



DORIS

30 years of technical, operational and scientific success in the precise determination of satellite orbits and ground station positioning.



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DORIS, 30 years of continuous operations at the heart of the of altimetry mission performance for oceanography and geodetic applications.

The DORIS system (Doppler Orbitography and Radio positioning Integrated by Satellite) was designed and developed in the early 1980s by CNES, IGN and GRGS to determine satellite positions with high accuracy to support altimetry missions dedicated to ocean monitoring.

DORIS was first embarked on the SPOT-2 satellite, which recorded the first DORIS measurement on 3 February 1990. Since then, the system has operated continuously on 18 satellites, including the space imaging satellites [SPOT2-3-4-5](#), Pleiades1A-1B, altimetry missions for ocean observations such as [Topex-Poseidon](#), [Envisat](#), [Jason-1/2/3](#), [Hy-2A](#), [Sarat/AltiKa](#), [Sentinel3-A/B](#), and also for hydrological monitoring and ice measurements with Envisat, [Cryosat-2](#); [Sarat/AltiKa](#) and Sentinel3-A/B.

This system allows the precise orbit determination of satellites embarking DORIS receivers. It is based on Doppler shift measurements of radio-frequency signals (400MHz & 2GHz) transmitted by a network of ground stations, used as reference points on the Earth's surface. About 60 DORIS stations uniformly distributed around the world are hosted by more than 30 international host agencies.

Conversely, the DORIS system is able to locate ground positions with the same accuracy.



This duality of DORIS is associated to altimetric oceanography or ice missions, to the study of the Earth's shape and movements, and a large number of localization services.

Thus, for the past 30 years:

DORIS contributes to the monitoring of the evolution of mean sea level, both regionally and globally, using data from the TOPEX/Poseidon and Jason 1, 2, & 3 missions.

- DORIS contributes to monitoring changes in mean sea level, both regionally and globally, using data from the TOPEX/Poseidon and Jason 1, 2, & 3 missions.
- Through the precise orbits provided for the Envisat, CryoSat-2, Saral/AltiKa and Sentinel3-A/B missions, the DORIS system has participated in monitoring the change in height of the Antarctic ice sheet over 25 years.
- It contributes to the definition of the International Terrestrial Reference Frame (ITRF) adopted in 2015 by the United Nations as a global geodetic reference frame for sustainable development, the study of deformations and movements of our planet.
- It observes and analyses geophysical phenomena such as earthquakes or periodic inflation and deflation events of volcanoes, tectonic plate movements, local ground uplift or subsidence, etc.

Since the beginning, the DORIS instruments (on board and on the ground), as well as its monitoring system, have been in constant evolution, the stability of the system and its performances have not ceased to progress : The DORIS network is the most homogeneous, stable and durable geodetic network in the world; in 30 years, the position in orbit has been reduced from 13 cm to less than 1 cm; the DORIS-DIODE navigator on board the satellites calculates the satellite's trajectory in real time with a radial accuracy of 2 to 3 cm; the DORIS contribution to the ITRF has progressed in the same way with new possible applications.

Further progress is expected in the next decade with the 4th generation beacon and the 3rd generation antenna, whose deployments started in 2019.

Studies are underway for the development of a future miniaturized on-board receiver coupling GNSS and DORIS signals.

The DORIS system really has a bright future ahead of it and will contribute to the success of many future missions that will carry it on board, such as [Jason-CS/Sentinel-6](#) and HY-2C this year, then the [SWOT](#) (oceanography and hydrology) mission, the future Sentinel3 missions and, hopefully, many others to come.

Happy birthday DORIS and congratulations!

More information on the International [DORIS Service website](#) and on the [AVISO+](#) website.