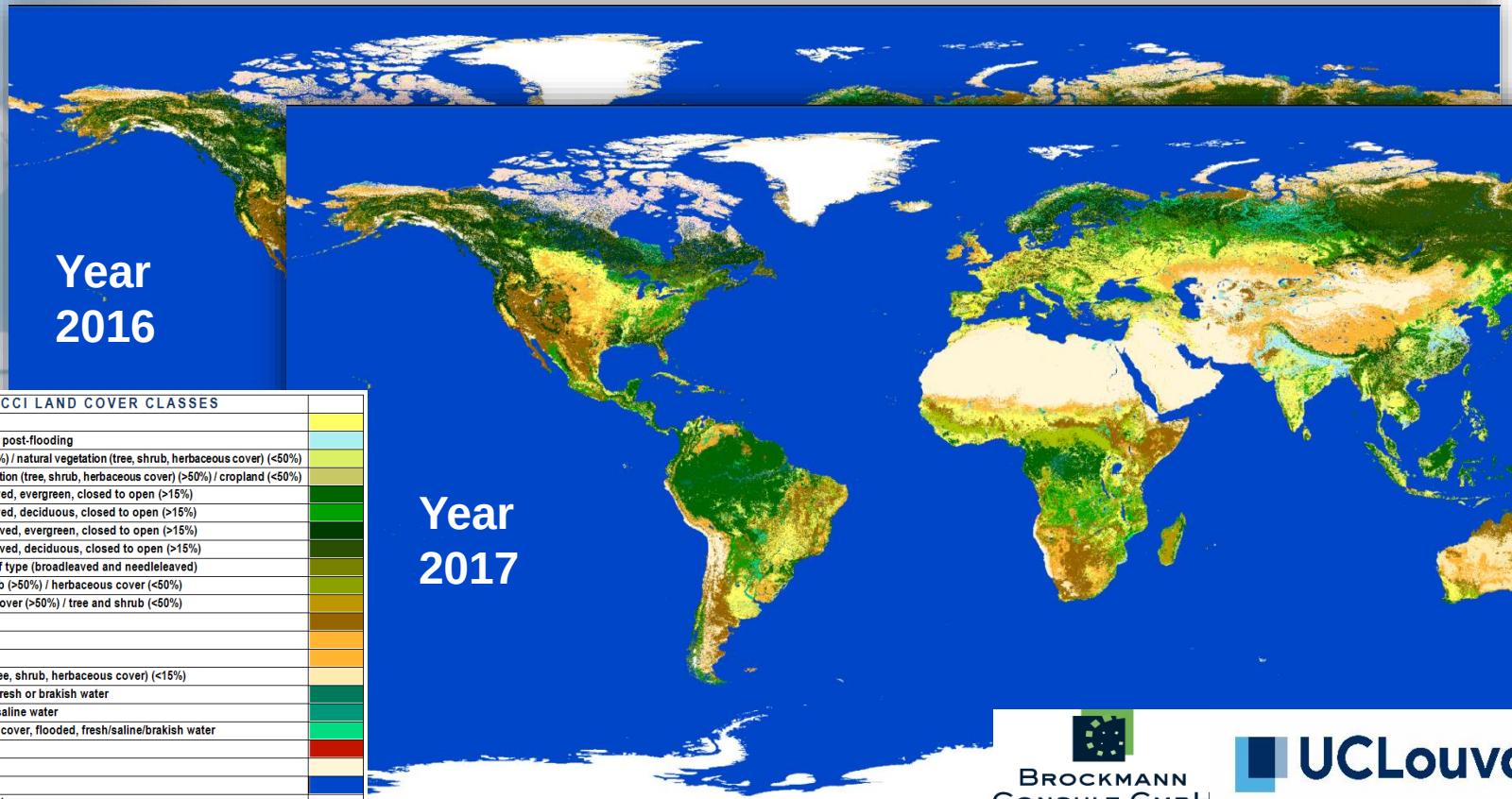
Consistent 300 m annual global land cover time series from 1992-2017 (22+ classes)



