

Académie Royale de Belgique

Comité National Belge
de
GÉODESIE et de GÉOPHYSIQUE

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voor
GÉODESIE en GÉOFYSICA

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<http://bncgg.oma.be>

Annual report 2015

Comité National Belge de Géodésie et de Géophysique *Belgisch Nationaal Comité voor Geodesie en Geofysica*

1. Short introduction on the subject of research and the goals of the Committee

The BNCGG serves as a link between IUGG and the Belgian scientists working in the fields of Geodesy and Geophysics. This activity reaches a climax every four years at the IUGG general assemblies. The BNCGG is then charged to propose to the Academy the national delegates to IUGG and to its eight Associations:

- International Association of Cryospheric Sciences (IACS);
- International Association of Geodesy (IAG);
- International Association of Geomagnetism and Aeronomy (IAGA);
- International Association of Meteorology and Atmospheric Sciences (IAMAS);
- International Association of Hydrological Sciences (IAHS);
- International Association of the Physical Sciences of the Ocean (IAPSO);
- International Association of Seismology and Physics of the Earth Interior (IASPEI);
- International Association of Volcanology and Chemistry of the Earth Interior (IAVCEI).

In the meantime, the BNCGG organises regularly conferences by known Belgian or foreign scientists.

The BNCGG tries also to encourage the participation of young scientists to the IUGG General Assemblies by attributing grants.

Belgium was among the 9 countries who established the International Union of Geodesy and Geophysics (IUGG) on July 28, 1919 in Brussels. The Belgian National Committee for Geodesy and Geophysics (BNCGG) was created shortly after in 1921. The running expenses were covered until 1950 by the National Cartographic Institute and later on by Royal Academy of Belgium, now split into "Koninklijke Vlaamse

Academie van België voor Wetenschappen en Kunsten" and "Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique".

In parallel with the BNCGG there exists since 1955 an "Association sans buts lucratifs de droit belge" called "Comité National Belge de Géodésie et de Géophysique, Bruxelles". It is charged to administrate the finances of the Committee.

2. Member list

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3. Meetings of the Committee in 2015

Dates and main conclusions

The traditional annual BNCGG General Assembly has been held on January 21 in the Meridian room of the Royal Observatory of Belgium. The introductory conference was given by Dr. Thomas Lecocq, Royal Observatory of Belgium.

A second BNCGG meeting was organized on May 21 at the Royal Observatory of Belgium with two conferences given resp. by Dr. Alexander Mangold (Royal Meteorological Institute) and Dr. Denis Lombardi (Royal Observatory of Belgium).

A third meeting was organized on Nov. 11 at the Royal Observatory of Belgium with conferences given resp. by Prof. Alain Dassargues (Departement ARGENCO, ULg) and Prof. Marnik Vanclooster (Earth & Life Institute, UCL).

The summary of the talks that were given to the Committee follow:

AcceleROB: measuring earthquake strong ground motion in Belgium

Thomas Lecocq, Royal Observatory of Belgium

January 21, 2015

Although usually of relatively small magnitude, earthquakes occur regularly in Belgium. 3 to 5 earthquakes are felt every year on average. The Belgian seismic network is one of the densest in the world, but still, it is impossible to have professional-grade seismometers every 10 or 20 km all over the country. Since 2002, the ROB runs a web-based "Did You Feel It?" inquiry, which allows citizens to witness the impact of an earthquake at their location. The information obtained from the seismometers (the ground motion) and from the citizens (the intensity) can be combined to define a map of the ground motion for each earthquake, but will always lack "ground truth" ground movements. With AcceleROB, we propose to deploy 90 small-scale, relatively low-cost accelerometric stations all over Belgium. With 90 stations, we can have a 15-km spaced grid of sensors. 13 of these sensors are already installed, 10 are available and 67 are in construction. This CNBGG meeting is a good occasion to present the equipment and to propose

members to host an AcceleROB at their home. All that is required is to have a permanent internet connection, an available power plug in the basement (or any place in direct contact with the ground) and some small place on the ground (max 30x30cm). The measurements will be sent automatically and in real time to the ROB processing server, and will provide acceleration values every 125th of a second on 3 components.

