



# OSCAR

Observing Systems Capability Analysis  
and Review Tool

**- User Manual for OSCAR/Space and OSCAR/Requirements-**

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## INTRODUCTION

This document describes and explains the functionality of the web-based interface of the **Observing Systems Capability Analysis and Review Tool (OSCAR)** for the general public, focusing on two components: the Space-based Capabilities module (OSCAR/Space) and the Observation Requirements module (OSCAR/Requirements). The third component of OSCAR, which is dedicated to Surface-based Capabilities (OSCAR/Surface), is addressed in the separate **OSCAR/Surface User Manual**. In addition, the [OSCAR/Requirements Manual for Focal Points](#), provides additional details on the management of observation requirements for designated focal points, who are responsible for maintaining and editing observation requirements in their respective area, with a dedicated account.

OSCAR/Space is a resource provided by WMO in support of Earth Observation studies and global satellite mission coordination. The information contained in OSCAR/Space is updated by the WMO Secretariat to the best of its knowledge, in close cooperation with space agencies and application experts. However, satellite systems and plans are continuously evolving. Neither WMO, nor the space agencies, nor any of their employees or contractors, makes any warranty on the data contents, or any assumed legal liability for the accuracy, completeness, or usefulness of this information.

It is underlined that the assessments contained in OSCAR/Space are performed according to objective criteria, based on instrument design characteristics, and submitted to validation by international expert teams (primarily the WMO/CBS Expert Team on Satellite Systems). These assessments only reflect a relative, and generally qualitative, evaluation. This first level analysis does not replace a detailed analysis of instrument performances or a detailed evaluation of the quality of derived environmental data records that are actually available for a specific user application.

Information contained in OSCAR may be used freely. Publications using information from OSCAR should acknowledge WMO.

### ***System Requirements***

The web-application is platform-independent, and can be accessed with any recent web-browser. JavaScript and Cookies need to be enabled for proper functionality. The application has been tested and is known to work with Internet Explorer 8 or higher, and with the two most recent versions of Firefox, Chrome or Safari. The application can be started by accessing <http://www.wmo.int/oscar/>.

## Basic Structure

OSCAR as shown in Figure 1 consists of three modules, Observation Requirements, Satellite Capabilities, and Surface-based capabilities. These modules can be accessed by the general public via one single web-interface. A user manual for OSCAR/Surface is provided separately and outside the scope of this Manual. Users with special rights, such as WMO Focal Points or Administrators are able to maintain data in their respective field.

