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**ATMOSPHERE AND CLIMATE SERVICES FOR THE 21<sup>st</sup> CENTURY: THE VALUE OF OBSERVATIONS**

Powered by models and high-performance computing from ECMWF and its partners, the European Union Copernicus Atmosphere Monitoring Service (CAMS) and the Climate Change Service (C3S) deliver atmospheric composition analyses, forecasts, and reanalyses to thousands of users 24/7, in a timely manner and with an open-data policy. This wealth of data would not be anchored in reality without the world-wide satellite and in-situ observing systems to inform the various data and information production workflows. This paper will start by reviewing the various types of observations used by these services. A particular focus will be made on the reanalyses EAC4 and ERA5. EAC4 is a global atmospheric composition reanalysis that covers the last two decades. ERA5 is the 5th generation global reanalysis since ECMWF started such activities in 1979 and that has now surpassed 95,000 registered users. A specific benefit of these reanalyses is that they are continually extended, running only a few days after realtime. ERA5 serves indeed users with seamless data for the present times, extending timeseries that go back to the mid-previous-century. We will describe in particular the key observation types that underpin the reanalyses. In a second part, the paper will present the preparations that are undergoing at present, with international partners, towards next-generation reanalyses. Efforts in the direction of preparation of rescued and reprocessed observations will be presented. These include observations that were forgotten and could be brought into the digital age through inter-agency coordination and numerous contributions. It also includes present-day initiatives to systematically inventory and organize the metadata for instrumented sites, including historical ones, under the auspices of the WMO Integrated Global Observing System (WIGOS). The paper will conclude with a call for continued, strong international collaboration in all areas that support environmental science and related services to society, including in particular free and open exchange of observational data.