LC_CCI LAND COVER CLASSES	
Cropland, rainfed	
Cropland, irrigated or post-flooding	
Mosaic cropland (>50%) / natural vegetation (tree, shrub, herbaceous cover) (<50%)	
Mosaic natural vegetation (tree, shrub, herbaceous cover) (>50%) / cropland (<50%)	
Tree cover, broadleaved, evergreen, closed to open (>15%)	
Tree cover, broadleaved, deciduous, closed to open (>15%)	
Tree cover, needleleaved, evergreen, closed to open (>15%)	
Tree cover, needleleaved, deciduous, closed to open (>15%)	
Tree cover, mixed leaf type (broadleaved and needleleaved)	
Mosaic tree and shrub (>50%) / herbaceous cover (<50%)	
Mosaic herbaceous cover (>50%) / tree and shrub (<50%)	
Shrubland	
Grassland	
Lichens and mosses	
Sparse vegetation (tree, shrub, herbaceous cover) (<15%)	
Tree cover, flooded, fresh or brakish water	
Tree cover, flooded, saline water	
Shrub or herbaceous cover, flooded, fresh/saline/brakish water	
Urban areas	
Bare areas	
Water bodies	
Permanent snow and ice	

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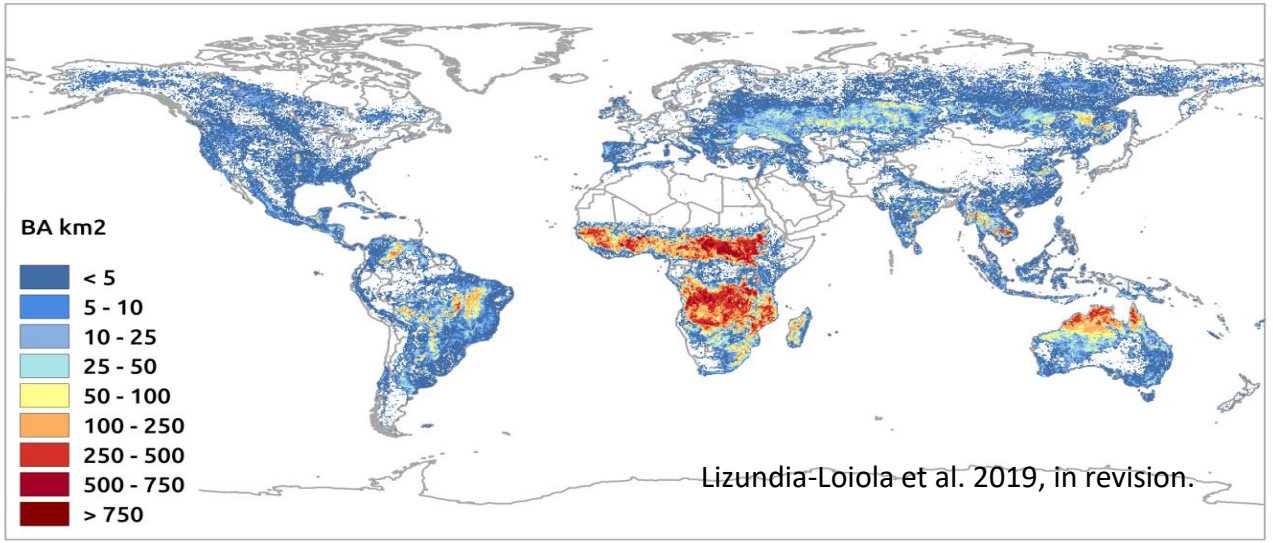
Examples of Products

- Grid products:
  - 2017-2019
  - 0.25º
- Layers:
  - BA
  - Standard error
  - Fraction of burnable area
  - Fraction of observed area
  - Number of patches
  - BA per LC



Lizundia-Loiola et al. 2019, in revision.

Mean burned area of FireCCI51 2017/2019

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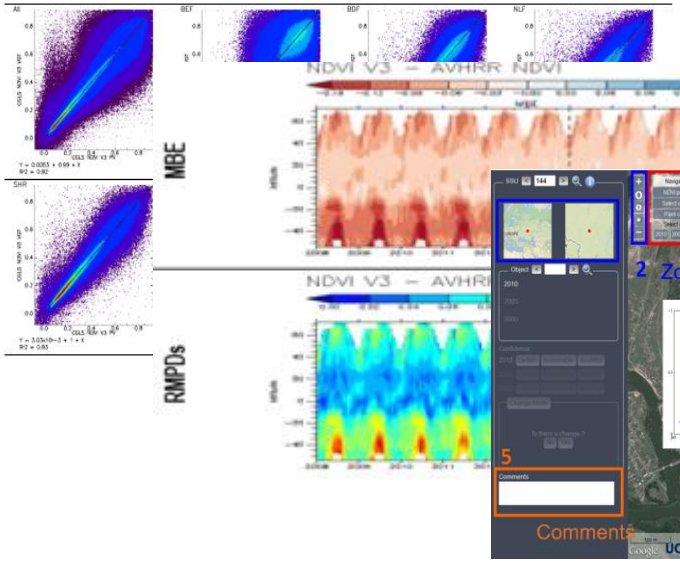
Extensive Quality Control