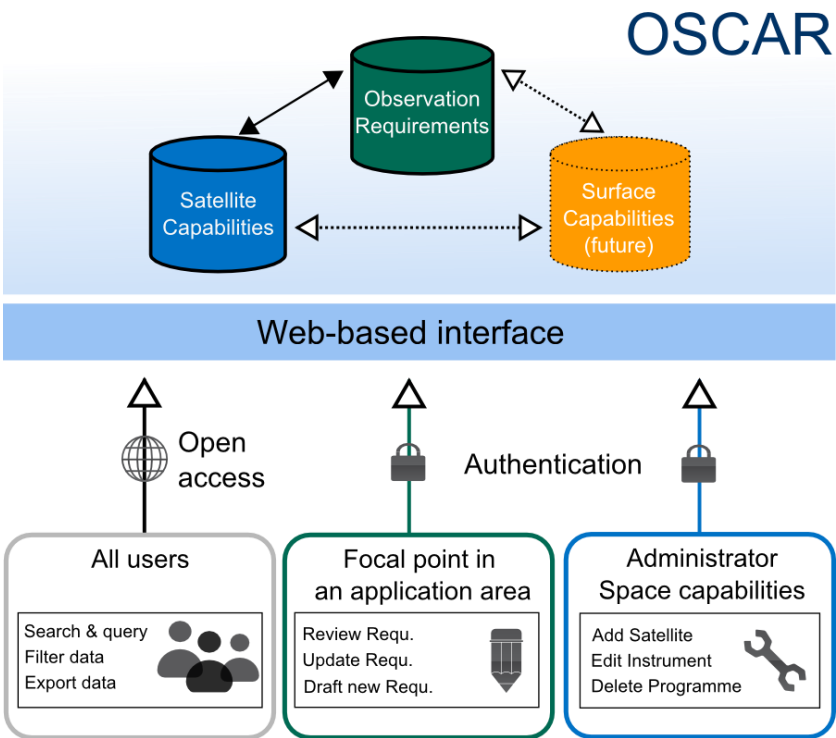


Figure 1 Basic Structure of OSCAR and examples of access

## USING OSCAR/SPACE OR OSCAR/REQUIREMENTS

### Home Page and Navigation

The first page users see consists of the head section (indicated as the green box in Figure 2), which includes a simple navigation bar and the login for registered users. This head section stays the same throughout OSCAR and allows direct access to all core content. The three main modules can be accessed from the navigation bar.

The content section (shown in red box) provides basic information about OSCAR

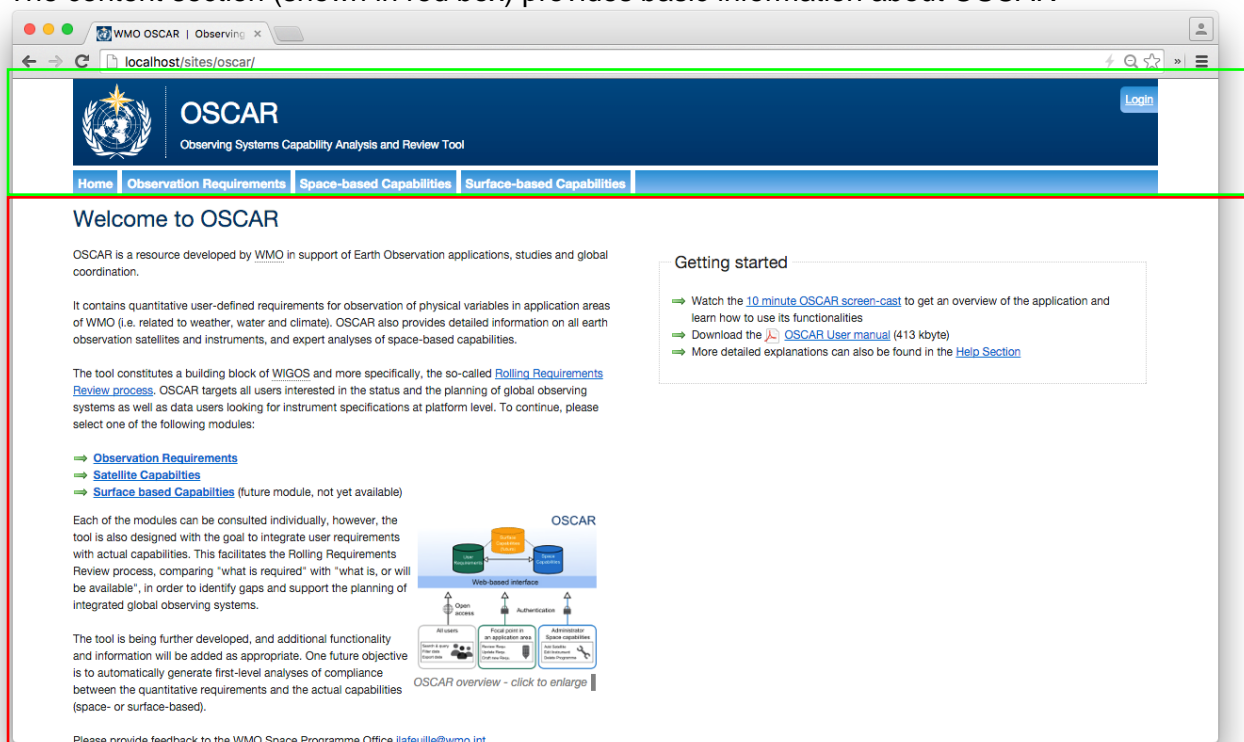


Figure 2: Home Page of OSCAR

## Accessing data

There are two general ways of accessing data in OSCAR, either through the “**quick search**” – helpful if searching for any particular Variable, Instrument, Satellite etc, or via the **full data tables**, if the objective is to get an overview over multiple data items, with the possibility to then narrow the search with the use of filters.

