# ASNARO-2 support within GAMMA Software

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## 1. INTRODUCTION

In this document the support provided in the GAMMA Software for the processing of data of the Japanese X-band SAR on-board ASNARO-2 is summarized. The basic approach followed is that SLC and higher level products, i.e. detected data in ground or in map coordinates, can be imported into the formats used in the GAMMA Software, so that a broad functionality including SAR interferometry and terrain corrected geocoding can then be used.

In the following the importing of the data and a geocoding and differential interferometry example are described.

For further information on ASNARO-2 see also: https://jpn.nec.com/ad/cosmos/asnaro2 and http://jeoss.co.jp/asnaro2 .

Access to demo data can be requested through the JEOSS web site, http://jeoss.co.jp . Also ordering and pricing information will be provided upon a request through that web site.

## 2. IMPORTING ASNARO-2 DATA

### 2.1. Importing SLC data

ASNARO-2 SLC data are provided in CEOS format (level 1.1), that can be read / imported using the program ***par_ASNARO2***.

ASNARO-2 acquires data in Stripmap, Spotlight and ScanSAR mode. Complex valued SLC data are available for Stripmap and Spotlight mode data. The SLC data provided for Spotlight mode have been "deramped" with a phase ramp in the azimuth direction, so that the spectrum of the resulting SLC is centered. When reading the SLC data ***par_ASNARO2*** applies a reramping to make the data consistent with the meta data. This is relevant as programs used in the SLC resampling and in the interferogram generation consider the meta data.

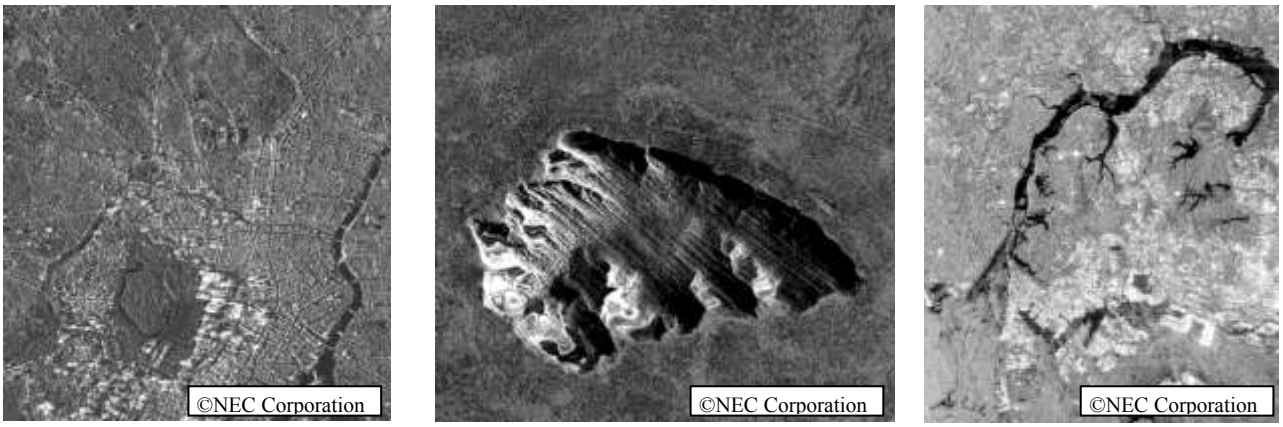
### 2.2. Importing detected data in slant range geometry

ASNARO-2 ScanSAR data are provided either as detected geocoded data (how to read these see below) or as detected intensity data in CEOS format, that can be read / imported using the program ***par_ASNARO2***.

### 2.3. Importing geocoded / georeferenced data

For ASNARO-2 there are also a geocoded and a georeference data product. The two products are more or less identical, apart from one being stored with a rotation and one without. Both are stored in GeoTIFF format and can be read using the program ***par_ASNARO2_geo***. When reading the data the values are converted from amplitudes to intensities, and a calibration factor indicated on the command line can be applied. We did not conduct calibration experiments (e.g. with corner reflectors or active transponders) to determine or check the calibration factor.

