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DORIS the space surveyor serving the ITRF

The DORIS system (Doppler Orbitography and Radiopositioning Integrated by Satellite), conceived and developed by CNES, France's national mapping, survey and forestry agency IGN and the French space geodesy research centre GRGS, has just turned 25. From the early 1990s, DORIS has driven effective exploitation of satellite altimetry data by supplying orbital parameters with centimetre accuracy. As a key element of geodetic and geophysical research, DORIS provides data for the International Terrestrial Reference Frame (ITRF), of which a new version—ITRF2014—is about to be released. And with new instruments soon set to launch on the Jason-3 and Sentinel-3 satellites, the DORIS constellation still has many more years of service in store.

First conceived 25 years ago, DORIS enables highly precise measurement of the host satellite's position and the data acquired by its altimetry instruments. It has thus played a key role in the Earth-observation missions that have made CNES's reputation in the fields of oceanography, glaciology and hydrology—notably the French-U.S. TOPEX/Poseidon satellites and the French-Indian SARAL-AliKa satellite—and in high-resolution imaging with Pleiades.

Designed and deployed in the 1980s by CNES and IGN, the DORIS ground network today numbers 60 stations spread evenly around the globe. Used as ground reference points, these stations continuously track satellite trajectories, offering a high level of precision and upgradability. Received data are sent to the SSALTO multi-mission orbit determination and altimetry ground segment in Toulouse, which processes them, calculates satellite orbital parameters and then archives and distributes them. A dozen satellites have supplied DORIS data to the international scientific community since 1990. With five satellites currently flying DORIS instruments, soon seven with Jason-3 and Sentinel-3, and future missions in development, the future of DORIS is guaranteed up to 2030 and beyond. For its first ever mission in 1990 on SPOT 2, DORIS determined the satellite's altitude with an accuracy of 13 centimetres. Today's altimetry satellites are now achieving sub-centimetre accuracy.

The DORIS system is contributing in many ways to the study of our planet, notably in establishing the International Terrestrial Reference Frame (ITRF), adopted by the United Nations last February as the global reference standard for sustainable development. The ITRF is the reference frame used by applications that require precise positioning like satellite orbit determination, geophysics, climatology and all of the sciences studying Earth's motions and displacements. It is calculated from measurements supplied by more than 600 receiving stations around the globe. Its accuracy is crucial for all these fields of science where observations call for millimetre accuracy. Due to its stability, its dense and uniform coverage and the increasing capability of its instruments, DORIS has made great strides in its contribution to ITRF2014, improving its positional precision from the previous ITRF2008 version from 15 millimetres 3D to 7-8 millimetres 3D. The DORIS system therefore has a bright future to look forward to and is set to support the success of upcoming missions that will be flying it, like Jason-3 and Sentinel-3.

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