Istituto Nazionale di Oceanografia e di Geofisica Sperimentale

DEPARTMENT OF GEOPHYSICS

DEPARTMENT OF GEOPHYSICS - GEO

The GEO research Department aims to maintain and improve the knowledge built over the decades in the fields of geophysics in marine and terrestrial environments, and participate in a process of knowledge transfer to the younger generations. Scientific focus of research and technological development is on emerging fields where the knowledge of the structure of the Earth interior, aided by numerical modelling, is becoming increasingly important for modern society. The Department vocation to geophysical research is supported by the added value of scientific, curiosity-driven approach provided by the participation of researchers, engineers and technicians in projects devoted to scientific excellence in any field of Earth science.

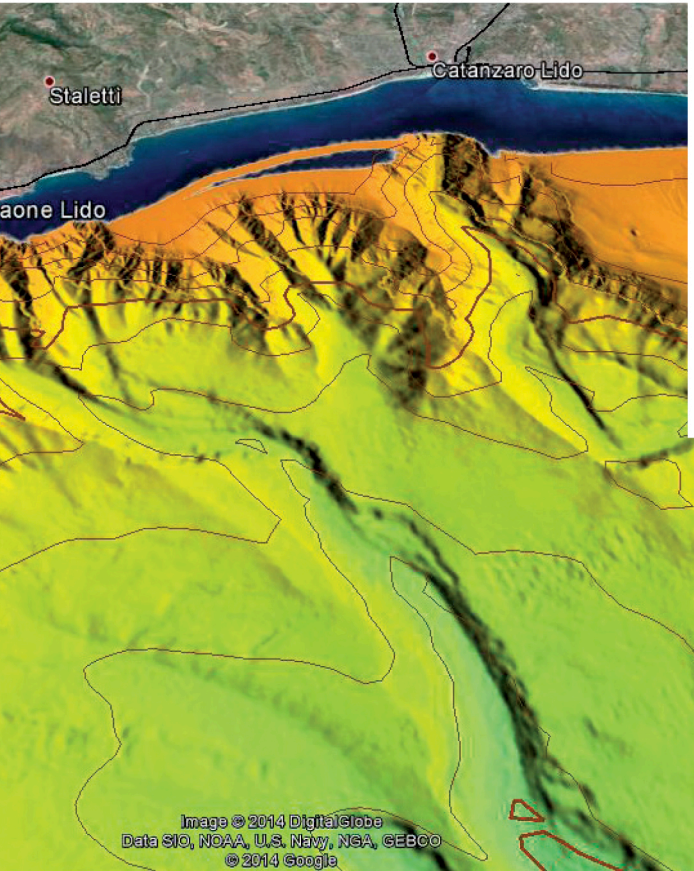
The GEO Department includes researchers, technologists, technicians, students and administrative staff, who distinguish themselves for their ability to plan and carry out scientific research and technological development in the field of geophysics in marine and terrestrial environments. The expertise of the Department staff of the division are grouped into three areas:

- Borehole Geophysics
- Geosciences
- Geophysical Integrated Analysis and New Technologies

The GEO Department manages a number of research infrastructures:

- the Piana di Toppo instrumented borehole test site PITOP, an unique infrastructure constituted by 4 boreholes drilled to a maximum depth of 420 m;
- the SEISLAB (jointly with the University of Trieste), a virtual laboratory for the integrated seismic data analysis and petrophysical modelling;
- the CoreLogging LAB (jointly with the University of Trieste) for the non-destructive analysis of sediments;
- the SMOLAB (jointly with the University of Trieste) for the analogic modelling of scaled geological processes;
- the multi-source wireless electrical data acquisition system for multi-dimensional geo-electrical surveys;

