Time variant and narrow bandwidth RFI detection in multi-receiver SAR: preliminary study in ALOS-2

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Abstract

Latest SAR platforms carry multiple receivers in order to increase their swath with discrete phase center (DPC) approach or digital beam forming (DBF), and / or perform along track interferometry (ATI). The main purpose of placing multiple receivers is to distinguish slight differences of the scattered echo in those receivers so that we can extract the targets' information further. From the point of view of RFI detection, those receivers can be used for advanced detection methods.
As RFI is a direct wave, the received RFI signals are the same and only receiving time can shift between the receivers depending on incidence angle. That is, only phase shift can be observed in the radio frequency domain. Contrary, scattered signals can be similar but have some variances because they are summation of thousands of scatterers on the ground. Therefore, when we calculate the correlation coefficient of received signals in frequency domain, RFI polluted bands mark higher coefficient than RFI free bands.

The merit of this method is its accuracy and simplicity. As it does not require temporal window, it can detect RFI pulse-by-pulse. It basically requires specific frequency window to calculate correlation coefficient and thus, easy to detect narrow bandwidth. Compared with typical amplitude-based method which detects abnormally strong signal in the radio frequency domain, proposed method requires narrower window in both time and frequency domain.
Here, we examined the difference of correlation coefficient for neighboring receivers in ALOS-2 raw data and found that RFI polluted parts have larger than correlation coefficient of 0.8 while non-polluted parts have 0.6 or so. The effective bandwidth for RFI detection was up to 250 kHz out of 80MHz in ALOS-2 case above. Note that the raw data in this research is recovered from distributed version of single-look complex (SLC) image and not the original one.

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