

# HALO Harmonised Atmosphere Land Ocean for GMES

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## What is HALO?

**HALO** stands for "Harmonised coordination of Atmosphere, Land and Ocean integrated projects of the GMES backbone".

**GMES** is a joint initiative of the European Commission and the European Space Agency, designed to establish a European capacity for the provision and use of operational information for Global Monitoring of Environment and Security. HALO coordinates the architecture and system integration for the interacting parts of the Ocean, Land, and Atmosphere thematic integrated projects (IPs), which develop the "GMES backbone":

**MERSEA** covers the ocean theme. (Apr 2004 – Mar 2008)

**Geoland** covers the land cover & vegetation theme. (Jan 2004 – Jan 2007)

**GEMS** covers the atmosphere theme. (Mar 2005 – Feb 2009)

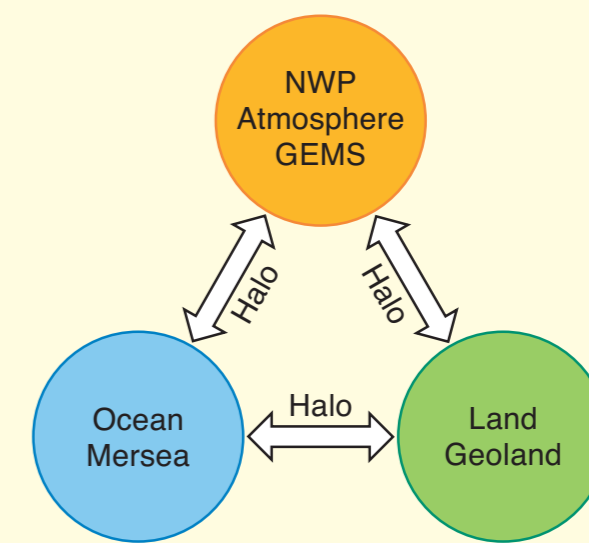
**HALO** is a Specific Support Action (SSA) in EU's Sixth Framework Program (FP6). Its duration is Feb 2004 – Jan 2007.