Research is implemented through the activation of PhD programs, Master theses and post-degree professional stages in collaboration with the Universities of Trieste, Udine, Siena and Padova. In line with the strong tradition of OGS, research and technological innovation is often performed through contracts with private enterprises, with a process of reciprocal knowledge transfer.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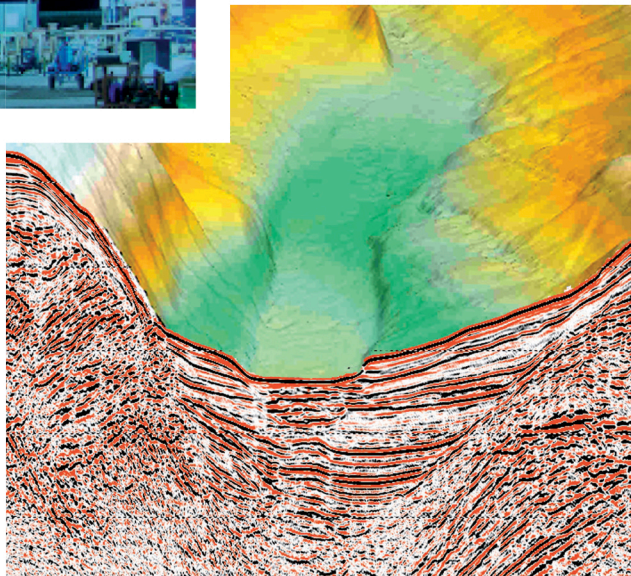


RESEARCH FIELDS

POLAR RESEARCH

Research in polar areas represents a key activity, building on the experience gained in almost three decades of Antarctic and Arctic geological and geophysical research, which includes the participation in the Italian "Programma Nazionale di Ricerche in Antartide" (PNRA), the Scientific Committee for Antarctic Research (SCAR) and the International Arctic Science Committee (IASC).
Thanks to the funding of several large-scale projects, significant advancements have been made in the understanding of the mechanisms of release and dispersion of sub-glacial meltwater plumes during the deglaciacion periods, and their impact on oceanic circulation. The long-term glacial history of the Antarctic continent has been addressed through extensive seismic data acquisition, processing and management, and through a major role in the research carried out within the International Ocean Discovery Program IODP on the Antarctic margins. Significant studies have been done on the structure of the fast-flowing ice streams and their motion, which has direct implications for the predictive modeling of polar ice sheets.

SUBMARINE GEOHAZARDS

This research acticvity is performed with the objective to assess the geohazards in marine environments induced by geological processes like submarine slope instability, mud volcanoes, natural gas emissions and tsunamis. The approach is both qualitative and quantitative, through the analysis of morphobathymetric and seismic reflection data aided by side-scan sonar, Automated Underwater Vehicles (AUV), and Remotely Operated Vehicles (ROV) data, where available. The research activity is focused both in the Polar and Mediterranean regions, thanks to the participation to projects financed by the Programma Nazionale di Ricerche in Antartide (PNRA), the Italian Ministry of Economic Development (MISE) and the Civil Defense Department Marine Geohazards along the Italian Coasts Project (MAGIC).

FOSSIL AND RENEWABLE ENERGY RESOURCES

Carbon Capture and Storage (CCS)

The geological and geophysical competences of the GEO Department play an important role in the National and European Carbon Capture and Storage (CCS) research activity for the identification and characterization of potential sites for CO_2 geological storage. Such research line is strengthened through the participation in technical boards managed by the Italian Ministry of Economic Development, the Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA) and the European Energy Research Alliance (EERA) Joint Programme CCS. The GEO Department also hosts the General Secretariat of the CO_2GeoNet, the European Network of Excellence on the CO_2 geological storage.

Geothermal research

This research activity involves primarily the borehole geophysics area, and in particular the Seismic While Drilling (SWD) method, developed at the PITOP geophysical-drilling test site. SWD allows to implement the geophysical information of the geothermal reservoir. It is particularly useful to investigate geothermal resources of medium and medium-high enthalpy and to implement Enhanced Geothermal Systems.
The GEO Department is also part of the European Energy Research Alliance (EERA) Joint Programme on Geothermal Energy, in a consortium with the University of Trieste.

