Radar Interference between C-band SAR missions

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Abstract

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The paper addresses the bi-static radar signal interference at SAR footprint intersections between C-band SAR missions, such as between Sentinel-1 and RADARSAT-2 and between Sentinel-1 and RADARSAT Constellation Mission (RCM).

A strategy is outlined with the goal to mitigate the impact on SAR image quality for users and application services by fixing the geographical location of these intersection areas affected by radar interference.

Most SAR missions fly in a dawn-dusk orbital plane, but at a different altitude. As a result, there are regular intersections of the SAR footprint. When these SAR missions operate within the same radar signal frequency band, then radar interference may occur during the SAR data acquisition resulting from the signal backscattered from the surface. Sentinel-1 and Canada's RADARSAT-2 and RADARSAT Constellation Mission (RCM) operate in C-band at the same centre frequency of 5.405 GHz.

The orbital height and repeat-orbit cycle of the three SAR missions are as follows:

• Sentinel-1 (700km) with 12 (6) days
• RADARSAT-2 (800km) with 24 days
• RCM (600 km) with 12 (4) days

There is an intersection of the Sentinel-1A/-1B and RADARSAT-2 footprints, which occurs 7 (14) times within 24 days and is quasi constant in latitude with a slow secular drift. This slow secular drift is caused by the drift of the Sentinel-1 Mean Local Solar Time (MLST) of 7sec per year and the uncontrolled drift of the RADARSAT-2 inclination showing long oscillations (i.e. in the order of many years).

Analyses performed during the Sentinel-1A Commissioning phase have shown the following:
• No direct RFI impact on both SAR systems • Bi-static interference effects (from Earth's surface) visible in both Sentinel-1 and RADARSAT-2 imagery In the case of RCM, there are four (4) latitude positions, where an inference between the footprints of Sentinel-1 and each RCM satellite can occur. This leads to a total of 24 potential interference intersections within 12 days. The location of these footprint intersections varies with latitude.

The goal is to freeze the unavoidable interference footprints at specific latitudes, where there is practically no impact on the User side (i.e. applications) by tightly controlling the orbit inclination and the Mean Local Solar Time.

Based upon simulations of different orbit acquisition scenarios, the presentation will illustrate, how these scenarios would determine the geographical location of potential interference areas and the required manoeuvres (i.e. delta-V) for orbit corrections.

Keywords - Calibration of future missions