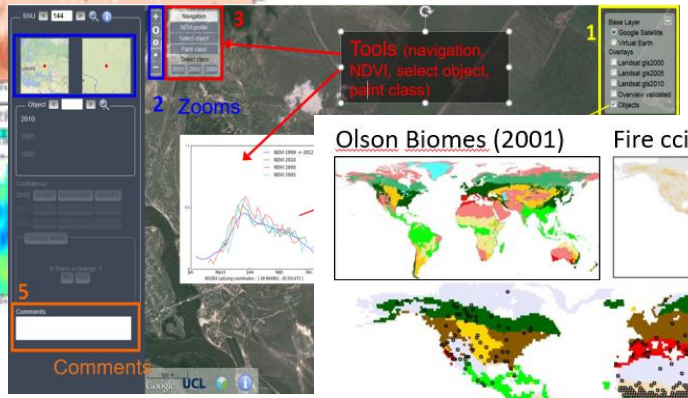
CEOS Land Product Validation (LPV)

- Compare with reference data/in-situ, time series analysis
- Stability, precision, accuracy, confusion matrix
- Key Performance Indicators, Quality Assessment Report

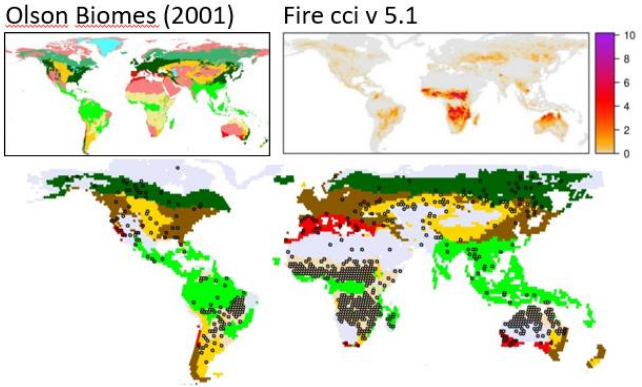
Surface Albedo LAI/fAPAR



