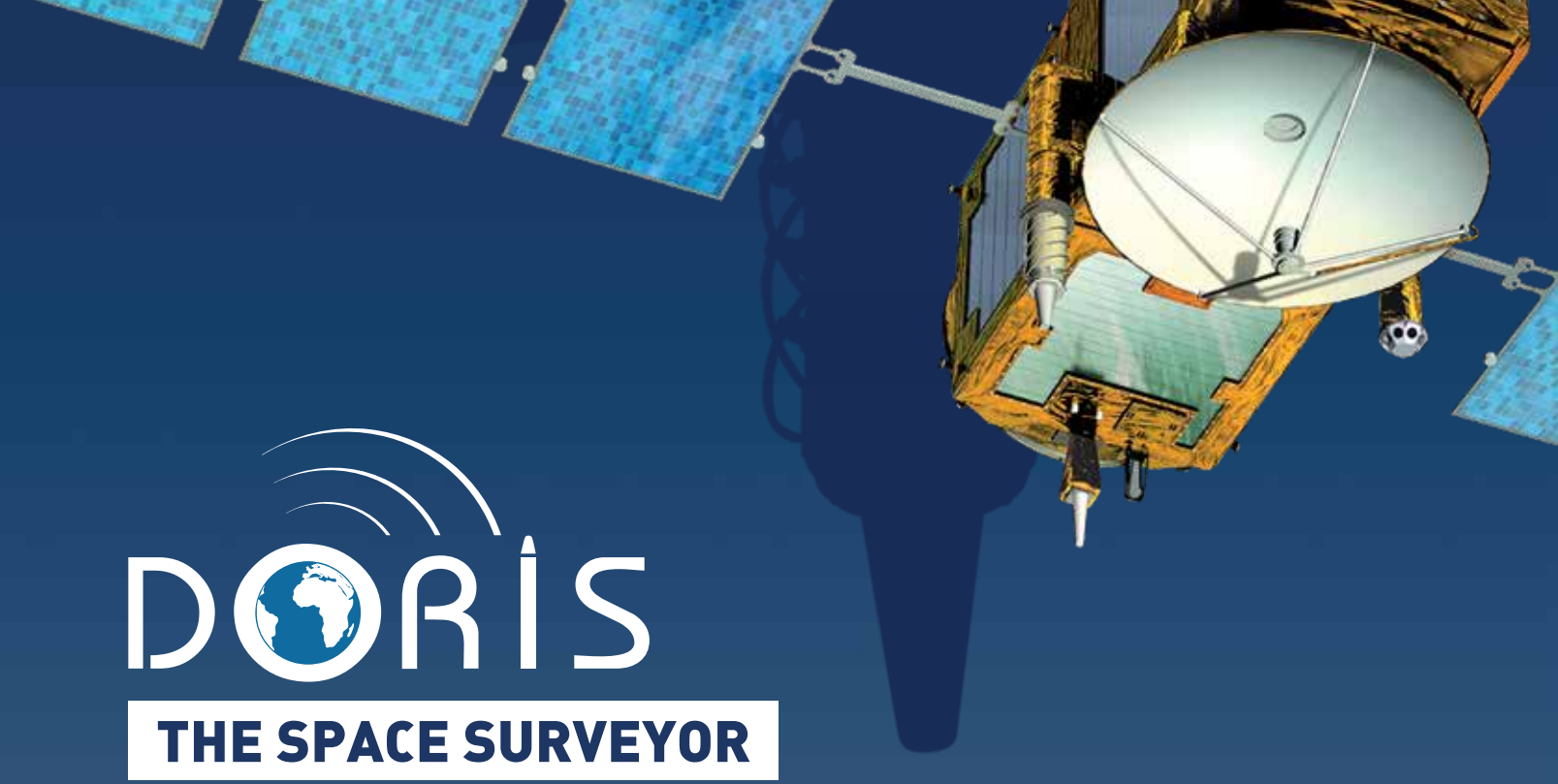

DORIS

THE SPACE SURVEYOR

Space is an excellent observatory for studying the Earth and its oceans, lakes and rivers. To be able to exploit the valuable data collected by a satellite's altimetry instruments, scientists also need information about its exact position. Since the beginning of the 1990s, the DORIS system has enabled scientists to exploit all of the data derived from these tools, by providing orbital elements that are accurate to the nearest centimetre. DORIS is also a highly accurate positioning system, of vital importance for geodesy and geophysics. The data it provides, which are used to determine the International Terrestrial Reference Frame (ITRF), are essential for studying the shape and even the tiniest distortions of the Earth.