## HALO Objectives

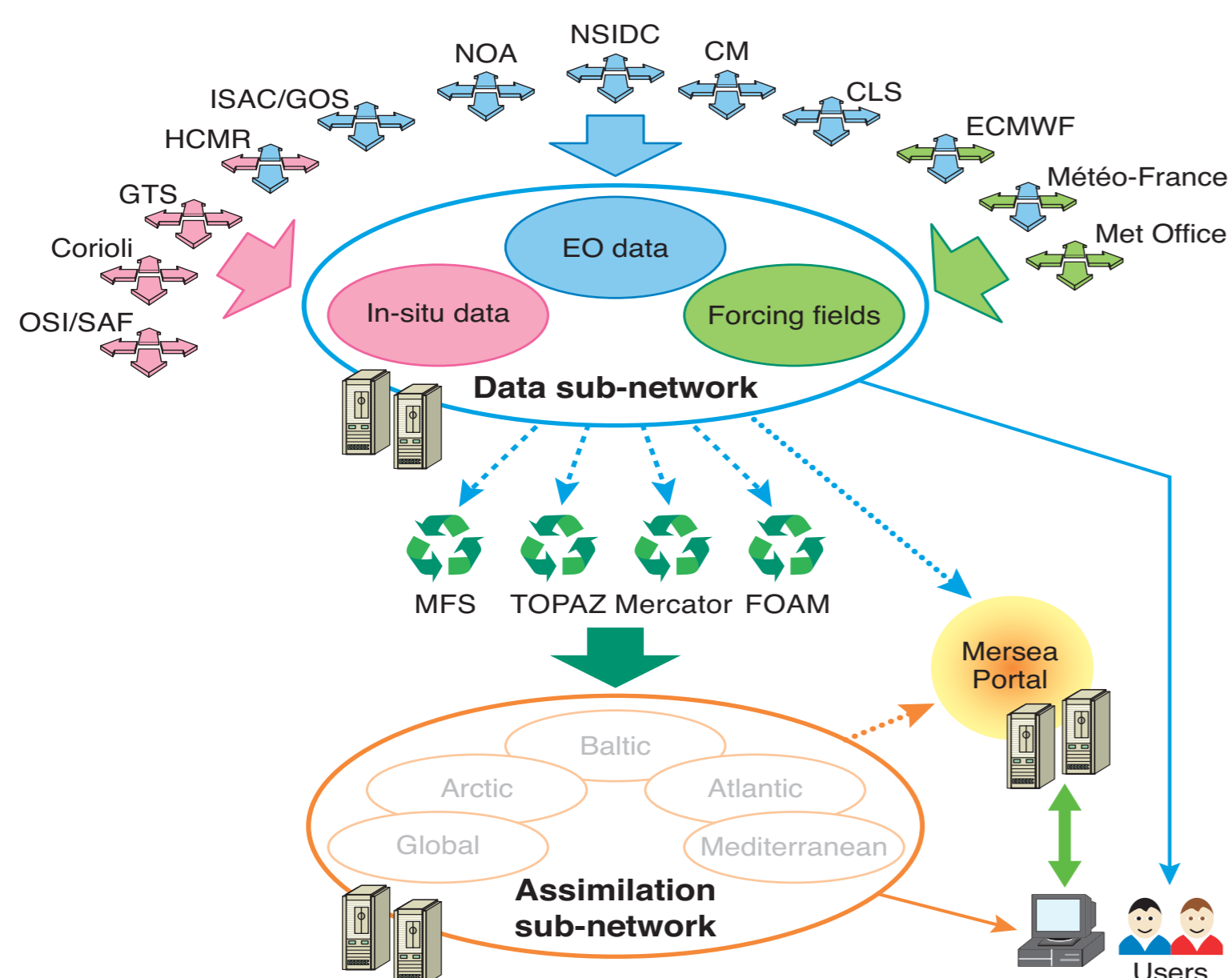
- HALO supports the joint transition of the IPs to operational status within the GMES framework by optimising the efficiency of their interactions. It formulates agreed recommendations to the IPs and the GMES Advisory Council (GAC) in areas of:
  - Scientific thematic analysis and coordination
  - Coordinated solutions to shared problems
- Recommendations for the transition to operational status.
- Possible model enhancements are identified by scientific thematic analyses of:
  - Direct product exchange
  - Unaccomplished data demands
  - Common data
- Candidates solutions for a coordinated data transfer infrastructure in operational mode are being developed.

## HALO Partners

- **ECMWF:** **GEMS**, Numerical Weather Prediction (NWP)
- **Infoterra:** **geoland**
- **Ifremer:** **MERSEA**
- **Alcatel Alenia Space:** candidate solutions **atmosphere-ocean**
- **EADS Astrium:** candidate solutions **atmosphere-land**
- **Medias France:** **geoland**
- **Météo-France:** **geoland**

