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Operational Copernicus services – state of programme and the role of EO research

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Year 2014 is a major milestone for the EU Copernicus programme (formerly GMES), for funding Europe's operational system of satellites and geo-information services. Copernicus services shall provide accurate, up-to-date and globally-available information related to the state of land, sea/ocean, atmosphere and climate change, as well as emergency response and security in support of European policies.
2014 sees the transition of services to fully operational state, looking back on some 10 years of development, evolving through research and making "laboratory" prototypes operational for the marine and atmosphere services. First integration of capabilities in dedicated GMES service projects started in early 2004 leading to operational maturity around 2011-2013. Several scientific and research challenges have been identified along the way, addressing very different stages of evolution, which need to be tackled collaborating with different partners and in different environments. The geoscience community and their funding programmes are faced with a range of opportunities arising from the presence of an operational space data and information programme such as Copernicus, a demand which also the EU research and innovation programme is striving to meet in Horizon 2020.
The last ten years have shown how the step from research prototypes to operational service chains requires specific and dedicated attention to this innovation step, shaping validated and proven products to users' demands. Special efforts are required in order for users to accept the innovative potential which new laboratory products promise. Specific attention needs to be given to processes in the users' workflows which incorporate the EO information – a step which often is underestimated in the formulation of R&D plans.
Service activities in a real-life environment, and the ever advancing new sensors set new research problems for researchers. The arrival of the Sentinel satellites will challenge running services with unprecedented streams of satellite data. Despite preparation through simulated data, a stable and predictable ability to access these large space data volumes will have to be demonstrated still. R&D dedicated to development of improved retrieval algorithms, advanced data assimilation techniques, better tools, as well as new visualisation and processing techniques will be needed. The outcomes of such R&D activities will have to be integrated into the overall frame of the Copernicus operational services.
Equally, the upcoming space sensors open up opportunities for new exploitation of space data hitherto unrecognised, let alone exploited for operational services, leading to exciting new opportunities for R&D in the EO domain.
This contribution will look back at the vision of a comprehensive Earth System description, see how GMES contributed to the puzzle by various research and pilot activities, and emphasize how Copernicus will continue in this spirit. Many remaining challenges both scientific and technical remain. Solutions strategies have been designed in the past which are still valid and indicate ample entry points into challenging research activities which will be crucial for continuously evolving and hence living operational services.