Land Cover



Fire



PQAD/PQAR documents

Data access

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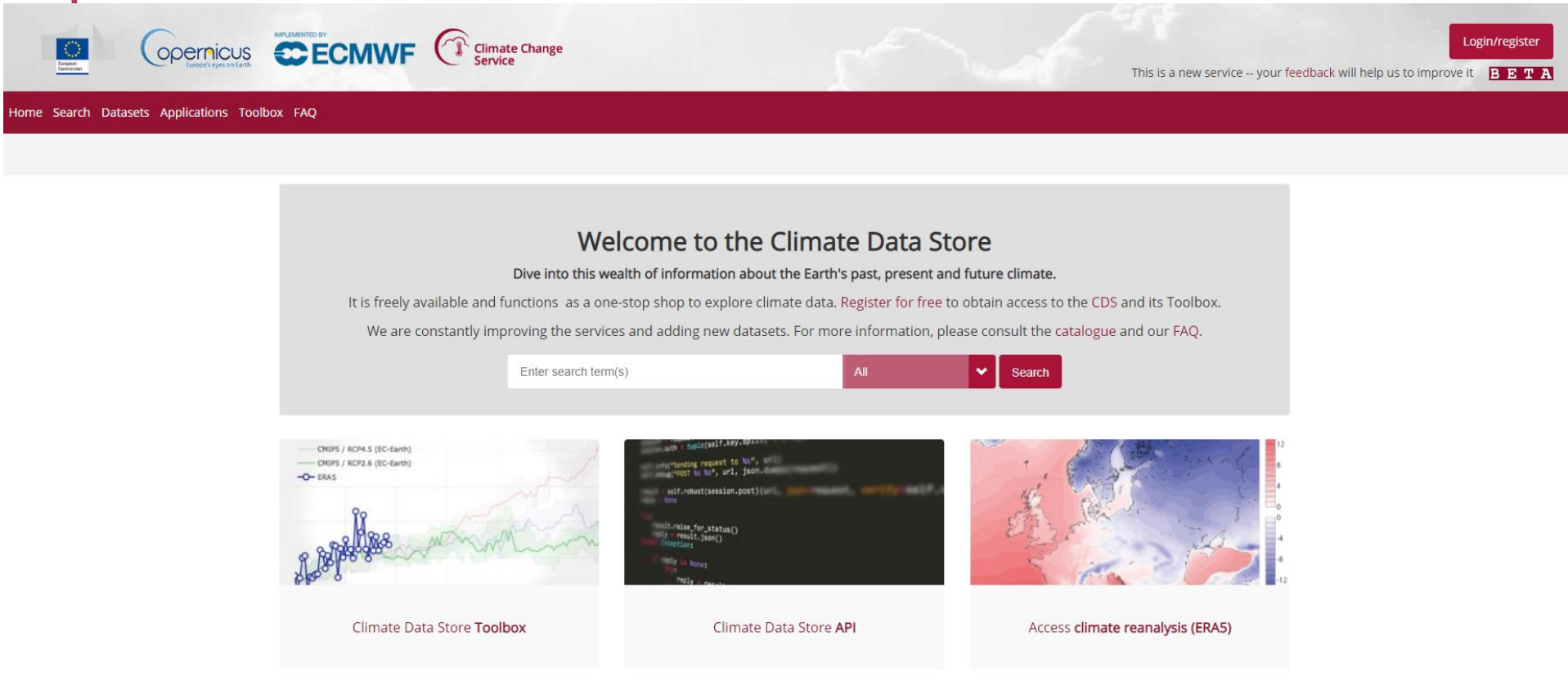
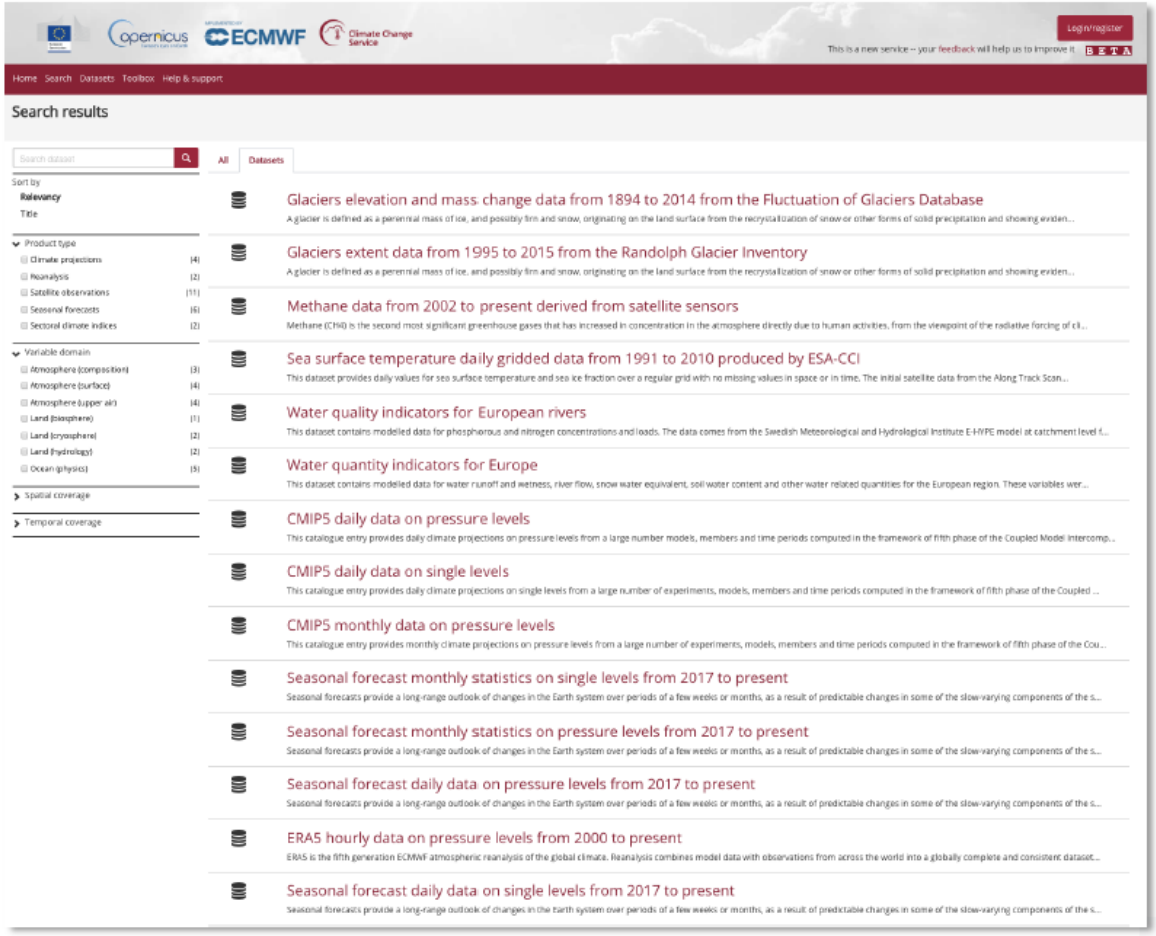
The CDS web portal is the single point of entry for the discovery and manipulation of products