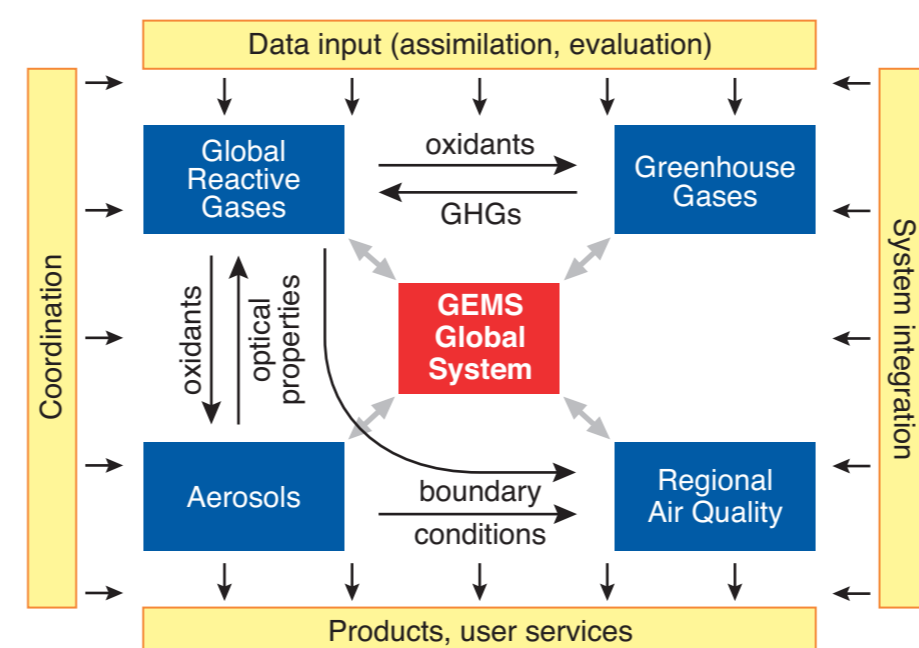


## GMES Backbone System Layout