### “Quick Search”

The quick search box is located in the right top header, and is available in both modules (Observing Requirements and Space-based capabilities), but not on the homepage. This free-text search field (Figure 3) expects the name or partial name of either

- **Variable** or **Application Area** (when in the *Observing Requirements* module)
- **Satellite, Programme, Instrument, Instrument type, Capability, Space Agency** or **Variable** (when in the *Space-based capabilities* module)

The search will present possible matches in a structured list while typing. The search is started as soon as at least 2 characters are entered in the field.

The “quick search” not only takes the acronym and name fields into account, but also the description field (if such information is available). Therefore it is also possible to use keywords, if the exact name of an item is not known. For example, the term “lightning” will return the instrument “LMI”.

As Figure 3 shows, the Search instantaneously returns some suggested results, trying to “guess” the user’s intention (in this case, searching for “Aerosol Effective Radius”). As soon as these results pop up, it is possible to directly click on any item, which takes the user to the required page.



**Figure 3: Free Text Search, searching for Term "aero"**

**Note**

The “quick search” is **context-sensitive**, which means it only searches through the data items that are part of the currently selected module (e.g. variables, application areas for OSCAR/Requirements; Satellites, Instruments, Space agencies, Variables etc. for OSCAR/Space)

The quick search is not **case-sensitive**, i.e. **Aerosol** and **aerosol** will return the same results.

**Working with the full data tables**

Another way of accessing the content of OSCAR is by navigating through the submenu of each module of the tool (Figure 4). This option offers tabular access to all available data, i.e. all Variables, Satellites, Instruments, and Application Areas etc. with respective links to more detailed pages.



Figure 4: Space-based capabilities Sub-menu

**Filtering**

Instead of browsing through the entire table, there is the possibility to use the “**Filter**” option(s) provided for most tables to pre-select items which are of most interest. Figure 5 shows the use of the filter option on the Satellite page.

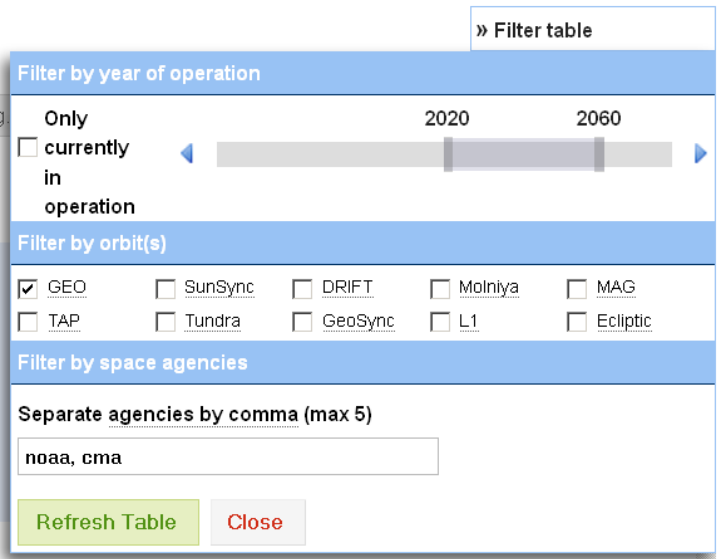


Figure 5: Filter options of the Satellite page

In this example, three types of filters are provided: By year of operation, orbit in which the satellite is flying and by agencies which are involved in the mission. All available filter options can be combined to create complex conditions such as

*Show all currently active Satellites in GEO or Drift Orbit, operated by NOAA or CMA*

