

Time-Series and Applications of Advanced Sentinel-1 Analysis Ready Data for Africa (SAR-4-Africa)

J. Haarpaintner¹, H. Hindeberg¹, T.G. Yitayew¹, B.D. Killough², R. Mathieu³,
L. Mane⁴, B. Gessesse⁵, S. Ofori-Ampofo⁶, E. Boamah⁶

1) jrha@norceresearch.no, NORCE – Norwegian Research Centre AS, Tromsø, Norway.

2) NASA - CEOS Systems Engineering Office, Hampton VA, USA.

3) CSIR, Pretoria, South Africa.

4) OSFAC, Kinshasa, Democratic Republic of Congo.

5) ESSTI, Addis Ababa, Ethiopia.

6) CERSGIS, Accra, Ghana.

Abstract

The two satellites Sentinel-1A and -1B (S1A, S1B) constitute the operational C-band synthetic aperture radar (SAR) earth observation (EO) mission of the European Copernicus Program. They provide weather and sunlight independent radar imagery of the whole earth on a 12 day (each S1 individually) cycle with a huge potential of application that need consistent and dense time series. However, there is still a strong reluctance by a large community to use SAR data because of its complexity in regard to sensor-specific noise, topographic effects, (pre-) processing requirements, and its unfamiliar appearance compared to optical data for untrained users. These technical and human capacity requirements, as well as the vast amount of data makes it out of reach for most non-technical user groups that could benefit from its monitoring potential in general and especially in persistently cloud-covered areas as the tropics.

Under the ESA activity “EO for Sustainable Development (SD)”, this project aims to overcome these technical challenges and subjective reluctance by providing easy-to-use “Advanced Sentinel-1 Analysis Ready Data” (ASARD) imagery with a focus on African users. Such ASARD imagery should be timely accessible, visually attractive, easily interpretable and at the same time reduce the data quantity without losing essential information for the users monitoring needs and its potential for further numerical analysis. This resulted in the provision of statistical parameters of preprocessed (i.e. georeferenced, radiometrically calibrated, terrain and slope corrected) S1 dense time series. The final ASARD products are noise-reduced, monthly and yearly averaged and median values of gamma-naught backscatter RGB mosaics using the two polarizations (VV, VH) and the Normalized Difference Index ($RGB = [VV;VH; NDI= (VV-VH)/(VV+VH)]$). In addition, the variance, minimum and maximum gamma-naught values as well as the number of acquisitions and a mask for SAR shadow and overlay are provided. By a demand-driven approach involving five African countries (D.R. Congo, Ethiopia, Ghana, Malawi and South Africa), we aim to standardize such ASARD imagery to boost the use of Sentinel-1 data for a wider non-technical user community, including policy makers, in order to support the United Nations Sustainable Development Goals (SDGs). We also investigate cloud processing possibilities and cooperate with the African Regional Data Cube (ARDC) to ease the operational provision and timely access of such data in the future.

In this talk, we will present final results of ASARD products over the five study sites, each covering an area of [2° longitude x 2° latitude]. Examples of the applications for environmental monitoring of

water, forest, land cover and change detection will be shown. The usability and added-value of these products for the users' environmental monitoring operations are assessed.

Keywords - Analysis Ready Data