SURVEY OF THE COPERNICUS WORKSHOP ON THE ATMOSPHERE AND CLIMATE CHANGE SERVICES

1. **Do you use Copernicus data, services or products?**

Even though some of those participating in the survey use Copernicus, the lack of information on the program is remarkably high.

2. **If affirmative:**

What Copernicus data or products are useful for your work or field of research?

- Atmospheric composition data (data on aerosols in operative mode and reanalysis) and meteorological data (ERA-Interim[1]).
- The IBI model.

Depending on the field, some images are used more than others.

a) Do these data/products replace those used previously, complement them or offer something new in your area?

There exists a tendency to recognise Copernicus data as complementary to those used and generated on a regular basis. A frequent problem is that data obtained through other programmes or methods used regularly are often considered to be better.

b) Are the other data you use: Spatial or in-situ data? Also freely available and free of charge? Please indicate the other data/products you use or have used.

- Satellite data (polar orbiting and geostationary) from NASA and EUMETSAT**.**
- In-situ air quality (Airbase, EMEP, aerosols (AERONET, EARLINET) and meteorological (METAR and SYNOP).
- Atmospheric composition models (NMMB/BSC-CTM, BSC-DREAM8b, GEOS-5, NGAC, ...)
- Both spatial and in-situ data (numeric wind and wave models, high frequency radar measures, one-off measures). The State Ports Authority provides these products which are freely accessible.
- *(Not all services have responded to this part of the survey, therefore it must be borne in mind that data used correspond to many other kinds of data).*
- They also indicate that they use freely accessible and free data.

[1] ERA-Interim is a data set that shows the results of global climate reanalysis from 1979 to the present. ERA-interim continues to be updated almost in real time as new data becomes available.

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c) What aspects would you improve (e.g. speed of access, resolution, frequency, etc.)? What data or services does Copernicus not offer compared to other satellite images and other products that you would like to have?

Areas to be improved:

- Access to data via MARS for the download of data. Often, when an error occurs downloading the report that is received, the message does not clarify very well the reason for the download failure. It would be desirable to improve the content of these logs.

- It is difficult to find the list with the catalogue of products with the reference to the variable to download and its associated parameters.
- In this sense, I would propose a graphic "interface" for the download (as used in other institutions such as NASA-LaRC).
- Climate information during all phases: design, function and maintenance, post.
- Estimates and reduction of uncertainty.
- Continuous frequent spatial assessments (monitoring) of quality of bathing water.
- LAI and FAPAR best estimate.
- The estimate of concentration of pollutants requires significant resolution, so as to allow for the identification of the source and the assessments of transnational impacts.
- Use of EO to estimate SO_2 emissions from boats in the Mediterranean Sea.
- Monitoring of the spatial distribution of pollutants.
- Special interest expressed in the ozone, the intrusion of dust particles from the Sahara, sulphur emissions from ships and the emission of particles from the burning of agricultural and forest waste.
- Significant interest in CAMS products, but provided they are easily accessible.
- Electricity generation: characterisation of instantaneous intermittency, improvement of 24 hour prediction, improvement of prediction of direct radiation.
- Generation of electricity and heat: characterisation of annual variability, spatial variability (need to develop local measures) and long-term information (profitability of investment).
- Importance of including local and regional work networks such as NDACC. The maintenance of these networks allows for the validation and provides trust in satellite-based products.
- Greater precision in prediction of extreme climate events.
- Highlight the need to work on the reliability of observations so that predictions based on mathematical models also evolve and are more exact.
- The ESA Catalogue does not appear to be easy to manage, it being compared to some that exist in other services (such as NASA), in terms of how it refers to the search, exploration and download.
- The tools presented by Sentinel-2 do not appear to function entirely well, with certain products not easy to use (specifically, Level 2A). If appropriate images are offered, comparable in terms of preparation and correction, the usefulness of Sentinel's "harmonized" products which might be compared and used through common standards

would increase. Even some external services are now offering adequate BoA (Bottom of Atmosphere) images.