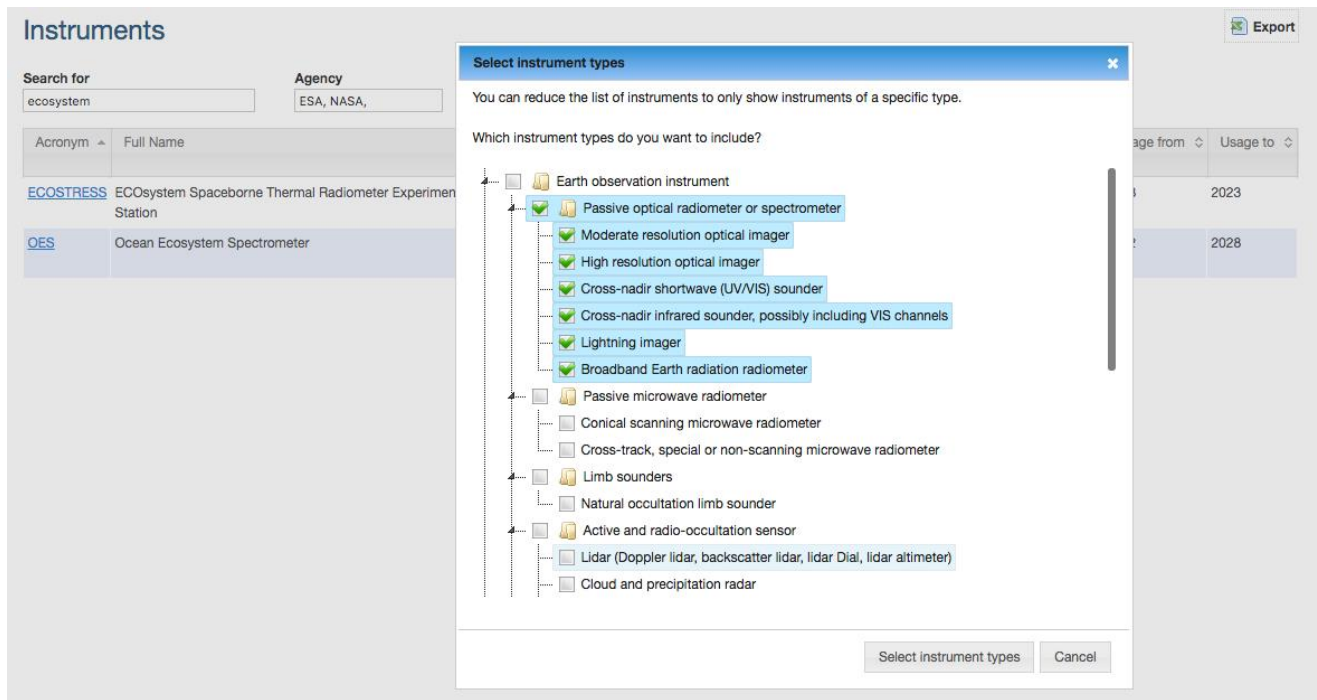
**Note:**

Generally, if no item is selected, all are returned.

The export functionality takes the current filter into account

The list of instruments includes expanded filtering possibilities which look slightly different but function along the same lines. In this example the list shows instruments that have the word “ecosystem” anywhere in their name or description, that are operated by either ESA or NASA, and that are a *Passive optical radiometer or spectrometer*.





The instruments can be further filtered by spectral domain, by orbit, by years of operation, and for some instrument types by additional filters (available by clicking the 'expert search' button).

Search for	Agency	Instrument types	Spectral domain	Expert search	Orbit	Years of operation		
ecosystem	ESA, NASA, I	Select	First select instrument type	First select instrument type	Select	Select		
Acronym	Full Name	Providing agency	Instrument type	Flying on satellites	Usage from	Usage to		
<a href="#">ACE Lidar</a>	Aerosol-Cloud Ecosystems Lidar	<a href="#">NASA</a>	Space lidar	<a href="#">ACE (Aer.Clo.Eco.)</a>	2023	2028		
<a href="#">ECOSTRESS</a>	ECOSystem Spaceborne Thermal Radiometer Experiment on Space Station	<a href="#">NASA</a>	High-resolution optical imager	<a href="#">ISS ECOSTRESS</a>	2018	2023		
<a href="#">GEDI Lidar</a>	Global Ecosystem Dynamics Investigation Lidar	<a href="#">NASA</a>	Space lidar	<a href="#">ISS GEDI</a>	2019	2024		
<a href="#">InSAR</a>	Interferometric Synthetic Aperture Radar	<a href="#">NASA</a>	Imaging radar (SAR)	<a href="#">DESDynI</a>	N/A	N/A		
<a href="#">OES</a>	Ocean Ecosystem Spectrometer	<a href="#">NASA</a>	Moderate-resolution optical imager	<a href="#">ACE (Aer.Clo.Eco.)</a> <a href="#">PACE</a>	2022	2028		
<a href="#">VCL</a>	Vegetation Canopy Lidar	<a href="#">NASA</a>	Space lidar	<a href="#">DESDynI</a>	N/A	N/A		

The spectral domain and expert search filters are applicable to each instrument type separately; therefore they are only available once the applicable instrument types have been selected.

