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European research opportunities and priorities for the next generation of meteorological satellites
EUMETSAT

Q&A via Slido and livechat

1. **Where do you see the biggest potential of the new missions for research in nowcasting severe weather ?**

Data from the upcoming Meteosat Third Generation (MTG) mission has major potential for better understanding atmospheric processes and for forecasting severe weather. MTG carries a suite of instruments that Europe never had before: the next-generation spectral imager with improved temporal and spatial resolution (FCI), the space-based lightning imager (LI), the hyperspectral infrared sounder (IRS), and the UV-VIS-NIR sounder (UVN, Copernicus Sentinel-4). Over Europe, these data will be collocated in space and time ("4D Weather Cube"), and the biggest potential for research and improving applications lies in their complementarity and combined analysis.

2. **How can EUMETSAT help scientists to get prepared for working with next-generation satellite data?**

EUMETSAT is working with ESA and the European Commission on space-related elements of the upcoming HorizonEurope research framework programme. EUMETSAT is encouraging users to communicate their requirements and needs, through the annual EUMETSAT Meteorological Satellite Conferences, the MTG and EPS-SG User Days 2021, and the Atmospheric Composition User Consultation starting in June 2020. EUMETSAT is open to new ideas, encourages research activities, and provides support as appropriate and within the frame of its programmes, activities, and studies.

3. **How do you see atmospheric chemistry products from the new missions being used in driving numerical weather models, and chemistry-climate models?**

Currently EUMETSAT focuses on atmospheric chemistry product generation, product quality monitoring, and the best characterisation of instrument data. Some fundamental issues need attention for atmospheric products, such as spectroscopy, long-term validation capabilities, and understanding of processes (diurnal cycles of atmospheric constituents, etc). Reprocessing of such products into long-term records is ongoing in partnership with the European Commission and ESA.

Getting user feedback from the atmospheric chemistry and the modelling communities is important for EUMETSAT, both on existing and planned products. The advent of data from the future Copernicus Sentinel-4 and -5 missions operated by EUMETSAT, combined with atmospheric chemistry information derived from MTG IRS and IASI, offers major growth potential for use in modelling, research, and applications.

4. **When will the AOD product from Sentinel-3 become operational?**

The product becomes operational once its performance is meeting the EUMETSAT quality standards and requirements.

5. **What are the gaps in cross-instrument application for meteorology and oceanography?**

There is not necessarily a gap in cross-instrument applications - they are just very challenging scientifically and technologically (calibration, instrument response, representativity). In the presentation, the PMAp aerosol product is generated using three instruments namely AVHRR (imagery), IASI (hyperspectral IR) and GOME-2 (UV-Vis). Each instrument provides different/complementary information but at different resolutions. It was quite a challenge to get it operational but after 5+year of R&D, the product is assimilated by CAMS since 2017.

On the next-generation platforms, many opportunities exist as well, including on air quality-related products. Also, surface products (land and ocean) will be able to take full advantage of the advanced air quality instruments Copernicus Sentinel-4 and Sentinel-5 in having fully characterised atmospheric corrections.

6. **In the slide with the aerosol optical depth (AOD) of the Australian wildfires, the smoke plume of the PMap product has missing pixels for the central part. Why is that?**

Main reasons for gaps in product coverage are cloud cover, which prevents meaningful retrieval of aerosol optical depth, and limits in data availability due to instrument swath coverage.

7. **EPS measures at 2 times a day locally and is prime for NWP. How do we work with other agencies to capture the faster weather processes on the smaller scales?**

Through data sharing agreements with partner agencies such as NOAA, CMA, facilitated through the Coordination Group for Meteorological Satellites (CGMS); the availability of polar-orbiter data from these partners through the EARS regional services; and the capacity of direct readout software packages such as the NWPSAF AAPP to process third-party data such as from CrIS on NOAA-19/-20, or from VASS on FY-3C/D.