Gas hydrates

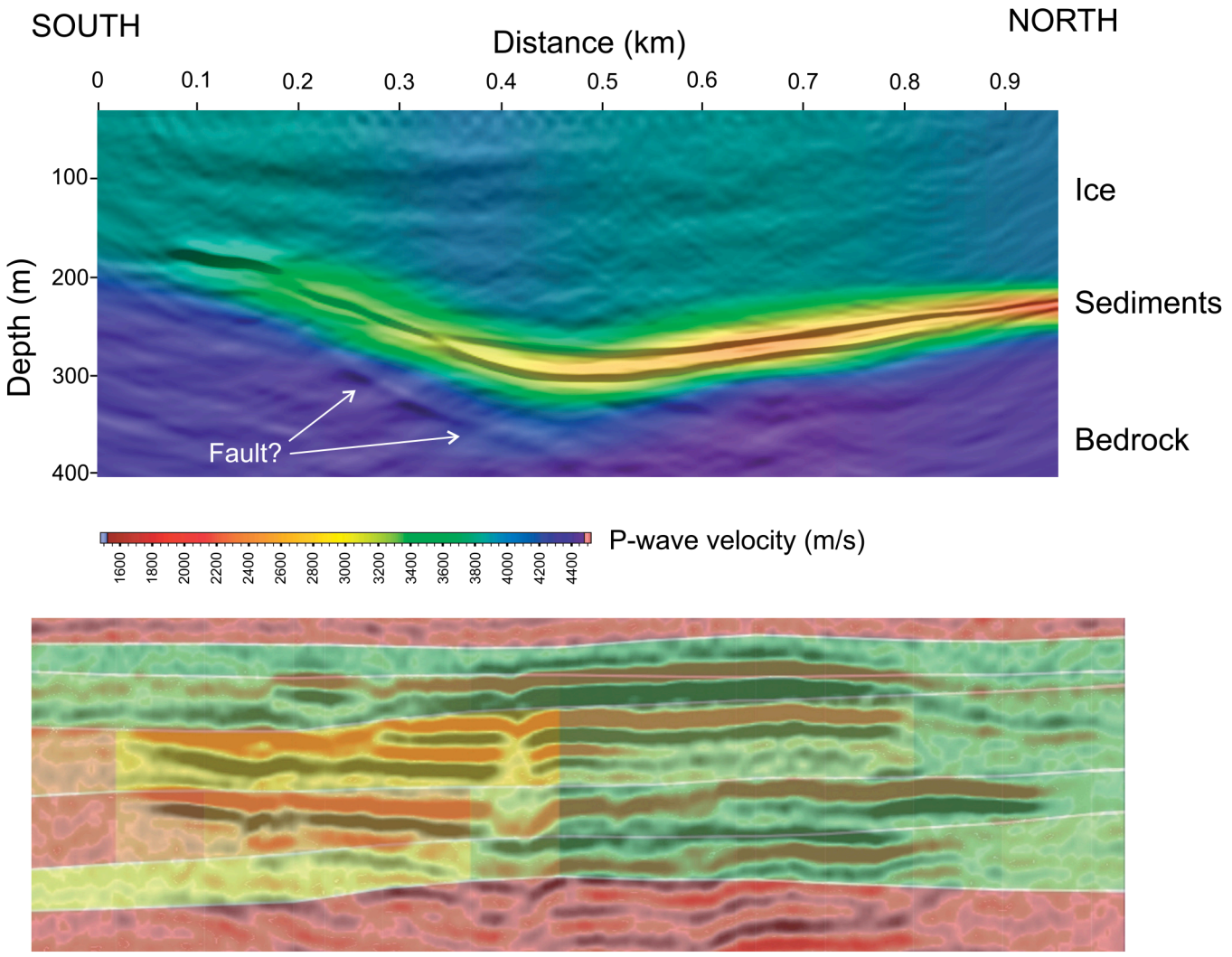
The GEO Department started this pioneering activity in 1993 and remains one of the leading players in the identification and quantification of natural gas hydrates in marine environments and in permafrost. This research activity is carried out through geophysical data processing and analysis that include in-house software ISTRICI and DRAGO for velocity analysis and the estimation of gas-phase concentration and pore pressure. These techniques has been applied to the Arctic region, where a map of the theoretical distribution of gas hydrates in the entire Arctic Ocean and an analysis of the potential methane release as a consequence of global warming has been provided. GEO researchers participate in the Management Board of the COST Action Marine Gas Hydrates: An Indigenous Resource of Natural Gas for Europe (MIGRATE).

