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ESA's Multi-mission Sentinel-1 Toolbox

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The Sentinel-1 Toolbox is a new open source software for scientific learning, research and exploitation of the large archives of Sentinel and heritage missions. The Toolbox is based on the proven BEAM/NEST architecture inheriting all current NEST functionality including multi-mission support for most civilian satellite SAR missions. The project is funded through ESA's Scientific Exploitation of Operational Missions (SEOM). The Sentinel-1 Toolbox will strive to serve the SEOM mandate by providing leading-edge software to the science and application users in support of ESA's operational SAR mission as well as by educating and growing a SAR user community.
The Toolbox consists of a collection of processing tools, data product readers and writers and a display and analysis application. A common architecture for all Sentinel Toolboxes is being jointly developed by Brockmann Consult, Array Systems Computing and C-S called the Sentinel Application Platform (SNAP). The SNAP architecture is ideal for Earth Observation processing and analysis due the following technological innovations: Extensibility, Portability, Modular Rich Client Platform, Generic EO Data Abstraction, Tiled Memory Management, and a Graph Processing Framework.
The project has developed new tools for working with Sentinel-1 data in particular for working with the new Interferometric TOPSAR mode. TOPSAR Complex Coregistration and a complete Interferometric processing chain has been implemented for Sentinel-1 TOPSAR data. To accomplish this, a coregistration following the Spectral Diversity[4] method has been developed as well as special azimuth handling in the coherence, interferogram and spectral filter operators.
The Toolbox includes reading of L0, L1 and L2 products in SAFE format, calibration and de-noising, slice product assembling, TOPSAR deburst and sub-swath merging, terrain flattening radiometric normalization, and visualization for L2 OCN products. The Toolbox also provides several new tools for exploitation of polarimetric data including speckle filters, decompositions, and classifiers. The Toolbox will also include tools for large data stacks, supervised and unsupervised classification, improved vector handling and change detection.
Architectural improvements such as smart memory configuration, task queuing, and optimizations for complex data will provide better support and performance for very large products and stacks.In addition, a Cloud Exploitation Platform Extension (CEP) has been developed to add the capability to smoothly utilize a cloud computing platform where EO data repositories and high performance processing capabilities are available. The extension to the SENTINEL Application Platform would facilitate entry into cloud processing services for supporting bulk processing on high performance clusters.
Since December 2016, the COMET-LiCS InSAR portal (http://comet.nerc.ac.uk/COMET-LiCS-portal/) has been live, delivering interferograms and coherence estimates over the entire Alpine-Himalayan belt. The portal already contains tens of thousands of products, which can be browsed in a user-friendly portal, and downloaded for free by the general public.
For our processing, we use the facilities at the Climate and Environmental Monitoring from Space (CEMS). Here we have large storage and processing facilities to our disposal, and a complete duplicate of the Sentinel-1 archive is maintained. This greatly simplifies the infrastructure we had to develop for automated processing of large areas. Here we will give an overview of the current status of the processing system, as well as discuss future plans. We will cover the infrastructure we developed to automatically produce interferograms and its challenges, and the processing strategy for time series analysis. We will outline the objectives of the system in the near and distant future, and a roadmap for its continued development. Finally, we will highlight some of the scientific results and projects linked to the system.