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NEW EARTH OBSERVATION MULTI-SATELLITE MISSION CONCEPTS AND SPACE ARCHITECTURES FOR DISASTER RISK REDUCTION

Abstract

User communities have brought to the fore the requirements for an effective emergency response capacity for Disaster Risk Management (DRM). The ESA study on "Disaster Risk Reduction (DRR) using Innovative Data Exploitation Methods and Space Assets" addresses the enhanced use of space technologies and assets with specific focus on DRR, i.e. hazard mitigation/prevention/preparedness.

One of the objectives of this study is to assess the contribution of current and firmly-planned in-orbit space assets to the DRM activity framework (with focus on DRR), to identify gaps in the fulfilment of the user needs, and to analyse new types of dedicated missions that could be designed to meet these needs.

Two hazard types have been analysed in details in the study, namely floods and volcanoes, and the corresponding user requirements have been specified leveraging the output of user consultations.

The DRR contributions enabled by existing space assets encompass primarily Earth Observation (EO) satellites and in particular ESA missions, including data archives and the current and future Sentinel missions, as well as European national EO missions featuring SAR and optical acquisition capabilities (e.g. Cosmo-SkyMed, Pleiades, TerraSAR) and other relevant non-European missions (e.g. WorldView, Landsat, RCM).

The performance parameters driving the space architecture design, the ground segment and the operations concepts for DRR scenarios include revisit time, coverage, data latency (for emergency response), throughput, data availability and quality. Good revisit time and spatial resolution performances and long-term continuity of SAR and optical acquisitions emerge as key enablers to build time series of high-quality data and data archives.

Candidate mission concepts to fill the detected gaps for the Volcano Hazard Case have been proposed, namely constellations of 2-8 optical satellites, which fulfil the requirement of 1-week revisit time with

optical instruments at 5-m spatial resolution for accurate mapping.

To exploit the synergies with the Copernicus Sentinels, the candidate mission concept to fill the gaps for the Flood Hazard Case consists of a constellation of six Sentinel-1-like satellites flying in convoy with Sentinel-1A and Sentinel-1B and guaranteeing 1-day revisit time. These Sentinel-1-like satellites will embark simpler C-band SAR instruments than the one on-board Sentinel-1, with spatial resolution of 50-100 m.

Federated satellite systems with in-orbit missions emerge as a promising gap-filling solution in terms of revisit time performance and continuity of data provision. These systems could be set up launching tailored versions of already-flying satellites, embarking simpler instruments that cover specifically the spectral bands for DRR.