8. **How do you see the contribution of EUMETSAT's future missions to Polar meteorology?**

Today's EUMETSAT low-Earth satellites overpass the Polar Regions with each orbit, giving potentially 3 overpasses over a given location, so data coverage is quite good, and there is significant untapped potential in today's data. The biggest impediments to characterising sea ice and snow are clouds; there are also challenges in detecting and quantifying precipitation (liquid, solid). Microwave sensors on EPS-SG, such as the Micro-Wave Imager (MWI) and the Ice Cloud Imager (ICI), will allow for better characterisation of clouds and precipitation in Polar Regions.

9. **Do you see specific developments for emergency service tasks?**

The next-generation imagers on MTG (FCI) and EPS-SG (METimage) will make a stronger contribution to emergency services. The imagers are in the mid-resolution category (i.e., 350m-1km horizontal resolution), contributing to many relevant applications such as detecting fires or snow melt. Contributions to imagery for disaster reconnaissance and relief are made through EUMETSAT's involvement in the International Charter Space and Major Disasters.

There are also instruments such as the passive MW imagers or the scatterometers that will provide information such as sea ice or surface winds in coastal areas. In general, there are tremendous

opportunities for new products and applications outside of meteorology, both in the preparation of these using existing European sensors such as Sentinel-3.

Once the next-generation systems are available, the applications can cover land, the cryosphere, hydrology, etc. EUMETSAT is interested in finding out about new applications, and is very happy to help with the technological and scientific aspects of the work.

We are currently cooperating with Portugal and Spain to improve regional surface wind forecasting, given the increased risk of hurricanes in that part of the eastern Atlantic.

10. **Are FCI L1C format familiarisation simulated data still planned for release in APRIL 2020?**

The release of this dataset is imminent, please check the MTG test data website for the latest details: https://www.eumetsat.int/website/home/Satellites/FutureSatellites/MeteosatThirdGeneration/MTGData/MTGUserTestData/index.html

11. **With the upcoming MTG satellites and the amount of data from them, do you see an increase in collaborations with partners and especially SAFs?**

The SAFs are integral to the EUMETSAT family, and the close cooperation will definitely increase with the new mission, especially with respect to the applications of data and products.

12. **EUMETSAT clearly recognizes lightning detection as asset, where do you see the biggest benefit of having lightning data in the future?**

The lightning mission on the geostationary MTG is going to be an interesting experiment on many levels. The idea is that it will help with respect to short-term forecasting (e.g. hazardous weather detection, storm intensity alerts, etc.), as well as fill gaps in knowledge (i.e., how much lightning and where? Contribution of natural NOx sources?).

13. **With regard to the Q about next-gen imagers, are there plans to generate flood mapping products, e.g. in the Hydrology SAF? NOAA has been producing these using JPSS VIIRS data which have proven useful especially in remote areas such as Alaska.**

Flood maps are not part of the H-SAF portfolio currently - but this may be a good application to pursue with the new generation sensors. Feedback from the user community, including in hydrological applications, is important for EUMETSAT in this regard. EUMETSAT supports seed activities and demonstrators: lately we support the demonstration of the impact of ice on lakes on local meteorology.

14. **What are the plans for an Aeolus Doppler wind lidar follow-on system?**

ESA and EUMETSAT are currently together investigating the way forward with a follow-on doppler lidar system potentially becoming available by the end of the decade. Wind is critical for weather prediction - the validation of Aeolus products and also experimental products such as 3D wind fields from hyperspectral IR instruments on EPS, EPS-SG and MTG are critical.

15. **The novel Ice Cloud Imager (ICI) on EPS/Metop-SG will be measuring in the sub-mm range between radar and IR, where no satellite sensor has measured before. This should help understand cloud microphysical processes. Do you think the spectroscopic databases to describe scattering and absorption of ice cloud particles need updating, to get the radiative transfer correctly modelled?**

ICI is a breakthrough MW instrument with very high frequencies, and many aspects there still require fundamental R&D, including the Radiative Transfer and the spectroscopy. EUMETSAT encourages researchers to start looking at this, and is looking forward to partnerships in the science community on these points.