https://cds.climate.copernicus.eu/



Data access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Search dataset
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Climate projections (4)
Reanalysis (2)
Satellite observations (11)
Seasonal forecasts (6)
Sectoral climate indices (2)
Variable domain
Atmosphere (composition) (3)
Atmosphere (surface) (4)
Atmosphere (upper air) (4)
Land (biosphere) (1)
Land (cryosphere) (2)
Land (hydrology) (2)
Ocean (physics) (5)
Spatial coverage
Temporal coverage
All
Datasets
Glaciers elevation and mass change data from 1894 to 2014 from the Fluctuation of Glaciers Database
A glacier is defined as a perennial mass of ice, and possibly firn and snow, originating on the land surface from the recrystallization of snow or other forms of solid precipitation and showing eviden...
Glaciers extent data from 1995 to 2015 from the Randolph Glacier Inventory
A glacier is defined as a perennial mass of ice, and possibly firn and snow, originating on the land surface from the recrystallization of snow or other forms of solid precipitation and showing eviden...
Methane data from 2002 to present derived from satellite sensors
Methane (CH4) is the second most significant greenhouse gases that has increased in concentration in the atmosphere directly due to human activities, from the viewpoint of the radiative forcing of cli...
Sea surface temperature daily gridded data from 1991 to 2010 produced by ESA-CCI
This dataset provides daily values for sea surface temperature and sea ice fraction over a regular grid with no missing values in space or in time. The initial satellite data from the Along Track Scan...
Water quality indicators for European rivers
This dataset contains modelled data for phosphorous and nitrogen concentrations and loads. The data comes from the Swedish Meteorological and Hydrological Institute E-HYPE model at catchment level f...
Water quantity indicators for Europe
This dataset contains modelled data for water runoff and wetness, river flow, snow water equivalent, soil water content and other water related quantities for the European region. These variables wer...
CMIP5 daily data on pressure levels
This catalogue entry provides daily climate projections on pressure levels from a large number models, members and time periods computed in the framework of fifth phase of the Coupled Model Intercomp...
CMIP5 daily data on single levels
This catalogue entry provides daily climate projections on single levels from a large number of experiments, models, members and time periods computed in the framework of fifth phase of the Coupled ...
CMIP5 monthly data on pressure levels
This catalogue entry provides monthly climate projections on pressure levels from a large number of experiments, models, members and time periods computed in the framework of fifth phase of the Cou...
Seasonal forecast monthly statistics on single levels from 2017 to present
Seasonal forecasts provide a long-range outlook of changes in the Earth system over periods of a few weeks or months, as a result of predictable changes in some of the slow-varying components of the s...
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ERA5 hourly data on pressure levels from 2000 to present
ERA5 is the fifth generation ECMWF atmospheric reanalysis of the global climate. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset...
Seasonal forecast daily data on single levels from 2017 to present
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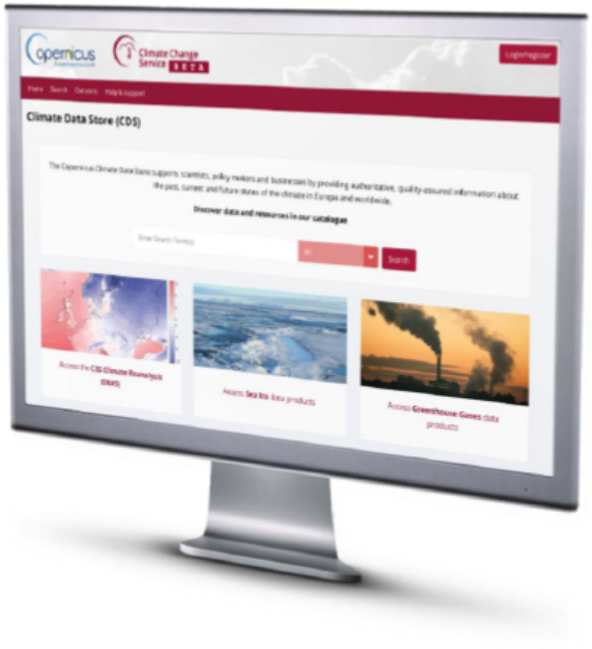
Climate Data Store (CDS)

