

## CENTER OF EARTH'S DYNAMICS RESEARCH IN THE YEARS 2005 – 2010

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The Center of Earth's Dynamics Research (CEDR) was created in 2000 as a background for realizing the project LN00A005 „Experimental Research of the Dynamics of the Earth and its Surface“ supported by the Ministry of Education, Youth and Sports of the Czech Republic within the frame of the national program „Research Centers“. In the period 2000 – 2004 CEDR was a joint research center comprising researchers of the following five institutions: 1) Research Institute of Geodesy, Topography and Cartography (RIGTC), Department of Geodesy and Geodynamics, Geodetic Observatory Pecný (GOP) at Ondřejov, 2) Astronomical Institute (AI) of the Academy of Science of the Czech Republic, Department of Dynamic Astronomy (since 2005 Department of Galaxies and Planetary Systems), 3) Faculty of Civil Engineering of the Czech Technical University in Prague (FCI CTU), Department of Advanced Geodesy, 4) Faculty of Sciences of the Charles University in Prague (FSci CHU), Department of Physical Geography and Geoecology and 5) Institute of Rock Structure and Mechanics (IRSM), Academy of Sciences of the Czech Republic, Department of Geofactors (since 2006 Department of Geodynamics).

The main CEDR's experimental basis was the Geodetic Observatory Pecný along with its associated observatory Skalka located at Ondřejov near Prague. Besides, the CEDR observation infrastructure was systematically built during 2000 – 2004 over the entire territory of the Czech Republic: the IRSM established and operated the second experimental basis consisted of five permanent GNSS stations that were included to EUREF Permanent Network (EPN) and the RIGTC established some GNSS and collocation (GNSS and gravity) stations. Large investments were made into the geodetic instrumentation, the most important of which were the FG5 absolute gravimeter of the Micro-g Solutions and a number of GNSS receivers for permanent stations.

Starting from 2005, a new follow-up project „Recent Dynamics of the Earth“ was launched within the program „Centers of Fundamental Research“ initiated by the Ministry of Education, Youth and Sports of the Czech Republic. Originally the 5-year project was prolonged by 1 year in 2009. Of the five institutions participating in the first period only four continued their work in CEDR in the second period from 2005. The researchers of the Department of Physical Geography and Geoecology, the Faculty of Sciences, and the Department of Geophysics, Faculty of Mathematics and Physics, Charles University in Prague have been participating as external experts and so did the scientists of the Department of Hydrology, Faculty of Civil Engineering of the Czech Technical University in Prague.

The instrumentation of the Geodetic Observatory Pecný was upgraded and extended by the superconducting gravimeter OSG-050, the microwave water vapor radiometer TP/WVP-3000 of Radiometrics Inc., USA and the 3-D very broad-band seismometer GURALP CMG-3TD installed in a deep borehole at the GOP. The Department of Geodynamics, IRSM, bought the precise spring relative CG-5 Scintrex gravimeter, 14 GNSS Topcon GB-1000 and 3 GNSS Topcon NET-G3 receivers with related antennas. The last Topcon NET-G3 type can already monitor all NAVSTAR, GLONASS and GALILEO satellite signals. These GNSS equipments together with the 5 previous Ashtech Z18 receivers were installed over the Czech part of the Bohemian Massif with respect to monitor and detect possible geodynamic movements among geologic structures. Established network, Geodynamic network of the Academy of Sciences (GEONAS), is operated and checked via IRS Operational Centre of the IRSM. Moreover, 3 gravity stations in the West Bohemian area were established for permanent monitoring of gravity field changes originated by post-volcanic seismic activity occurring in this area.

The objectives of the project „Recent Dynamics of the Earth“ are to investigate

- Earth's rotation and dynamics in space,
- changes of the Earth's gravity field,

- rapid and secular changes of the earth surface,
- problems related to local geodynamical networks, and
- regional geodynamic pattern of the Bohemian Massif and its parts.

The total costs of the project for the entire 6-year period are 145 million CZK, the contribution of the Ministry of Education, Youth and Sports of the Czech Republic is 56 million CZK.

The research team consists of 32 researchers, the age of 14 of them is less than 35 years, 21 of them are scientists. During the time there were only slight fluctuations in the team structure. The young researchers submitted and defended 7 PhD theses and 6 diplomas.

The CEDR's merit is in interdisciplinary collaboration of several geo-scientific disciplines: geodesy, geodynamics, geophysics and geomorphology. Thanks to the large investments made in the last years, the cooperating institutions can do their experimental work on a high international level.

Investigations of the most of the problems call for a broader international cooperation. Therefore, an international cooperation is developed under the umbrella of international scientific organizations like European Geosciences Union (EGU), International Union of Geodesy and Geophysics (IUGG), International Association of Geodesy (ISG), International Association of Seismology and Physics of the Earth's Interior (IASPEI), International Bureau for Weights and Measures (BIPM), Central European Initiative (CEI) and within the research framework programs of the European Union. A significant part of the international cooperation is realized through the international scientific services associated with the IUGG, IASPEI or IAG, such as International Earth Rotation and Coordinate System Service (IERS), International GNSS Service (IGS), EUREF Permanent Network (EPN), International Centre on Earth Tides (ICET), European Seismological Commission (ESC), International Gravimetric Bureau (BGI), International Gravity Field Service (IGFS) and also through international projects such as E-GVAP (GNSS meteorology project) in cooperation with meteorological services of Great Britain, Denmark, Sweden and France. A bi-lateral cooperation has been running with several research institutions and universities in Slovakia, Poland, United Kingdom, Germany, Austria and France. In the Czech Republic, CEDR cooperates with the universities in Brno, Ostrava and Plzeň and also with geologic, geophysical and geodetic institutions.

The principal topics investigated in international context are

- international GNSS based observation programs (IGS, EPN, ECGN, LEO) and programs based on collocation of different observation techniques like Global Geodetic Observation System (GGOS),
- operation of the international data and analysis centers for space geodesy (IGS, EPN, DORIS),
- periodic and non-periodic gravity variations – gravimetric earth tides, long-term contributions to the ICET, GGP – Global Geodynamics Project, and
- operation of permanent GNSS network in the Czech Republic and its employment in international projects.

Some significant results of the international cooperation are

- theory of the determination of parameters of a time-variable Earth's gravity field from a combination of satellite and terrestrial data,
- a new long-term precession model,
- derivation of geophysical effects in nutation,
- methodology of EOP determination from a combination of space geodesy techniques,
- models of environmental effects on gravity,
- models of a visco-elastic Earth and of ice sheet flow,
- geodynamic model and model of the horizontal surface deformations of the Bohemian Massif, and
- seismotectonic and geodynamic model of the West Bohemian area.

The results are presented at international symposia and published in renowned scientific journals and in proceedings of international scientific events. The CEDR team results are also periodically presented at its own internal seminars. During its existence CEDR organized three times such a seminar the Třešť château under the auspices of the Academy of Sciences of the Czech Republic.

Attention is also paid to the CEDR public relations. Beside publishing in the Czech popular scientific journals *Vesmír* (The Space) and in other popular periodicals, a ten minutes film on the CEDR was made by the Czech TV and broadcasted in the regular program series „Popularis“.