For example, if a user has selected instrument types “Moderate resolution optical imager” and “Cross-nadir shortwave (UV/VIS) sounder”, then trying to filter by spectral domain would only display those spectral filters that are potentially applicable to these instrument types:

**Select spectral domain**

**Moderate resolution optical imager**

- ☐ UV
- ☐ VIS
- ☐ NIR
- ☐ SWIR
- ☐ MWIR
- ☐ TIR
- ☐ FIR
- ☐ mm/sub-mm

**Cross-nadir shortwave (UV/VIS) sounder**

- ☐ EUV
- ☐ UV
- ☐ VIS
- ☐ NIR
- ☐ SWIR

Reset filter Apply Cancel

The orbit filter is applied across all instrument types. It allows you to limit the instrument list to those instruments that are flying on one or several orbit types, for example, in a Geostationary or Geosynchronous orbit:

**Select orbit**

- ☒ GEO & GeoSync
- ☐ HEO
- ☐ MEO
- ☐ LEO/SunSync
- ☐ LEO/Drifting
- ☐ Magnetosphere
- ☐ Ecliptic
- ☐ L1
- ☐ Solar

Reset filter Apply Cancel

Finally, the “years of operation” filter allows you to limit the list to instruments flying on a satellite that was active, or is planned to be active during at least part of the selected period.

**Select years of operation**

Please select the years of operation to filter the list of instruments.

1957 2008

Reset filter Apply Cancel


## Sorting

In tables data can be sorted in ascending and descending order where indicated by small arrows, (red circle in Figure 6). Sort direction is changed by clicking on the respective column head.

Variable name	Theme
<a href="#">Accumulated precipitation (over 24 h)</a>	Clouds and precipitations
<a href="#">Aerosol Absorption Optical Depth</a>	Aerosols and radiation
<a href="#">Aerosol Extinction Coefficient</a>	Aerosols and radiation

Figure 6: Detailed view of Table, with sort options in columns

## Export

All Tables indicated with  **Export** (such as Requirements, Variables, Themes, Satellites, Instruments etc.) can be downloaded and saved in .xlsx Format, a native Office 2007 format, which can be read by most other spreadsheet software. These files are automatically generated and thus reflect the current status of the Database. The export function also takes the current filter status into account. Please note that the generation of a large table might take a few seconds.

## Detail pages

All data items, such as Variables, Requirements, Instruments or Satellites have their own dedicated detail pages which are accessible through a unique URL (and can thus be bookmarked). These pages can be accessed directly through the quick search, but also from the tables. Detail pages contain all information that is available, e.g. in the case of a satellite, there can be many additional details that are not shown in the overview tables, such as comments on platform status, frequencies used for downlink, payload status, etc.

## Variable: Aerosol Extinction Coefficient ◀ ▶

Definition				Classification	
<b>Full name</b>	Aerosol Extinction Coefficient			Domain: <a href="#">Atmosphere</a>	Used in Application Areas: <a href="#">Climate-AOPC</a>
<b>Definition</b>	3D field of spectral volumetric extinction cross-section of aerosol particles.			Theme: <a href="#">Aerosols and radiation</a>	
<b>Measuring Units</b>	m <sup>-1</sup>	<b>Uncertainty Units</b>	m <sup>-1</sup>	Variable: Aerosol Extinction Coefficient	
<b>Horizontal Res Units</b>	km	<b>Vertical Res Units</b>	km	Measured in Layers:	
				HS&M	
				LS	
				HT	
				LT	
<b>Comment:</b>	The scattering and absorption components of aerosol extinction coefficient are called "aerosol scattering coefficient" and "aerosol absorption coefficient" May be specified as a size-dependent quantity.				
<b>Last modified:</b>					