CDS toolbox

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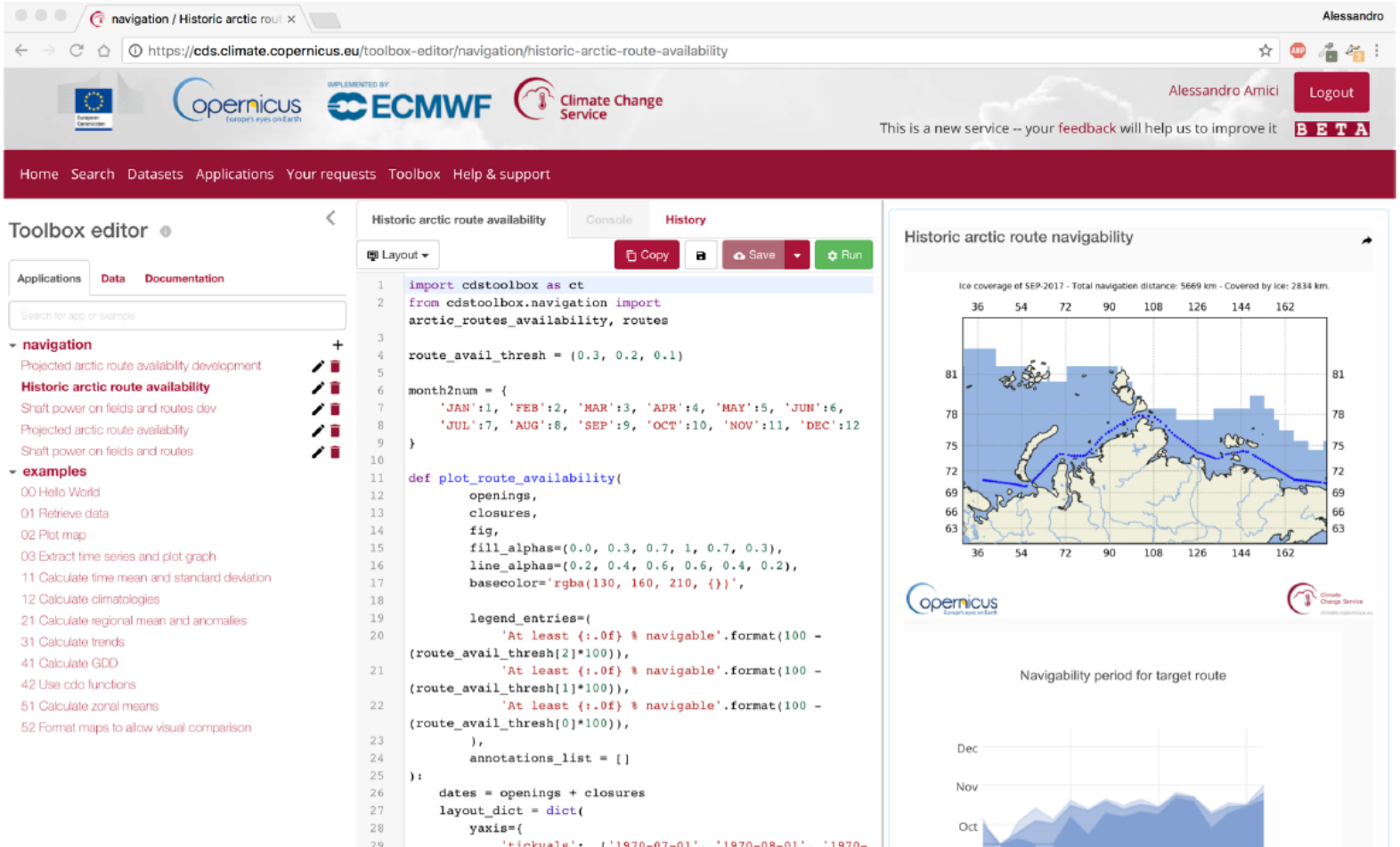

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Consortium

Brockmann Consult GmbH

vito
vision on technology

FastOpt
Fast Optimisation and Sensitivities

HYGEOS

King's College London

EOLAB

Universidad de Alcalá

UCLouvain

UCL

METEO FRANCE

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Thank you

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