

ESA's Extended Timing Annotation Dataset (ETAD) for Sentinel-1 – Product Status and Case Studies

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SAR images benefit from excellent geometric accuracy due to accurate time measurements in range and precise orbit determination in azimuth. Moreover, the interferometric phase of each single pixel can be exploited to achieve differential range measurements for the reconstruction of topography and the observation of Earth surface deformation and surface motions. But these measurements are influenced by the spatial and temporal variability of the atmospheric conditions, by Earth dynamics, and by SAR processor approximations, which may lead to spurious displacements shifts of up to several meters. These effects become visible in various SAR applications including the retrieval of surface deformation applying offset tracking and various InSAR applications, which might require several post-processing steps and external information for correction.

To facilitate straightforward correction of the perturbing signals in the Sentinel-1 SAR data, the Extended Timing Annotation Dataset (ETAD) was developed in a joint effort by ESA and DLR based on research results and processor prototypes available at DLR. ETAD is a novel and flexible product for correcting the SAR range and azimuth time annotations in standard Sentinel-1 interferometric wide-swath and stripmap products. It accounts for the most relevant effects, including tropospheric delays based on 3D ECMWF operational analysis data, ionospheric delays based on total electron content (TEC) maps inferred from GNSS, solid Earth tides calculated following geodetic conventions, and corrections of SAR processor approximations. The effects are converted to range and azimuth time corrections with an accuracy at a global level of at least 0.2 m, and are provided as 200m resolution grids matching the swath and burst structure of Sentinel-1 SAR data. First experimental evaluations show that an even better accuracy of a few centimeters can be attained when applying the ETAD corrections.

The ETAD product is planned to become an operational Sentinel-1 product by the end of 2022. Currently, the processing software is undergoing pre-operation evaluation at ESA. In addition, it was integrated into the Geohazards Thematic Exploitation Platform (G-TEP) where users can participate in pilot studies and can generate ETAD products for dedicated applications. First successful usage of ETAD corrections could be demonstrated in ice velocity tracking and InSAR applications. ESA has now formed several study groups making use of the G-TEP to perform further evaluations. Our presentation will summarize the ETAD product and report on the status of operational integration. Moreover, results from the pilot studies with the G-TEP will be presented.