Paper ID: 86829
oral

31st IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
25th Workshop on Small Satellite Programmes at the Service of Developing Countries (1)

Author: Prof. Erick Lansard
Satellite Research Center, Nanyang Technological University (NTU), Singapore, Republic of

Prof. Yee Hui Lee
Nanyang Technological University (NTU), Singapore, Republic of
Dr. William Blackwell
MIT Lincoln Laboratory, United States
Charles Elachi
Jet Propulsion Laboratory, United States

HOW NEAR-EQUATORIAL CUBESATS COULD DRASTICALLY IMPROVE WEATHER MONITORING AND FORECAST OVER EQUATORIAL/TROPICAL REGIONS.

Abstract

Since a long time, huge investments have been made by governmental agencies of major space countries to deploy, operate and exploit large fleets of environmental satellites. However, equatorial/tropical regions are still insufficiently covered by existing and planned satellites. This is a growing and very serious concern in a context of climate change, at a time when science is more and more struggling to explain what is happening, while severe and potentially dramatic consequences impact the population of these regions.

Traditional meteorological satellites are large and costly, flying sophisticated instruments in Geostationary Orbit and in polar Low Earth Orbits, to ensure a global Earth coverage. However, although the so-called Big-LEO satellites provide highly accurate measurements that are matching the needs of mid-high-latitude regions, they are still facing huge challenges providing timely data over equatorial/tropical regions. This is due to limited ground pass opportunities when there are too few Big-LEO satellites, and to the huge size and cost of the constellation of LEO satellites that would be necessary over equatorial/tropical regions.

Understanding the science behind currently unpredictable extreme weather events, requires new data to fill the identified knowledge gap above the equatorial/tropical belt. Therefore, creating new tropical data from space is no longer an option and has become mandatory to improve our understanding of the environmental threats and, ultimately, to improve forecast models.

The good news is that low-cost Cubesats solutions do exist already, with the potential to powerfully synergize with existing and planned large satellites. The emergence of low-cost satellite manufacturing technologies and the improvement in sensor technologies offer an unprecedented solution to these new remote sensing challenges.

Worth pinpointing is that Cubesats will not replace the Big-LEO satellites and their high level of sensor performance. Yet Cubesat will provide the needed high revisit time, though with less efficient sensors. Nevertheless, the intrinsic limitation of the Cubesat sensors might be overcome by a smart and careful cross-calibration between Big LEO and Cubesat sensors. From that perspective, getting the best of both LEO systems seems at hand, with both high revisit and high performance for all satellites, Big-LEOs and Cubesats.

Finally, synergizing Big-LEOs and Cubesats would allow to reduce the total number of Big-LEO satellites and their launchers to the strict necessary, with a great flexibility regarding the size of the Cubesat constellation. This new "sober" constellation design will hopefully pave the way to more efficient, flexible, and sustainable future systems.