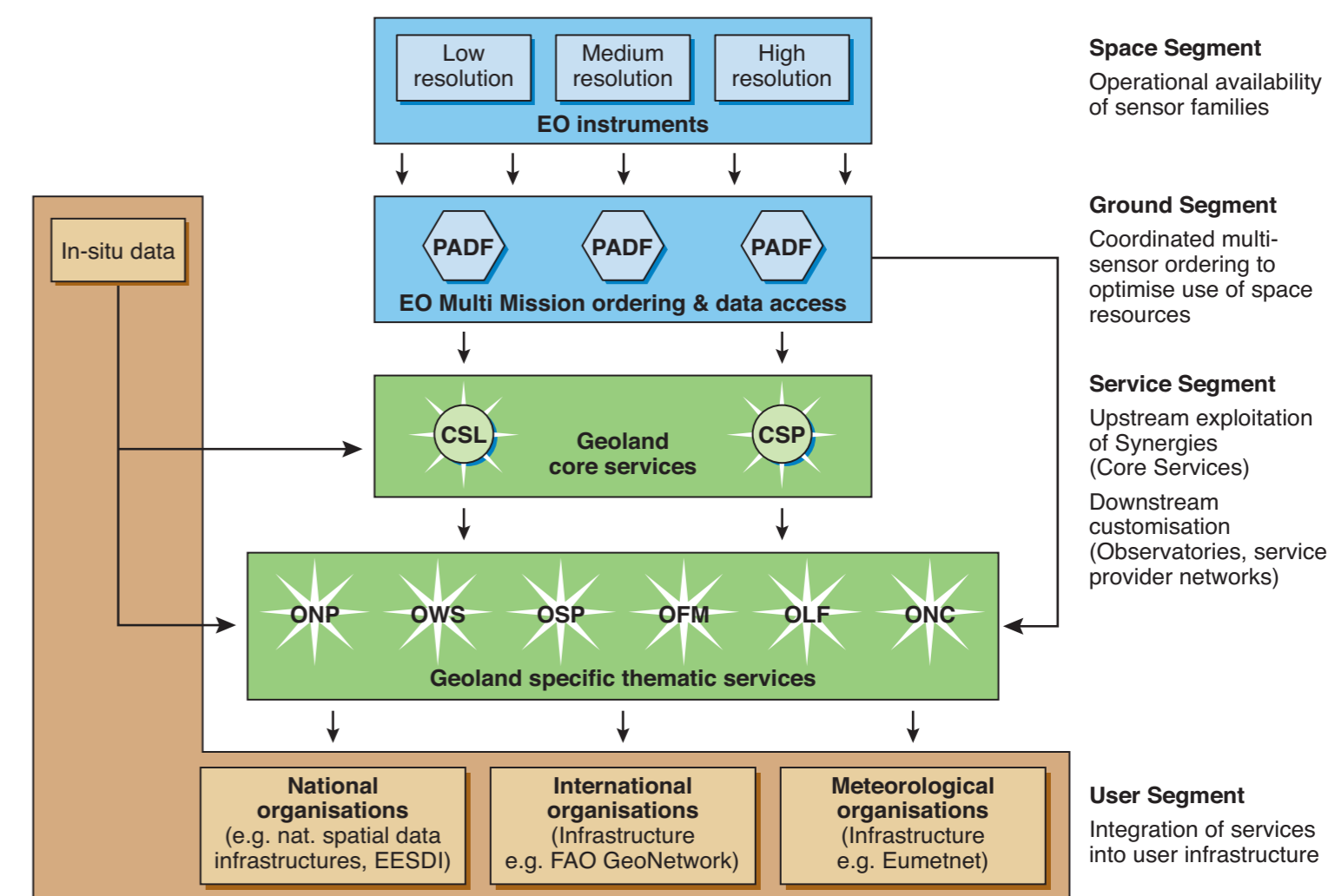
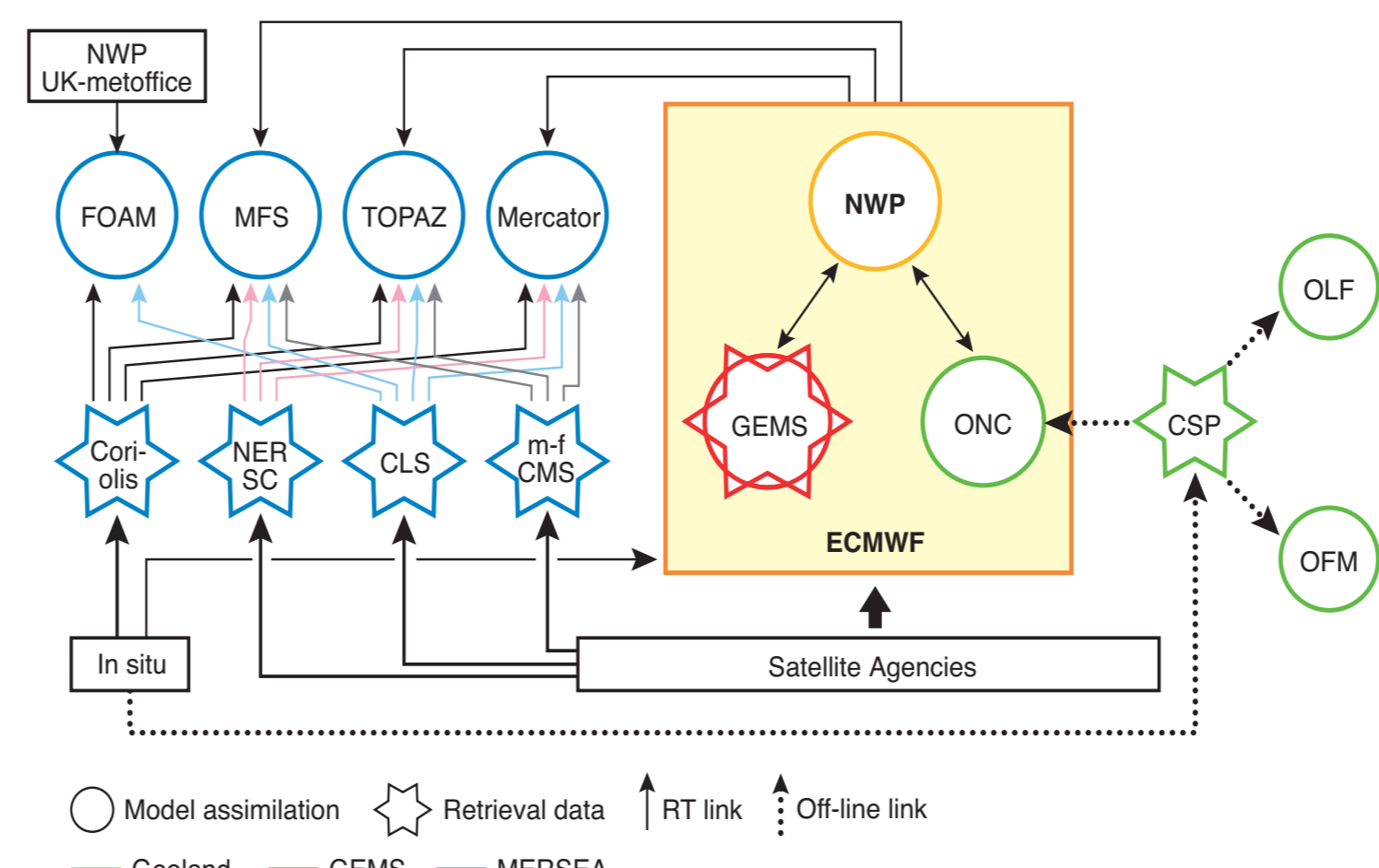
### MERSEA