Requirements defined for *Aerosol Extinction Coefficient* (4)

This table shows all known Requirements defined for this variable area. For more operations/export, please go to the main [Requirements page](#)

Note: In reading the values, goal is marked **blue**, breakthrough **green**, and threshold **orange**

Id	Layer	Application Area	Uncertainty	Horizontal Resolution	Vertical Resolution	Observing Cycle	Availability	Conf Level	Val Date	Source	Comment
55	HS&M	<a href="#">Climate-AOPC</a>	1e-05 m <sup>-1</sup>	10 km	0.5 km	24 h	7 d	reasonable	2007-07-19	AOPC	
			1.5e-05 m <sup>-1</sup>	20 km	0.65 km	2 d	14 d				
			2e-05 m <sup>-1</sup>	100 km	1 km	7 d	60 d				
56	HT	<a href="#">Climate-AOPC</a>	1e-05 m <sup>-1</sup>	10 km	0.5 km	24 h	7 d	reasonable	2007-07-19	AOPC	
			1.5e-05 m <sup>-1</sup>	20 km	0.65 km	2 d	14 d				
			2e-05 m <sup>-1</sup>	100 km	1 km	7 d	60 d				
57	LS	<a href="#">Climate-AOPC</a>	1e-05 m <sup>-1</sup>	10 km	0.5 km	24 h	7 d	reasonable	2007-07-19	AOPC	
			1.5e-05 m <sup>-1</sup>	20 km	0.65 km	2 d	14 d				
			2e-05 m <sup>-1</sup>	100 km	1 km	7 d	60 d				
58	LT	<a href="#">Climate-AOPC</a>	1e-05 m <sup>-1</sup>	10 km	0.5 km	24 h	7 d	reasonable	2007-07-19	AOPC	
			1.5e-05 m <sup>-1</sup>	20 km	0.65 km	2 d	14 d				
			2e-05 m <sup>-1</sup>	100 km	1 km	7 d	60 d				

Figure 7: Detail page: All information on a specific variable

## Instruments

In addition to a technical description, the Instruments page contains the indication of the satellites carrying the instruments, the main measurement objectives the instrument has been designed for, and a tentative evaluation of the performance of these measurements according to an expert system, which is the basis for the Gap Analysis described below. Only the first five primary mission objectives are displayed on the standard view, the full list can be seen in clicking on "Show all". The tentative evaluation of measurements also indicates possible "operational limitations" and a line of explanation. The list of measurements can be filtered, for example Figure 7 bis shows the evaluation of measurements from MLS(Aura) filtered by the word "Ozone".

**Mission objectives**

**Primary mission objectives**

- BrO
- ClO
- H<sub>2</sub>O
- HCl
- HDO

Show all

---

**Tentative Evaluation of Measurements**

The following list indicates which measurements can typically be retrieved from this category of instrument. To see a full Gap Analysis by Variable, click on the respective variable.

*Note: table can be sorted by clicking on the column headers*

Search:

Variable	Relevance for measuring this variable	Operational limitations	Explanation
<a href="#">O<sub>3</sub></a>	3 - high	Limited to high atmosphere.	Mm-summ spectrometryOzone lines around 240, 300 and 500 GHz.

Showing 1 to 1 of 1 entries (filtered from 10 total entries)

**Figure 7 bis. Tentative evaluation of measurements from MLS (Aura) filtered by the word “ozone”.**

The detailed status of an instrument flying on a particular satellite can be shown, when this information is available, by clicking on “See instrument status” after the name of the satellite on the upper-right part of the Instrument page.

## Frequencies

The Frequencies table aims to provide a directory of radio-frequencies used on each satellite platform, including the telecommunication frequencies (uplink/downlink) and the microwave remote-sensing frequencies (active or passive). This list is not exhaustive but focuses on operational satellites. The same information is available on the Satellite pages, in a summary form on the standard view, and with full details when selecting “Show expert details”.

