Polar zone ozone and UV exposure, under closer scrutiny than ever

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Global changes, such as climate warming and stratospheric ozone depletion, are increasingly noticeable. Therefore, there is a need for scientists to have reliable information about atmospheric and stratospheric processes. Today, all developed countries have invested in sophisticated surveillance systems. Their data feeds into mathematical atmospheric models to provide sets of graphical, data and documentary information—often available online—used by climate scientists, weather forecasters, environmental agencies, authorities, etc. Europe specifically keeps data of unique and most valuable long-time Arctic and Antarctic ozone concentrations levels.

Now, the EU funded project MACC-II has completed development and testing of a service that provides total surveillance of the Earth's sensitive coats; namely the troposphere and the stratosphere. "It is generally acknowledged that the project can offer a previously unmatched bundle of very high quality data and model products," says Martin Schultz, group leader for atmospheric modelling, at the Research Centre Jülich, in Germany, who is involved in the project.

Specifically, the project maintains and updates the historical record of stratospheric ozone using available satellite observations from 1979 until now. It has a special focus on the period 2003 to 2012; a time where ozone variations were quite dynamic. This service will become routinely operational from the spring of 2015. Indeed, it will be a component of the even larger initiative for an independent European Earth observation system, called Copernicus. In addition to the services developed in

MACC II, this system includes land and marine monitoring, emergency management, border and maritime surveillance. It also gives access to climate change indicators such as temperature increase, sea level rise, and ice sheet melting.

The project is now ready to acquire a wealth of data from satellites and ground stations all over the world in near real time; that is within one day or, at most, a week. Reliable mathematical models of atmospheric gases including greenhouse gases and ozone over the Polar regions will be run continuously. These regions react very sensitively on human-made chemicals, such as CFCs.

In addition to analysing the current health of the Earth's cushion of air, it will be able to forecast the development of ozone concentration for up to eight days in advance. The ozone concentration, in turn, influences the amount of UV radiation reaching the Earth's surface. This will produce valuable information for political decisions on industrial emissions and for public health warnings.

The challenges were to connect all the globally distributed databases and satellite data streams. And align the different data formats in a way that they could be fed into models. Models have now been developed and validated, and the final visualisation of the analyses and forecast products has been realised. Model evaluations were, for example, performed at the Norwegian Meteorological Institute, which has long expertise in trans-boundary long-range transport of air pollutants. "We are testing how good the project models perform by looking into their performance against true ground observations," Michael Gauss tells youris.com. He is researcher at the Norwegian Meteorological Institute in Oslo. Pollutants can travel very long distances by air from industrial areas at lower latitudes up to the Polar regions, even diffusing on their way into the stratosphere.

The project has been well received by international organisations such as the World Meteorological Organisation (WMO), based in Geneva, Switzerland. It is already a frequent user of the project's results. "We see this as a very useful, value adding project, because it combines satellite and meteorological data. And also uses ground based data to validate the models. This can give us information on geographical scales from the local up to the global," explains Geir Braathen, senior scientific officer at WMO.

Specifically, Braathen produces WMO's ozone bulletins for the meteorological community and for the authorities interested in how the ozone holes over the Poles developed during a past season. They may give hints if political governance regarding the protection of the ozone layer had any effects. Braathen also uses the results from models of the US based National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA). "But the project will offer a much better ozone product, because an atmospheric chemistry model is included. With that you can follow the chemical change in ozone from day to day," Braathen tells youris.com.

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