SEDIMENTARY BASINS EVOLUTION

The structural and sedimentary evolution of outer continental and oceanic basins is addressed with the regional approach of integrated seismic reflection, gravity, magnetic, coring/drilling and bathymetric data analysis. The aim of this research topic is the geological and structural characterization of active and passive margins, from the coastal to deep sea environments, the identification and characterization of fluids migration in marine sediments and the correlation between deep and surficial geological structures. Regional analyses are conducted in both the Polar continental margins and the Mediterranean area, with special focus on the Italian EEZ (Economic Exclusive Zone) in the Adriatic and Ionian seas and in the Sicily Channel.

FUTURE PERSPECTIVES/GOALS

The research performed in the GEO Department is evolving towards a continuing integration of different data types and sources for the solution of geological and geophysical problems.
Future applications are foreseen in the emerging field of submarine archaeological research on the outer continental shelf, hydrological research and the study of induced/triggered seismicity related to CCS, in collaboration with the Seismological Research Department. Moreover, a new emerging field is the application of the geophysical investigation techniques to studies on glacier dynamics.


SOUTH
NORTH
Distance (km)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Depth (m)
100
200
300
400
Ice
Sediments
Bedrock
Fault?
P-wave velocity (m/s)
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
4200
4400

NATIONAL INSTITUTE OF OCEANOGRAPHY AND APPLIED GEOPHYSICS

The National Institute of Oceanography and Applied Geophysics - OGS - is a public research Institute which acts internationally in the fields of Earth and Marine Sciences, Oceanography, Geophysics and Seismology.
The Institute aims at safeguarding and enhancing the environmental and natural resources and focuses its efforts on evaluating and preventing geological, environmental and climatic risks, and spreading the scientific culture and knowledge.

OGS has four locations in the Friuli Venezia Giulia Region (North-Eastern Italy) and it is structured under four main Departments:
- Oceanography - OCE;
- Geophysics - GEO;
- Seismological Research - CRS;
- Research Infrastructures - IRI.

With its strategic infrastructures of excellence (such as the oceanographic research vessel OGS Explora), OGS makes its own expertise available for research related to environment and climate, biodiversity and ecosystem functionality and to the study of seismicity, hydrodynamic and geodynamic phenomena having an impact on both environment and population.

HEADQUARTER

The headquarter hosts the offices of the Presidency, the Administrative and Technical Departments and the four Scientific Departments. It is located in the municipality of Sgonico, 12 km from the center of Trieste.

Borgo Grotta Gigante 42/C - 34010 Sgonico (TS) - Italy
Tel.+39 040 21401 - Fax.+39 040 327307

SANTA CROCE

The biochemistry and biology labs of the Oceanography Department are adjacent to the sea.

Via Auguste Piccard, 54 - 34151 Trieste (TS) - Italy
Tel.+39 040 21401 - Fax.+39 040 327307

MIRAMARE

Here are hosted the modelling and High Performance Computing labs of the Oceanography Department.

Via Beirut 2/4 - 34014 Trieste (TS) - Italy
Tel.+39 040 21401 - Fax.+39 040 327307

UDINE

Here is located the Department of Seismological Research.

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