DORIS thus plays a major role in the remarkable results of observation missions, whether for oceanography, glaciology, hydrology with the joint French-American series of TOPEX/Poseidon and Jason satellites, or the ESA satellites Envisat and Cryosat, the French-Indian SARAL-AltiKa satellite, the Chinese HY-2A mission, or accurate imaging with the Pleiades satellites. As a genuine surveyor of the Earth from space, DORIS will continue to take on new challenges during the years to come, thus contributing to the success of future missions for observing and studying our planet.

The components of the DORIS system

On the satellite:
An antenna, pointing toward the ground, receives radio waves sent by the stations over which the satellite flies. An electronic receiver measures the Doppler frequency shifts. An ultra-stable oscillator, the instrument's clock and key to the entire system, time-tags the measurements and ensures their accuracy.

On the ground:
Some sixty permanent stations, distributed evenly around the globe, each emit an omni-directional radio signal into space, which is picked up by the satellites.

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DORIS

MESURING FROM SPACE TO WITHIN A CENTIMETRE

A TAILOR-MADE SYSTEM THAT HAS PROVED ITS WORTH

The DORIS system (Doppler Orbit determination and Radio-positioning Integrated on Satellite) was designed and developed by CNES jointly with the French National Geographic Institute (IGN) and the Research Group for Space Geodesy (GRGS) to determine the exact position of satellites on their orbits and precisely locate terrestrial stations.

AN EXEMPLARY NETWORK OF STATIONS

A network of independent stations was deployed throughout the world in 1986. They are used as ground control points, to provide continuous coverage of satellite trajectories. Thanks to exemplary international cooperation, the DORIS system has a network of about sixty stations spread evenly around the world.

MONITORING AND MAINTAINING THE SYSTEM

At the system level, DORIS has undergone various far-reaching developments and improvements: in particular, the integrity-monitoring team can immediately ensure a remote detection of a faulty station, or its first signs of aging, well before its performance starts to decline.

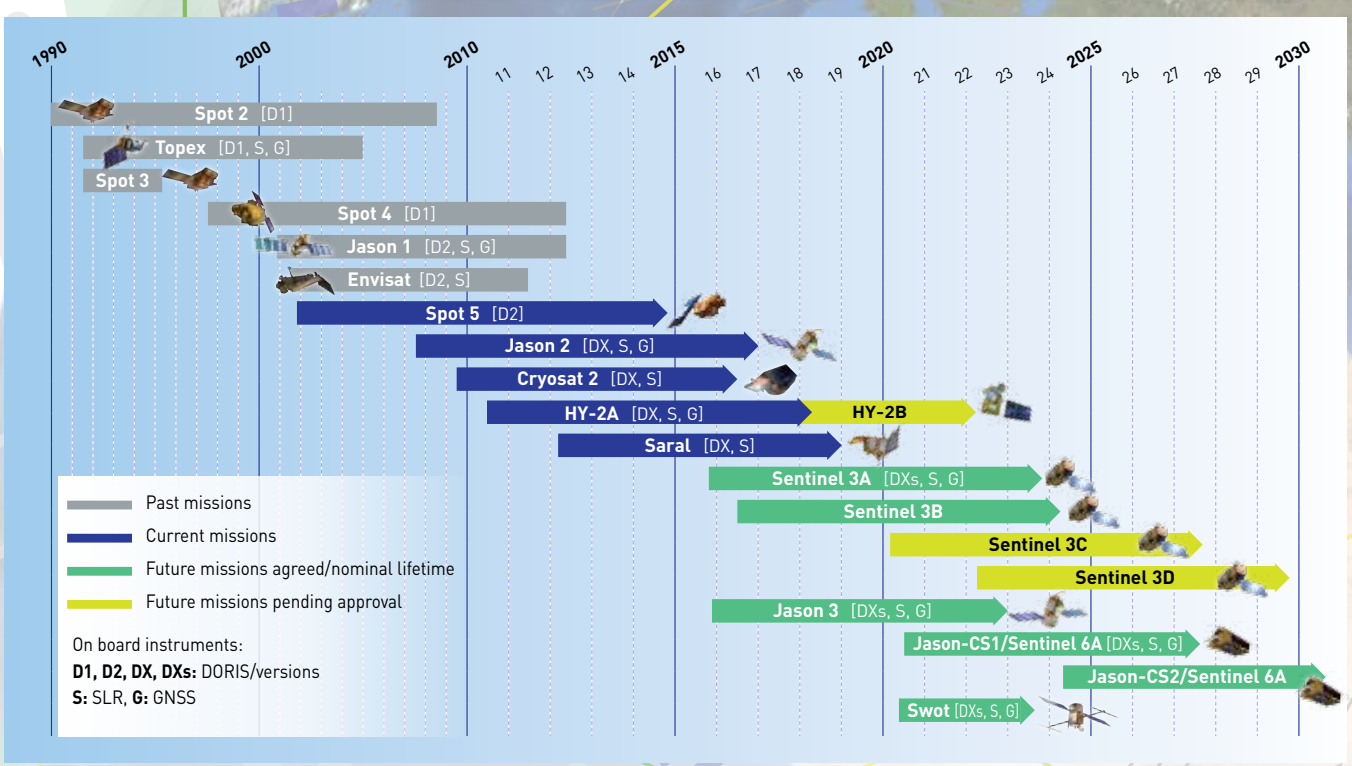
Working in synergy with this team, the IGN carries out maintenance work on the network to improve the performance of the stations and ensure they remain compliant with the current requirements of the system. The homogeneity, reliability, maintenance, and constant upgrades

