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Author: Mrs. Itziar Barat
ESA - European Space Agency, The Netherlands

Mr. Berthyl Duesmann
ESA - European Space Agency, The Netherlands
Mrs. Melanie Lapointe
CSA, Canada
Mr. Stephane Cote
Canadian Space Agency, Canada

DYNAMIC AND CONTROL OF THE INTERFERENCE LOCATIONS BETWEEN 2 SAR CONSTELLATIONS

Abstract

Most SAR missions are flying in the dawn-dusk orbital plane, but at a different altitude, therefore, satellites overpass each other regularly. If during this crossing both SAR missions are imaging, the SAR pulse can create a signal interference as it is transmitted (and backscattered) over the same location. Sentinel-1 and Radarsat-2, both C-band SAR missions, have already experienced interference between them. Also for the to be launched Radarsat Constellation Mission (RCM) SAR interference with Sentinel-1 are expected.

Giving the example of Sentinel-1 and RCM, the purpose of this paper is to describe the dynamic of the crossing points between spacecraft, and how these locations can be selected with the aim to minimize the interference between both missions. The same basic principles shown here can be applied to any other pair(s) of constellations, reducing in the future the interference between SAR missions.

RCM consists of 3 spacecraft phased 120 deg. Sentinel-1 constellation is formed by 2 satellites phased 180 degrees. Both constellations are in the 18:00 dawn-dusk orbit. Each RCM − S1 spacecraft pair will result in 4 interference events every 12 days, that results in 24 interference equally distributed in time and within the orbital plane, one every 12 hours.

The analysis shows that by selecting the correct longitude phasing between S1 and RCM these 24 interference locations can be placed at the optimal global location, away from zones of nominal operation for both RCM and S1. Then a fine tuning of the Mean Local Solar Time (MLST) difference between satellites, can reduce the interference locations from 24 to 8 or 4 areas, depending on mission constraints.

The cost of the phase changing and the MLST tuning once in orbit is very high but a clever planning of the launch injection times and the constellation acquisition strategy can achieve an optimal location of the crossing points/areas almost for free. For this reason anticipation and collaboration between agencies is essential to minimize the impact of the interference between SAR satellites.

The paper will explain in detail the geometry that defines the dynamic and location of the crossing points between the satellites of both constellations and will propose strategies to locate them at the most favorable areas. It will also address the importance of tuning the launch injection times and the constellation acquisition strategy to achieve this purpose with a minimum cost.