Data:

- Aerosols extinction and concentration profiles of the CAMS model. Extinction is comparable to the data provided by LIDARS and ceiliometers and also of today, it is necessary to generate this variable using different variables (relative humidity, pressure, temperature and mixing ratio by size of particle) for all levels of models (currently 60 vertical levels). The same occurs with concentration, the conversion of mixing ratio to concentration must be completed and for that, the meteorological parameters are required.
- Data from satellite observations and surface networks. For the moment, there is no direct access to the observations from the CAMS data catalogue. The observations are included in the process of assimilation and in the validation/evaluation of the models, but cannot be downloaded directly from CAMS.
- It is not possible to download only images for specific use on the part of the user. When a use is defined, everything must be downloaded, including the specific region (more information than the user requires is downloaded, which means time wasted).
- Inclusive and collaborative science, public data (i.e. different actors capable of nestling in central services of C3S to develop their own models and services).
- Databases from old projects on a Google-type platform that allows for meta-data and framework conditions.
- On-line platforms and tools for the management and exploitation of data.
- Importance of prediction of aerosols and dust for which AEMET is currently using MODIS data (Sentinels only used in test).
- Corrections of additional images must be carried out by the ESA. In this way, products won't require additional processing and would be used immediately ("users wait for a prepared image for immediate use").

3. **If you do not use them, please state** why**.**

- Lack of knowledge of the program and its possibilities.
- There exists a certain uncertainty between what added value Copernicus offers to the national data obtained in-situ.
- The lack of knowledge regarding the official validation of the data.
- They do not know how to access the program.

a) **What are the main shortcomings you find (e.g. speed of access, resolution, frequency, type of data, etc.).**

b) What data or products would Copernicus need to offer and in what format or in what way to make them useful in your day to day work? Are they available openly and free (the same or similar data from other sources?).

For many potential users that do not use Copernicus, the different responses to question "a" mean they did not respond to "b" or "c". That is to say, broadly speaking, there are two types of people: those that used Copernicus and those that don't even access it due to lack of knowledge.

4. Finally, please suggest actions that you would like or that you believe should be carried out by the Spanish Administration or the European Commission to improve the use of Copernicus data and products (especially in your own particular case) in Spain.

- "Interface" graphics for the download of data and that allow for simple graphics (maps and time series) and calculations (ratios) to be generated from CAMS data. This would make more users use Copernicus data.
- Training programmes (on-line and face-to-face courses) on use and interpretation of CAMS products.
- Copernicus is oriented towards regional-continental scale products but must also promote national support programmes for the development of specific tools for air quality and civil protection.
- A greater dissemination and the possibility of accessing data in a more intuitive manner.
- Clarification of how Copernicus and Inspire are going to interfere.
- Practical workshops at the level of potential users that have never accessed the program.
- Practical applications in the public employment domain. This would help greatly with its dissemination.
- Management of issues relating to human health (including outbreaks/epidemics) and the development and analysis of provincial level models. It would be interesting to carry this out with greater spatial detail.
- Monitoring of outcrops of algae that affect aquaculture and have an important impact on food safety.
- Monitoring and propagation of illnesses transmitted by vectors, including indirectly (temperature, wind, swamps, etc.).
- Possible synergies of EO with radiological environmental monitoring, in relation to the transposition of the Water Quality Directive.
- Predictions (harvests).
- Need to reach the final user through open applications on mobile devices.
- CAMS service to reach the education and academic community.
- Strengthen the connection between researchers and industry.

- Emphasise the importance of collaboration with European partners both on European and international projects.
- The Public Administration produces and supplies in-situ data within the framework of the monitoring and reporting of information, as required by European regulation. The challenge is to find Copernicus programme projects that fit with the needs of the authorities provided that they are based on official data produced.
- One of the possible benefits that may assist with monitoring and reporting of European regulation - if satellite images are improved - would be to look at the shortcomings of information observed once all the information has been obtained, for example, the lack of information when information goes from the regional to the national scope.

Acronyms	
	l Aeronautics and Space Administration
AEMET	Spanish State Meteorological Agency
AERONET	Aerosol Robotic Network
Airbase	European air quality database
BSC-DREAM8b	Barcelona Supercomputing Center- *Dust Regional Atmospheric Model*
C3S	*Copernicus* Climate Change Service
CAMS	*Copernicus* Atmosphere Monitoring Service
EARLINET	European Aerosol Research LIdar NETwork
EMEP	*The European Monitoring and Evaluation Programme*
EO	Earth Observation
ESA	European Space Agency
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAPAR	Fraction of Absorbed Photosynthetically Active Radiation
GEOS-5	Goddard Earth Observing System Model, Version 5
LAI	Leaf Area Index
MARS	Maritime mobile Access and Retrieval System
METAR	Meteorological Aerodrome Report
NASA-Larc	National Aeronautics and Space Administration-Langley Research Center
NDACC	Network for the Detection of the Atmospheric Composition Change
NGAC	*National Geospatial Advisory Committee*
NMMB/BSC-CTM	Nonhydrostatic Multiscale Model on the B grid / Barcelona Supercomputing Center- Chemical Transport Model
SYNOP	Surface Synoptic Observations