AN EXPANDING PROCESSING CENTRE, PLUS A GROWING CONSTELLATION OF SATELLITES

The data acquired and stored on satellites are periodically transmitted to SSALTO, the multi-mission orbitography and altimetry centre located in Toulouse. It monitors stations to ensure that they are operating correctly, processes all the measurement data, determines the orbit of the instrument-carrying satellites, then archives and distributes the data.

Since 1990, a dozen satellites, with four always in orbit simultaneously since 2002, have provided measurements that are then exploited by the international scientific community. There are currently five contributing satellites in orbit, and the future missions being prepared will ensure that a DORIS constellation continues to fly beyond 2030.

DORIS MISSIONS



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DORIS

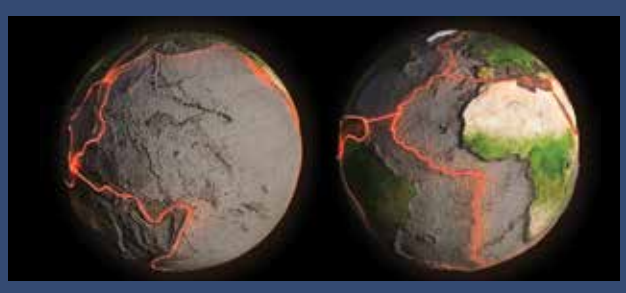
TRACKING THE EARTH'S MOVEMENTS

The constant improvement of DORIS has made it a benchmark for precision orbitography, which is a crucial aspect of altimetry applications, ranging from operational oceanography, modelling to climatic studies.

From geodesy to geophysics

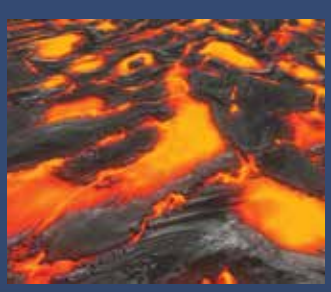
DORIS has made good use of its unique network of stations and its highly accurate positioning capability, to address the needs of geodesy and geophysics.

Monitoring the level of the oceans



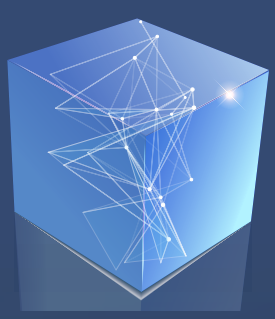
Determining the movement of tectonic plates

Participating in the International Terrestrial Reference Frame (ITRF)



