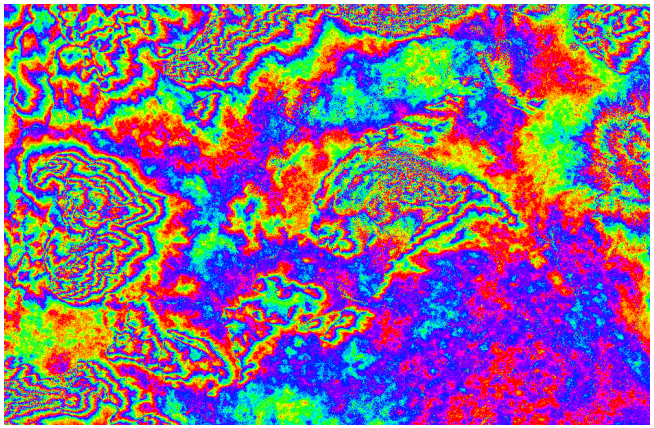
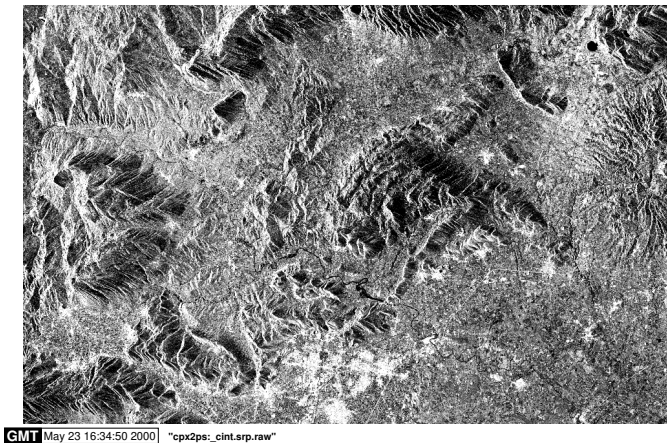
Doris v2.3 includes (May 2000)

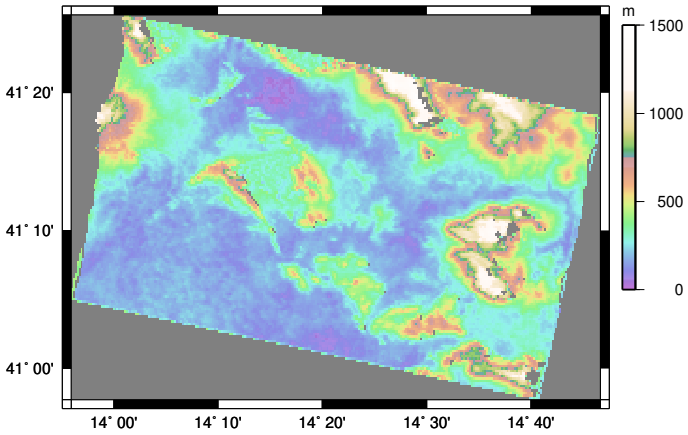
- I/O for ESA SLC images for ERS 1 and 2
- Automatic retrieval of the Delft precise orbits
- Sub-pixel level coregistration based on magnitude images
- Interpolation with various kernel functions
- Adaptive range filtering
- Interferogram and coherence map generation
- Subtraction of ellipsoidal reference phase
- Subtraction of topographic phase by radarcoding a Digital Elevation Model
- Slant range to height conversion based on precise orbits
- Geocoding based on precise orbits

Phase and magnitude of complex interferogram





Geocoded DEM



Doris

- Public domain Delft object-oriented radar interferometric software for research, educational, and operational purposes
- Made freely available to establish a user community and to make the development of software for interferometric SAR a joint effort.
  See: www.geo.tudelft.nl/doris
- Integrated package, with interchangeable modules for each processing step
- Portable (coded in C++ on a Unix platform, standard libraries, GNU compiler)
- Well documented (in source code, 70 page user manual)
- Visualization with Generic Mapping Tools (GMT)
- Fast, user friendly, and tunable memory requirements.
- Utility programs, Matlab^{TM} toolbox