MERSEA appointed dedicated centres for the retrieval of altimetry, Sea Surface Temperature (SST), ocean colour, and sea ice from in-situ and satellite Earth-Observation (EO) data, taking atmospheric forcing fields into account. The retrieval centres transfer their products for assimilation to the four model centres in a crossover type topology.



### GEMS

GEMS will ultimately deliver a single global system and several regional air quality systems. The global system will assimilate observations of aerosols and reactive and greenhouse gases directly into the model. Since the assimilation of radiances is preferred, retrieval and model assimilation are intrinsically linked.



### Geoland

Geoland establishes the Core Service bio-geophysical Parameters (CSP) for the global parameter retrieval from EO data. The parameters are used by the global Observatories Natural Carbon Fluxes (ONC), Land cover and Forest Change (OLF), and Food Security and Crop Monitoring (OFM). The other core service and observatories are not considered by HALO since they are dedicated to regional monitoring.

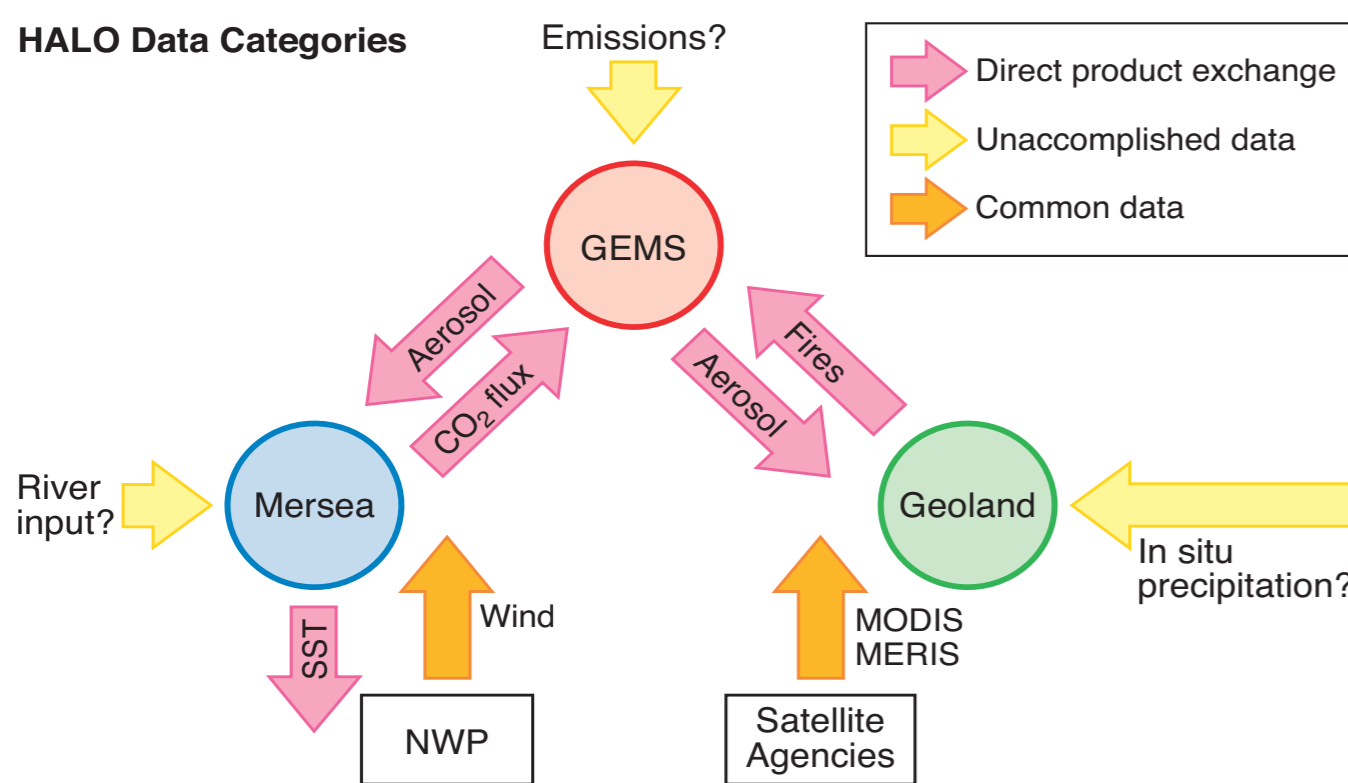
### Interacting System

Numerical Weather Prediction (NWP), the global GEMS system, and ONC are hosted by ECMWF. They depend on data input from CSP and EO data and provide input to the MERSEA modelling centres. (Only the main data links are depicted. For example, all satellite retrieval centres will use the GEMS aerosol product.)