# Expert analysis tools

The OSCAR Space-based capabilities module also serves as a first level analysis tool providing expert assessments on the availability and relevance of the various instruments to fulfil particular missions, or for measuring particular variables. This should however only be seen as a starting point for more detailed, specific studies. These assessments are considering the potential performance of instruments, primarily on the basis of their design features, and do not take into account other important criteria such as accuracy of instrument calibration or actual data availability or timeliness.

Three kinds of Gap analyses are currently provided: by variable based on expert rules, by variable based on a simplified approach, and by type of mission.

## Gap Analyses by Variables (expert rules)

The Gap Analysis by Variable relies on a rule-based expert system to determine whether and to what degree an instrument has the potential to measure a particular geophysical variable. This tool can be used to draw measurement timelines by specific Variables, by selecting a sub-domain (e.g. Cloud and precipitation Land surface, Ocean) and the particular variable. For example, a rule can say that *Moderate resolution optical imagers* with more than 2 VIS channels and more than 2 different viewing angles are the primary instruments for measuring the *Earth Surface Albedo*. The OSCAR/Space knowledge basis contains over 2500 built-in rules to determine how a particular instrument (among nearly 1,000 recorded instruments) is suited to measure a given variable (among more than 160 variables measurable from space), according to its main technical specifications. The resulting data (Figure 9) can be sorted by clicking on the header columns (e.g. satellite, instrument, year, etc). Filtering by satellite or instrument is also possible.

Doc. ID: 04289/2016, ver. 1.0

Select a variable

Basic atmospheric

✓ -- Select variable --

Air pressure (at surface)

Air specific humidity (at surface)

Air temperature (at surface)

Atmospheric density

Atmospheric temperature

Height of the top of PBL

Height of the tropopause

Integrated Water Vapour (IWV)

Specific humidity

Temperature of the tropopause

Turbulence

Wind (horizontal)

Wind (vertical)

Wind speed over the surface (horizontal)

Wind vector over the surface (horizontal)