Examples of Spotlight, Stripmap and ScanSAR mode backscatter data are shown in Figure 1.




Tokyo, Spotlight mode | Uluru, Stripmap mode | Singapore, ScanSAR mode

Figure 1 ASNARO-2 Spotlight, Stripmap and ScanSAR mode backscatter examples.

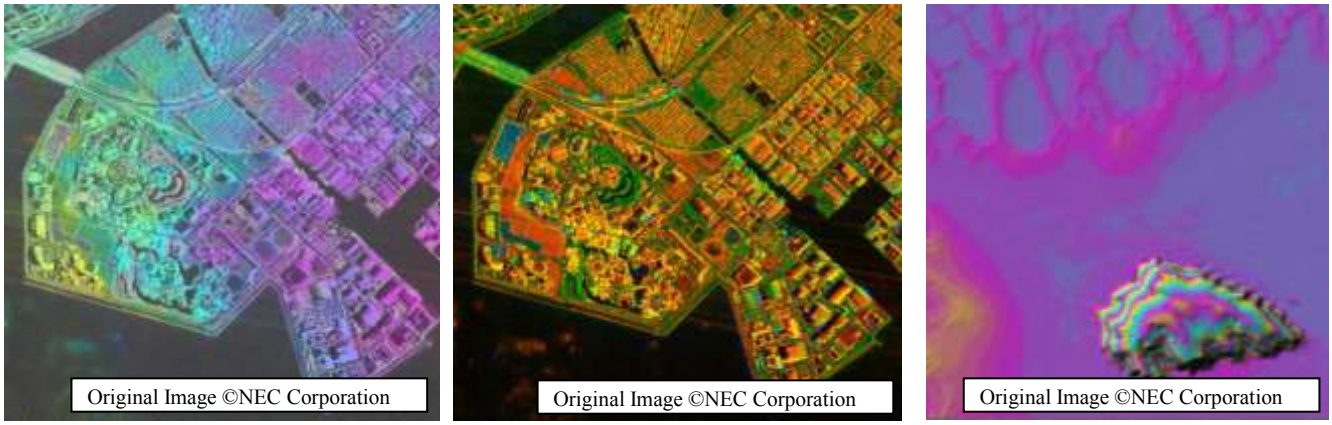
# 3. SAR INTERFEROMETRY USING ASNARO-2 DATA

## 3.1. Preparation of co-registered SLCs

ASNARO-2 interferometric pairs over Chiba, Japan (Spotlight mode data) and the Uluru mountain, Australia (Stripmap mode data) were processed. The repeat interval of ASNARO-2 is 14 days. The orbit data available with the data is of high quality, facilitating steps as geocoding, the SLC co-registration and the calculation of the topographic phase based on a digital elevation model (DEM).

Over Chiba we had a stack of 5 interferometric spotlight mode acquisitions available for the tests. For short baselines the coherence was high, for long baselines (> 500m) the quality of the used SRTM DEM heights was not sufficient to get a differential interferogram with high coherence (nevertheless, this could be mitigated by improving the terrain heights used). An example of a differential interferogram with a short spatial baseline is shown in Figure 2 together with the corresponding coherence product (RGB composite of the interferometric coherence, the backscatter and the backscatter change between the two acquisitions).

A set of 3 interferometric stripmap acquisitions over the Uluru mountain in Australia was used to improve the SRTM heights to get a DEM with higher spatial resolution and higher accuracy. Thanks to the high coherence in the area this could be achieved (see Figure 2 to the right).




Chiba Japan, differential intergerogram | Chiba Japan, coherence product | Uluru Australia, Interferometric DEM height

Figure 2 Examples of ASNARO-2 interferometric products.

# 4. ACKNOWLEDGMENT AND COPYRIGHTS

Japan Space Imaging Corporation is acknowledged for providing us the ASNARO-2 data used to adapt the GAMMA Software. The Original Image data is ©NEC Corporation.