Geolocation Accuracy Assessment of NovaSAR-1 Analysis Ready Data Products

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CSIRO has developed an Analysis Ready Data (ARD) processing workflow for NovaSAR-1 data using the GAMMA software to generate Analysis Ready Data products compliant with the CEOS-ARD Normalised Radar Backscatter Product Family Specification v5.5 [1]. In this document we provide an assessment of geolocation accuracy for the CSIRO NovaSAR-1 ARD products. We leverage targets from the Geoscience Australia Queensland Corner Reflector Array [1] to perform the assessment for 20 NovaSAR-1 images acquired between December 2019 and May 2022 and across the various imaging modes. The image filenames used are listed at the end of this document.

Assessments were performed for co-polarised (HH or VV) images from both the Stripmap and ScanSAR image modes. Point scatters of corner reflectors in a NovaSAR-1 image are shown in Figure 1, where the blue dots indicate the locations of corner reflectors. A cross-correlation matching method was implemented to find the coordinates of point scatterers in the vicinity of nearby corner reflectors. The total numbers of point scatterers for each imaging mode are shown in Table 1.

Table 1: Numbers of point scatterers close to corner reflectors for each imaging mode

Imaging mode	Stripmap 13 Asc	ScanSAR 22 Asc	ScanSAR 27 Asc	ScanSAR 27 Desc	ScanSAR 29 Asc	ScanSAR 29 Desc	ScanSAR 32 Asc
Number of points	25	16	107	76	71	53	8
Valid points	25	16	96	75	71	53	8

Invalid point scattering targets (with obvious orbit vector errors) were removed, leaving 25 valid points from Stripmap mode images and 319 points from ScanSAR mode images. The mean and standard deviation of coordinate differences between the point scatterers and their corresponding corner reflector references in longitude and latitude directions were derived and are shown in Table 2.

Table 2: Geolocation accuracy assessment of NovaSAR-1 ARD products over the Queensland corner reflector array

Imaging Mode	Stripmap	ScanSAR
Number of points	25	319
Mean Longitude (m)	-4.976	-6.018
Mean Latitude (m)	-1.048	15.554

Standard Deviation Longitude (m)	2.728	34.765
Standard Deviation Latitude (m)	6.358	22.503

