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A SYSTEM-LEVEL ENGINEERING APPROACH TO DEFINE THE SOCIAL VALUE RATING OF EARTH REMOTE SENSING MISSIONS THROUGH SUSTAINABLE DEVELOPMENT GOALS

Abstract

Space-related activities directly or indirectly affect many social aspects and not only the services each space mission has been designed for. Daily life dependence on space has been growth with the increase in spacecraft launches, not only by space agencies, but also by private industries. The main consequence is that space will be overcrowded in the next decades and a criterion to decide which mission to be launched will be required. On the other side, indicators are needed for stakeholders to assess the importance and impact of space missions on humankind development.

Many works related to data analysis coming from Earth observation missions exist for the evaluation of different tasks: a single service, risk management, space situational awareness, cost analysis. All these studies contribute to the improvement of one single objective, but they do not provide an evaluation method for the overall space mission. The first attempt in solving this problem has been provided by the Copernicus programme, which has been developed with the aim to improve specific Sustainable Development Goals (SDG). These SDG have been defined by the United Nations (UN) as targets to be achieved to solve global challenges like planet protection, ending poverty, and prosperity for all.

In this paper a system-level engineering approach is developed to assess the social value rating of Earth remote sensing missions. The SDG have been used as reference to define a performance index related to a space mission. For each SDG eight services (i.e., mapping, forestry, geology, hydrology, etc.) have been identified which are managed to define the efficiency of the space mission in satisfying the specific SDG. The performance of each service depends in turn on the payload onboard the spacecraft and a weighted average between four factors is used to evaluate it: space resolution, time resolution, spectral efficiency, and Earth coverage. The aim of the paper is to define a methodology to help system engineers during the design phase to maximise the utility of the future space missions.

Therefore, a detailed analysis of past Earth remote sensing missions is carried out comparing their utility according to the new performance index. The Copernicus programme is used as reference for the verification and validation of the proposed methodology.