GNSS data is extensively exploited by INGV scientists to monitor a variety of geophysical parameters to learn, for instance, about geodesy and physics of the lower and upper atmosphere. The advent of Galileo provides additional capability in terms of spatial coverage and spectrum extension. In this framework, the former GPS networks are now being upgraded with GNSS (multi-constellation) receivers, capable to track Galileo satellites.

INGV personnel matured ICT skills to design and realize data archives and data bases collecting INGV data and gathering GNSS data acquired by other networks or single stations. INGV scientists have a long expertise on GNSS data handling and analysis addressed to scientific uses and to the development of products and services supporting a broad spectrum of GNSS-based operations. INGV collaborates with a number of institutions, academies and private bodies to provide consultancy, services and products based on GNSS data. INGV makes use of GNSS data for validation and calibration of other satellite-based products. INGV deploys and manages low cost receivers to monitor landslides, slope deformations and strategic infrastructures. INGV makes use of GNSS data to monitor, forecast and mitigate space weather events. INGV collaborates with GNSS receivers manufacturers to assess the receivers’ performance under space weather events and under extreme environmental conditions. INGV collaborates with Software-Defined Radio GNSS receivers’ developers to assess the actual capability to monitor the upper atmosphere. INGV is deeply involved as data provider and it is appointed as GNSS analysis center of EPOS (European Plate Observing System), the European Research Infrastructure on solid earth.
INGV products

INGV provides a number of products based on GNSS data. Here follows an overview not exhaustive but representative of the broad spectrum of applications.

Precise daily positions are computed routinely for all the archived stations. These time series allow the estimation of the crustal deformation and the establishment and maintenance of a reliable reference system for the whole area.

Velocity field and strain-rate maps are computed periodically for the Italian and European area. These products are input for tectonic studies, volcano deformation monitoring and regional seismic hazard evaluations. RING data and other GNSS data contribute in the estimation of the coseismic deformation pattern observed after major earthquakes. Full 3D position estimates are used for calibrating other geodetic techniques, e.g. InSAR and terrestrial surveys.

Map of velocities (left panel), crustal deformation (mid panel) and Total Electron Content (right panel) from GNSS data.

INGV provides assistance to monitor, forecast and mitigate the space weather impact on GNSS precision positioning. Space weather events induce perturbations in the ionized part of the atmosphere, the ionosphere, that increases the degradation, already caused by the ionosphere under quiet conditions, of GNSS signals. The result is an increase of the positioning error provided by GNSS.

INGV is partner of the Pan-European Consortium for Aviation Space weather User Services. The PECASUS initiative aims for a global space weather information service center as specified by the International Civil Aviation Organization (ICAO). On the 7th of November 2019 PECASUS started its 24/7 operations to provide civil aviation with information on space weather that has the potential to affect communications, navigation and the health of passengers and crew. INGV took part of the consortium that designed and realized the European Commission-funded Galileo Ionosphere Prediction Service (IPS). IPS monitors the ionospheric activity and informs GNSS users in good time of an upcoming event that could disrupt GNSS signals and applications.

INGV Portfolio
Governmental Authorities
Public Authorities SMEs
Industries
Academia

Web pages
ring.gm.ingv.it
eswua.ingv.it
pecasus.org