## More Information?

Please visit the HALO homepage at [http://www.ecmwf.int/research/EU\\_projects/HALO](http://www.ecmwf.int/research/EU_projects/HALO)

## Data Flow Description



### MERSEA

Data flow	Source	Destination	Delivery Mode	Theme/Product
Meteorological forcing fields	ECMWF	Ocean Model Centre	Regular distribution, real-time analysis and forecasts, Regional high-resolution models	Meteorological forecast/NWP Bulletin
GEMS global aerosol products	ECMWF	Mersea retrieval centres	To be checked, initially research mode only	Atmospheric aerosol data for atmospheric corrections in retrieval
Satellite data	ESA, EUMETSAT, NASA, NOAA	MERSEA Satellite TEP	Regular	Along track, validated
Satellite products	SAT-TEP, GHRSSST, SSALTO, OSI/SAF	Ocean Model Centre	Regular	Merged, gridded, validated products
In-situ observations	GDAC, RDAC, ARGO, GTSP, DBCP	In-situ Data Centre	Regular + On-demand	High quality controlled, merged gridded products, climatology
In-situ observations in real time	ARGO	In Situ - TEP	Real Time flow	ARGO data in real -or near real -time, with QC flags
In-situ observations in real time	In Situ - TEP (from ARGO)	Ocean Model Centre	Real Time flow	ARGO data in real -or near real -time, with QC flags
In-situ observations in real time	In Situ - TEP	?	Real Time flow	GSUD / VOS, Ocean time series / BBCP

### Data Flow Categories

- Internal within one IP
- Interacting between two IPs
- External between an IP and a third party