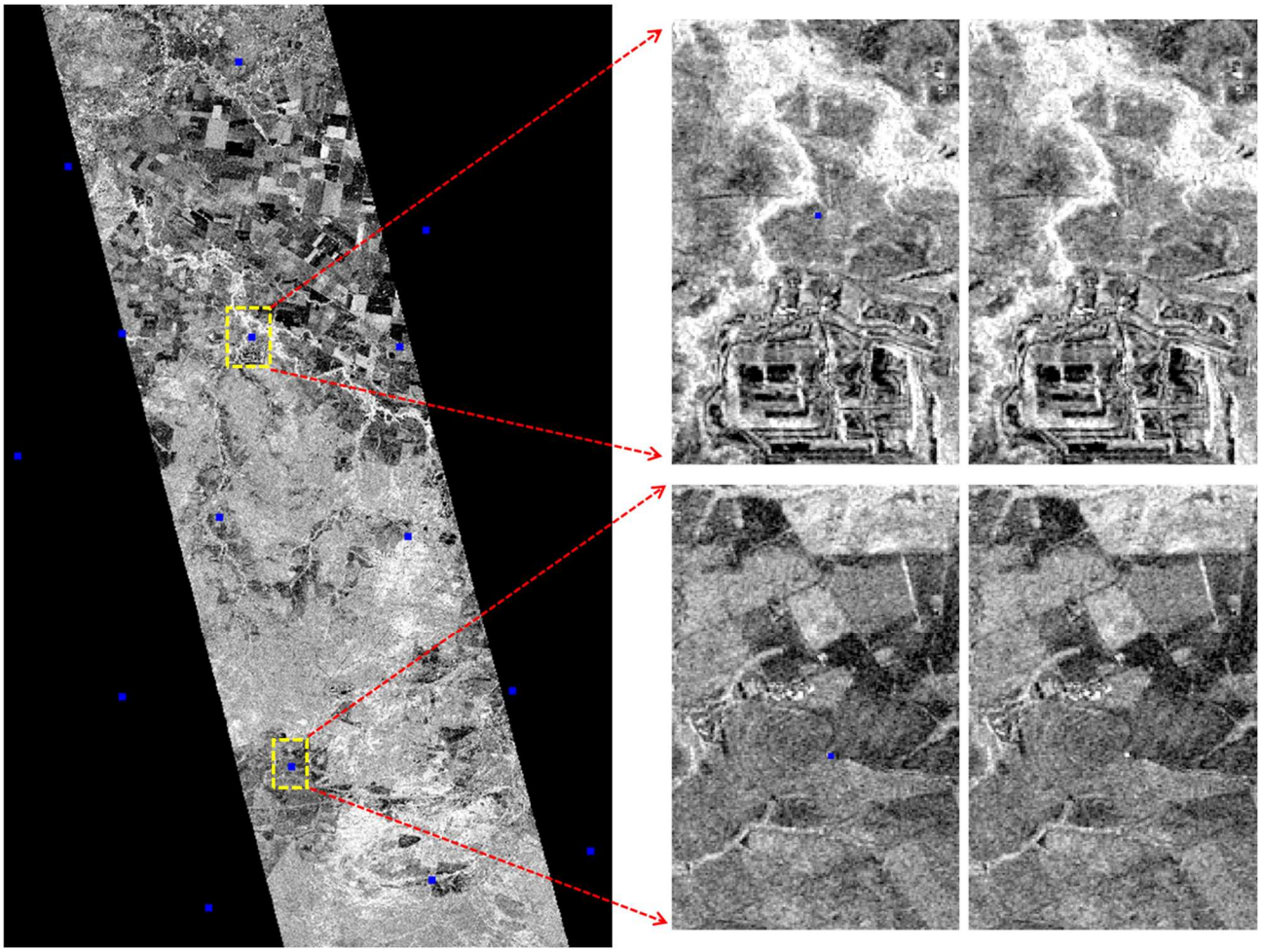

Figure 1 Partial corner reflectors of QCRA are shown as blue dots on top of HH image of NovaSAR_01_33068_scd_220418_005644_HH_HV.zip (left), two zoomed-in subsets for the left yellow dashed-line rectangles with the blue dot of a corner reflector (middle) and the zoomed-in subsets for the left yellow dashed-line rectangles without the corner reflector location mark (right).

References

1. CEOS-ARD, 2021, Product Family Specification, Normalised Radar Backscatter, version 5.5, https://ceos.org/ard/files/PFS/NRB/v5.5/CARD4L-PFS_NRB_v5.5.pdf
2. Fuhrmann, T., Batchelor, J., McCall, T., Garthwaite, M.C., 2020, Positions and orientations for the Queensland corner reflector array, Australia: Report on geodetic surveys conducted in May and June 2018, Record 2020/034, Geoscience Australia, Canberra, http://dx.doi.org/10.11636/Record.2020.034

NovaSAR-1 images assessed

6m_Stripmap (Product ID 13) Ascending:

- NovaSAR_01_8885_grd_191222_005359_VV.zip
- NovaSAR_01_28758_grd_211120_005853_HH.zip
- NovaSAR_01_30262_grd_220108_005418_HH.zip
- NovaSAR_01_30791_grd_220125_005640_VV.zip
- NovaSAR_01_31330_grd_220211_005855_VV.zip

30m_ScanSAR (Product ID 22) Ascending:

- NovaSAR_01_25148_scd_210727_010037_VV_HH_HV.zip

35m_ScanSAR (Product ID 27) Ascending:

- NovaSAR_01_24080_scd_210623_005614_VV_HH_HV.zip
- NovaSAR_01_24610_scd_210710_005826_VV_HH_HV.zip
- NovaSAR_01_25664_scd_210812_005657_VV_HH_HV.zip
- NovaSAR_01_26635_scd_210914_005515_VV_HH_HV.zip

35m_ScanSAR (Product ID 27) Descending:

- NovaSAR_01_24864_scd_210718_122447_VV_HH_HV.zip
- NovaSAR_01_30039_scd_211231_122501_VV_HH_HV.zip
- NovaSAR_01_33730_scd_220512_121938_VV_HH_HV.zip
- NovaSAR_01_33762_scd_220513_122444_VV_HH_HV.zip

50m_ScanSAR (Product ID 29) Ascending:

- NovaSAR_01_14980_scd_200913_005214_HH_HV.zip
- NovaSAR_01_31843_scd_220227_005515_HH_HV.zip
- NovaSAR_01_32411_scd_220316_005711_HH_HV.zip

50m_ScanSAR (Product ID 29) Descending:

- NovaSAR_01_11906_scd_200528_122223_HH_HV.zip
- NovaSAR_01_11921_scd_200529_122853_HH_HV.zip

20m_ScanSAR (Product ID 32) Ascending:

- NovaSAR_01_33053_scd_220417_005059_HH_HV.zip
- NovaSAR_01_33068_scd_220418_005644_HH_HV.zip