or select a type of mission

-- Please select a type of mission --

Figure 8: Selecting a sub-domain and a Variable for Gap Analysis

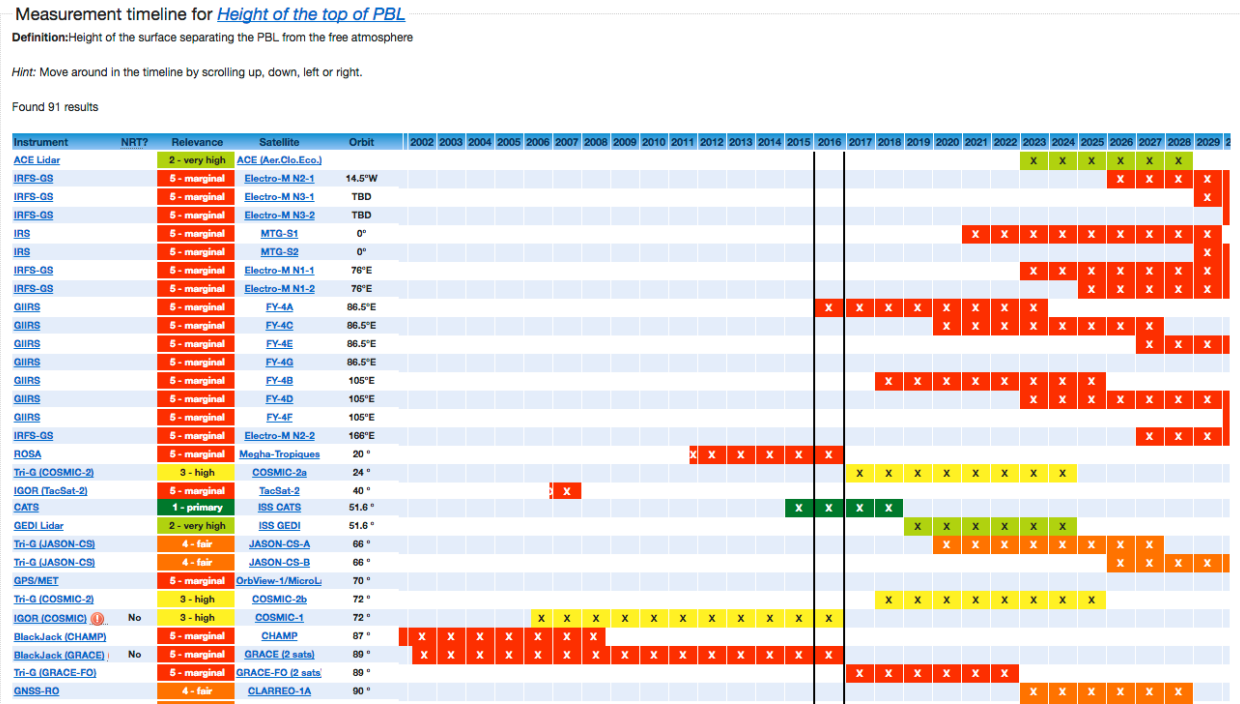


Figure 9: Result of a Gap Analysis

**Note:** Instruments to fly on satellites which are not firmly planned are shaded with stripes in the table. The current year is highlighted with black bars. It is possible to sort the Gap Analysis table by clicking on any of the cells in the table header. A warning icon (⚠) indicates a degraded satellite. Hover over the icon or select the satellite to see details on the type of degradation

Gap Analyses by Variables (simplified analysis)

In the “Simplified” mode, the results are calculated by looking at each instrument’s mission objectives: for each instrument we keep track of what the primary, secondary, and opportunity mission objectives are. These mission objectives indicate respectively that an instrument is primarily designed to measure variable X, Y and Z, that variables A, B and C are its secondary objectives, and that it may offer the opportunity to measure variables I and II although it is not optimized for that. The simplified Gap analysis produces a timeline based on this information. The simplified Gap analysis considers the relative priorities of measuring certain variables in the design and exploitation of a particular instrument, while the expert approach analyses the objective characteristics of all instruments of the relevant type.

## Gap analyses by type of mission

This tool is specifically designed to support WMO Members in monitoring the implementation of the space-based observing system and planning its further evolution. It refers to a pre-determined list of capabilities such as those identified in the WMO Vision of Global Observing Systems for 2025. Unlike the gap analysis by variable, the gap analysis by mission is technology-oriented. The instruments are sorted in up to five categories, according to the technology used. The sorting criteria of each mission are displayed when clicking on the relevant box (“Show sorting criteria”).

To see instruments contributing to a particular capability, one can select that capability in the same screen as the Gap Analysis. However, instead of selecting a variable, you select a *mission* from the second dropdown menu. The resulting timeline functions in a similar way to how the Gap Analysis works. In addition, a block “Additional filters” appears. This block allows drilling down the analysis in limiting the display to specific spectral bands, among the bands that are applicable to at least one instrument in the list.

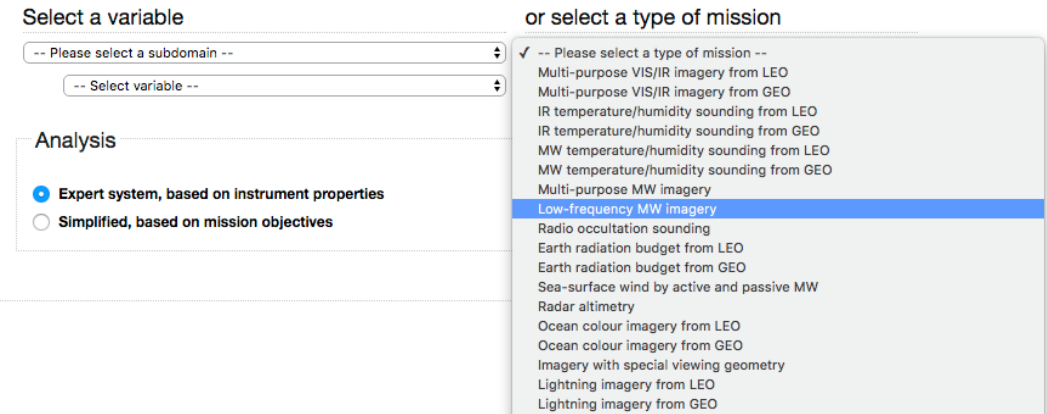


Figure 10: Selecting a mission for the capability review (in the Gap analysis screen)