### GEMS

Data flow	Source	Destination	Delivery Mode	Theme/Product
Geoland CSP-OFM Vegetation CO <sub>2</sub>	GEOLAND-OFM	GEMS at ECMWF	To be checked, initially research mode only	Land use change and forest fires
Geoland ONC Vegetation CO <sub>2</sub>	GEOLAND-ONC at ECMWF	GEMS at ECMWF	To be checked, initially research mode only	Vegetation data as input for emission models (biogenic and fires): CO <sub>2</sub> fluxes, above-ground biomass, stomatal conductance
GEMS global aerosol products	ECMWF	Mersea retrieval centres	To be checked, initially research mode only	Atmospheric Aerosol data for atmospheric corrections in retrieval
GEMS global aerosol products	ECMWF	geoland retrieval centres	To be checked, initially research mode only	Atmospheric Aerosol data for atmospheric corrections in retrieval
Meteorological forcing fields	ECMWF	Ocean Model Centre	Regular distribution, real-time analysis and forecasts, Regional high-resolution models	Meteorological forecast/ NWP Bulletin
Meteorological forcing fields for land surface models	ECMWF	Geoland/ONC	Regular	Air temperature/humidity, wind speed, precipitation and incoming radiation (short and longwave)
Geoland Global products	Geoland-CSP	GEMS	Regular + On-demand	Generic Land Cover (300 m - 1 km resolution)
Satellite data	ESA, EUMETSAT, NOAA / NASA (UNI-BREMEN, UMW)	ECMWF	Operational	Raw radiances and satellites products on atmospheric species concentration and fire count/ burnt area
In-situ data	Scattered provider (NILU, EEA, national and regional authorities)	ECMWF, MPI, KNMI, RAQ Centres	Regular	In situ observation for validation
CO <sub>2</sub> concentration	www.cmdl.noaa.gov, gaw.kishou.go.jp	GEMS at ECMWF	On demand	Validation data for CO <sub>2</sub> assimilation. Open access on the Internet.
GEMS global products	ECMWF	GEMS RAQ Centres (6)	Operational	Boundary conditions for regional air pollution models

### Geoland

Data flow	Source	Destination	Delivery Mode	Theme/Product
Meteorological forcing fields for land surface models	ECMWF	Geoland-ONC	Regular	Air temperature/humidity, wind speed, precipitation and incoming radiation (short and longwave)
Geoland Global products	Geoland-CSP	GEMS	Regular + On-demand	Generic Land Cover (300 m - 1 km resolution)
Geoland CSP-OFM Vegetation CO <sub>2</sub>	GEOLAND-OFM	GEMS at ECMWF	To be checked, initially research mode only	Land use change and forest fires
Geoland ONC Vegetation CO <sub>2</sub>	GEOLAND-ONC at ECMWF	GEMS at ECMWF	To be checked, initially research mode only	Vegetation data as input for emission models (biogenic and fires): CO <sub>2</sub> fluxes, above-ground biomass, stomatal conductance
GEMS global aerosol products	ECMWF	Geoland retrieval centres	To be checked, initially research mode only	Atmospheric Aerosol data for atmospheric corrections in retrieval
Satellite data	ESA, EUMETSAT, NOAA / NASA	Geoland-CSP	Regular + On-demand	Satellite observation to infer information about the land surface, in three areas: vegetation, radiation, water
In-situ data	Météo	Geoland-CSP	Regular + on demand	Rainfall
In-situ data	Research labs	Geoland-CSP	On demand	Validation data for Vegetation, radiation, soil moisture products
Satellite data	SPOT Image, NASA	Geoland-CSP	On demand	Validation data for Vegetation & Land cover products
Satellite data to be assimilated	ESA, EUMETSAT, NOAA/NASA, CNES	Geoland-ONC	Regular + On-demand	Satellite observation to infer information about the land surface and the vegetation status.
In-situ data for validation	Fluxnet	Geoland-ONC	On-demand	CO <sub>2</sub> and water fluxes
In-situ data for validation	GAW	Geoland	On-demand	Radiative surface fluxes
Geoland Global products	Geoland-CSP	Geoland-ONC, GEMS	Regular + On-demand to be checked, initially research mode only (TBC)	Biogeophysical Parameters (Rainfall for water cycle, burned area, active fire and LAI for trace gas emission) Vegetation data as input for emission models (biogenic and fires) (TBC)
Satellite forcing fields for land surface models	Geoland-CSP	Geoland-ONC	Regular	Improved precipitation fields and incoming radiation (short and long-wave)