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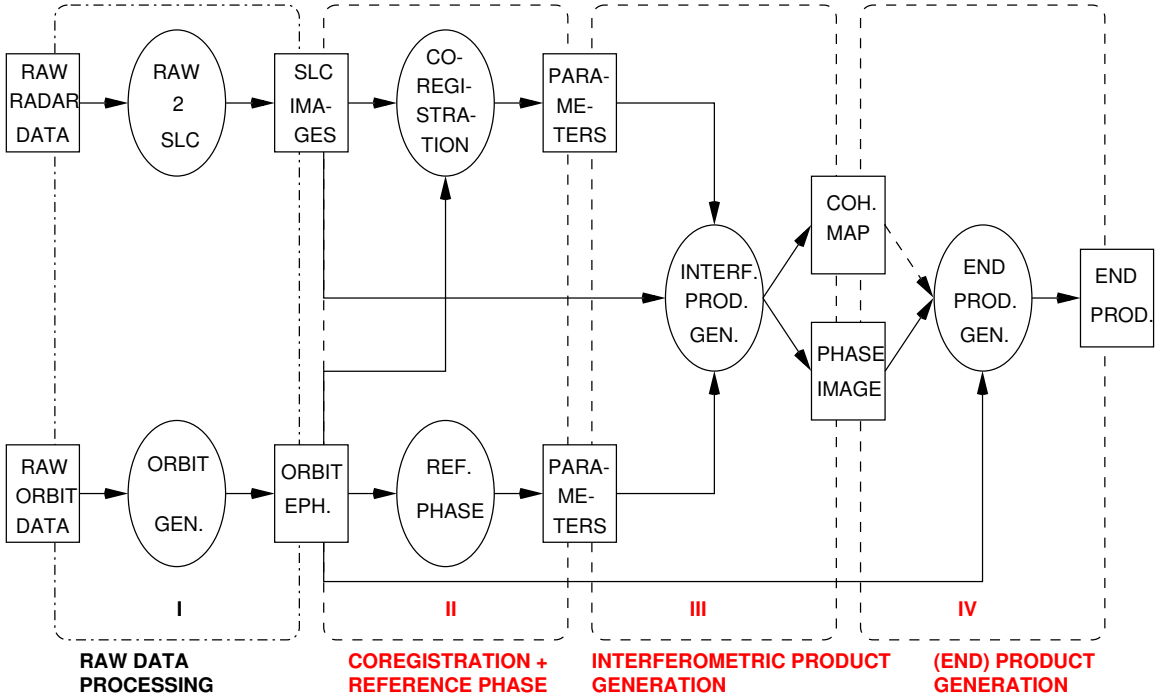
InSAR processing scheme, Doris consists of blocks II, III, and IV



The Delft object-oriented radar interferometric software is being developed at Delft University of Technology, The Netherlands, since September 1998. It has been made freely available to the scientific community, in order to establish a user community and to make the development of software for interferometric SAR a joint effort.
Doris consists of a single program which applies several modules. All processing parameters for the requested algorithms have default values, which can be tuned in an ascii input file. The modules can be run independently using a shell script which creates dummy parameter files.
Doris is coded in C++, an object-oriented language which is very suitable to image processing. Portability is increased by using standard libraries and by using the GNU compiler, see www.gnu.org). Optionally, HP Veclib and Lapack libraries may be used to increase processing speed.

The software is well documented and a user manual has been written and made available online.
The GMT software (released under the GNU General Public License, see www.soest.hawaii.edu/gmt) can be used for visualization of the products. Dedicated shell scripts have been written for visualization and to facilitate the operation of the software. A Matlab^{TM} toolbox has been released, which includes scripts to support file handling, phase unwrapping, visualization, and demonstrations.

Doris was initially designed to generate interferometric products based on ESA SLC images of ERS 1 and 2. (Block II and III in the flow chart.) The information in these SLC files can be extracted by Doris, and a rectangular area of interest can be selected. The Delft precise orbits are retrieved automatically and modeled using cubic splines.

Coregistration is performed on the magnitude images, to a sub-pixel accuracy level.
The complex interferogram and coherence image can be computed, see the example given at the back. The phase of a reference ellipsoid is computed based on precise orbit information. A Digital Elevation Model can be radarcoded and subtracted from the interferogram in order to reduce the number of topographic fringes, which supports phase unwrapping, or to focus on surface deformation or the atmospheric refractivity distribution.
Slant range to height conversion and geocoding can be performed with several algorithms based on the precise orbits.
In the near future algorithms will be implemented to facilitate Differential InSAR (3 pass and 4 pass method), in order to generate deformation maps. A tie-point approach will be implemented to enhance geocoding.

With the increased experience in InSAR data analysis it becomes apparent that refined processing techniques need to be applied to overcome the problems of atmospheric signal, partial temporal decorrelation, and phase unwrapping. Many of these problems can be approached by analyzing series of SAR acquisitions, using different linear interferometric combinations between available scenes. Moreover, the temporal decorrelation problem necessitates an analysis at single pixel level instead of standard area-covering approaches.
An InSAR covariance-function has been developed which can be tuned to the conditions of a particular interferogram. Including the influence of atmospheric effects, orbit errors, and decorrelation, these covariance functions will be applied in Doris and used for the development of geodetic adjustment and testing techniques for the interferometric data. As a result the quality control of the interferometric products will be more quantitative which improves data interpretation.