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Towards integrated geological maps and 3D geo-models of planetary surfaces: the H2020 PLANetary MAPping project

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PLANMAP is a Horizon2020-COMPET4 project with the major aim of developing an efficient European network for geological planetary mapping which, exploiting the available datasets, can provide new products complementary to the existing ones, starting with the three main bodies of interest for Europe in the next decade: Mars, Mercury, and the Moon (http://www.planmap.eu/). At present, the methodological approach for geological mapping of planetary surfaces is mainly based on techniques developed in the 1970s which guarantees valuable products but leaves wide room for improvement considering the diversity, complexity and large amount of data collected by modern instrumentation and new sensors. Indeed, a gap has emerged between the common process of geological map production, mainly based on B/W image interpretation, and the enormous potential of integrating multiple independent data-sets such as spectra, image-cubes, chemical information and Digital Terrain Models (DTM) at different resolutions. The innovative approach of PLANMAP is to integrate data from different sources (images, DTMs, spectral-cubes, chemical data, radar sounding products, in situ observations) to produce geological maps specifically dedicated to planetary exploration at different levels (orbital probes, robotics and human). The final result would be planetary geological maps that, unlike the traditional photo-interpreted ones, should be more similar in information to Earth geological maps where the geomorphological, structural, and stratigraphic characteristics are integrated with other information (lithological, compositional, and ages on Earth; colors, spectra, elemental composition, and model ages on other bodies). They will also provide the basis for subsurface 3D geological modelling, and will be disseminated using dedicated WebGIS software.
Hence, PLANMAP is designed to generate pipelines and enhanced products with three major aims: support observational strategies of planetary surfaces by orbiting spacecraft, produce high-resolution products to characterize potential landing sites and sites of interest of future robotic and human missions, utilize 3D geological reconstructions and virtual environments for training astronauts and planetary scientists. The first objective requires a regional approach, whereas the other two must be focused on specific locations where sufficient data are already accessible. Given the upcoming BepiColombo mission and the fresh multi-source data available from MESSENGER spacecraft, Mercury is the best planetary candidate to fulfil the first goal because geological maps are required to optimize the operation of BepiColombo instruments. However, specific locations on Moon and Mars (targets of upcoming robotic missions and of interest for future human exploration) are perfect to achieve the other two objectives. The South Pole-Aitken basin has been ranked among the top scientific priorities for future lunar exploration by several reports, including the NASA Decadal and the NRC reports, whereas either Gale crater, Western Arabia Terra or Nili Fossae on Mars are and/or will be sites for rover investigations. Hence, we will create modern maps of key areas on the three terrestrial bodies considered, in order to both help the science of these key regions and develop tools that can be applied to other regions of these bodies, or other planetary bodies such as the Galilean icy moons, that will be visited by the upcoming ESA-JUICE mission.