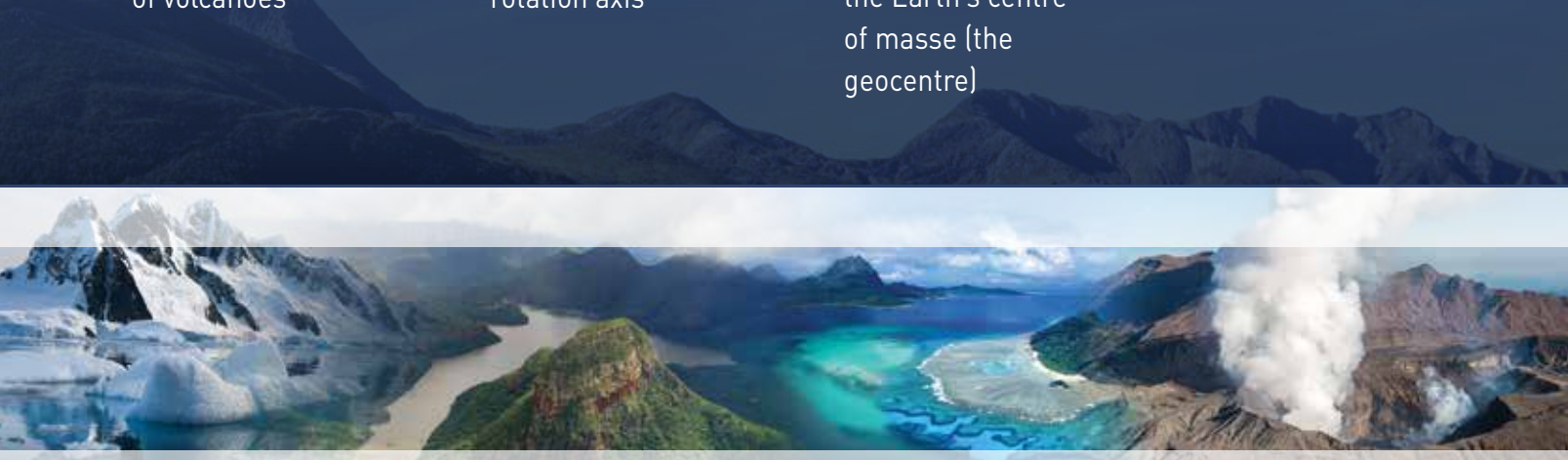
Observing the movements of volcanoes

Measuring variations in the Earth's rotation axis

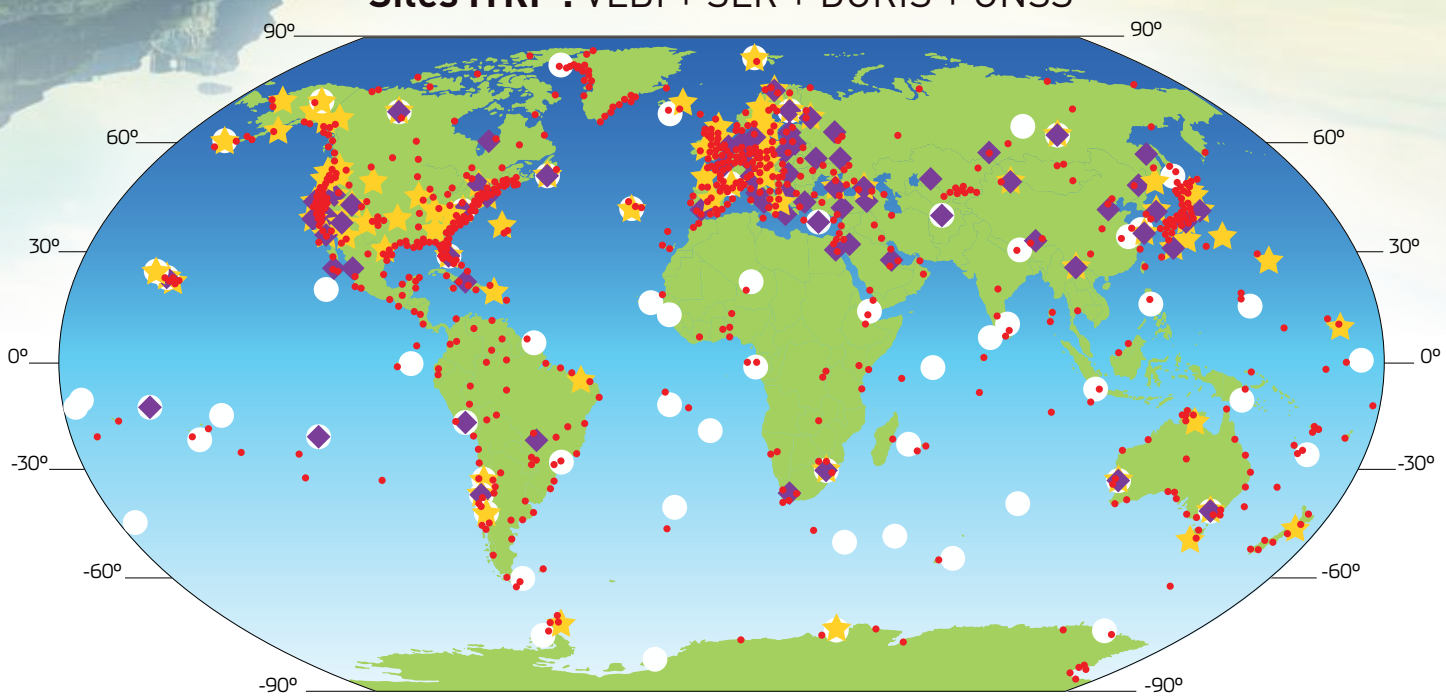


Understanding the movement of the Earth's centre of masse (the geocentre)

And even more applications...



Sites ITRF : VLBI + SLR + DORIS + GNSS



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