Atmospheric aerosol at Princess Elisabeth station, East Antarctica: what those tiny particles can tell us about the Antarctic atmosphere

Alexander Mangold, Royal Meteorological Institute of Belgium

May 21, 2015

Aerosols play an important role in atmospheric physics and chemistry. They attenuate, scatter and absorb solar radiation, influencing by this way the temperature at the surface and within the atmosphere and exerting a positive or negative radiative forcing. Also, they influence cloud formation and properties such as cloud particle phase and size and their ability to produce precipitation. The aerosol amount in Antarctica is extremely low and aerosols are mostly carried to Antarctic via long-range atmospheric pathways. However, also minor local aerosol sources exist. Since 2010, several complementary ground-based instruments for the long-term monitoring of the composition of the Antarctic atmosphere have been operated at the Belgian Antarctic research station Princess Elisabeth in the framework of a common project of the Royal Meteorological Institute of Belgium, the Belgian Space Aeronomy Institute, and University of Ghent. The station is manned from November to end of February and operated under remote control during the other months. Measured properties comprise aerosol size distribution, total aerosol number, total aerosol mass concentration, mass concentration of light-absorbing aerosol and absorption coefficient and total scattering coefficient. All instruments have been installed for continuous operation. Besides these instruments, a sunphotometer provides total aerosol optical depth (AOD) during austral summer since February 2009. A Brewer ozone spectrophotometer provides total ozone, spectral UV and AOD in the UV-A during austral summers. In addition, a cloud condensation nuclei counter (CCNc) has been operated in austral summers 2013/14 and in 2014/15. Seasonal variations of mass concentration of light-absorbing aerosol, aerosol number and size, or of aerosol optical properties have been observed. Combined measurements of aerosol number, size and of the concentration of cloud condensation nuclei reveal specific periods of increased numbers of very small particles, indicative of new particle formation events. In the presentation, an overview of gathered results will be given and links with atmospheric dynamic processes will be discussed.

Seismology at Princess Elisabeth station, East-Antarctica: what seismometers can tell us about the ice-sheet dynamics

Denis Lombardi, Royal Observatory of Belgium

May 21, 2015

One century after the Amundsen and Scott South Pole expeditions, Antarctica is still regarded as the last unexplored land on Earth. Although this view may be true to some degrees, from a scientific perspective this is drastically changing. Indeed, with the growing global warming threat, Antarctica experiences a new era of science investigations aiming at understanding the past, present and future evolution of a continent whose overlying ice sheet represents 80% of fresh water on Earth. With the return of Belgium to Antarctica and the establishment of the new Princess Elisabeth base (PE base) in 2009, the Royal Observatory of Belgium launched a project of geodynamics with the main objective being long term monitoring of the local ground and ice-sheet dynamics. Within this frame, during the last years, several experiments using seismometers were carried out in the vicinity of the PE base to monitor the local and regional seismicity as a proxy for the behaviour of ice – rock interactions. One of the experiments was focused at the edge of the Antarctic plateau where the ice sheet meets a local mountain range while another, located near the coast, concentrated on the interactions of ice flow and ocean. In this talk I will present the project objectives and describe those experiments in such a harsh environment. I will then show why Antarctica which is usually considered as aseismic is actually not at all and how the recorded seismicity can tell us more about the ice sheet dynamics.

Groundwater pumping and sinking cities: back to the forefront due to global change

Alain Dassargues, University of Liège

November 12, 2015

Much attention is paid to sea level rise but the problem of land subsidence, induced by manchanged (fluid) groundwater conditions in the underground, can be by far more significant locally. The 'sinking' regions correspond most often to coastal densely populated areas located in regions where compressible loose sediments are found. As they are usually under-consolidated and compressible, geological settings made of recent coastal and especially estuarine, deltaic and lacustrine sediments are particularly concerned. Venice, Mexico, Bangkok, Shanghai, Changzhou, Jakarta, Manila, New Orleans, Houston, Tokyo, Ho Chi Minh City, Hanoi, ... are only a few examples among the numerous 'sinking cities'. Recent unconsolidated or semi-consolidated deposits form often a succession of layers that can be considered, from a hydrogeological point of view, as semi-confined or confined aquifer systems. In confined aquifers but also in unconfined aquifers, it is well known that the lowering of the piezometric head due to pumping or drainage induces additional effective stresses directly in the concerned aquifer and then, with a delay depending on their characteristics, in the compressible confining layers or in the compressible lenses of loam, clay, and peat included in the aquifer. This effective stress increase induces a drained consolidation process in the compressible layers. Coupling the transient groundwater flow equation with geomechanical aspects, allows understanding the considered transient processes induced by the artificial lowering of the water pressure in the porous medium. For accurate calculations, used for understanding the observed subsidence and predicting the future subsidence, it is important to take into account the strongly non-linear effects as the variation of the specific storage coefficient and of the permeability during the consolidation process. Recently this issue was back to the forefront of the scientific actuality as land subsidence plays an important role linked to global change and groundwater management challenges.

Introducing uncertainty in the impact assessments of climate change on local scale hydrology

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November 12, 2015

The recently released AR5 report of IPCC confirms that freshwater-related risks of climate change increase significantly with increasing greenhouse gas (GHG) concentrations and that climate change is projected to reduce renewable surface water and groundwater resources significantly in many areas overall the world. This will intensify competition for water among agriculture, ecosystems, settlements, industry, and energy production, affecting regional water, energy, and food security and increase water insecurity. This calls for paradigm shifts in the water management policy and adaptation of water management at different levels (physical technical, social, institutional). However, many barriers for adaptation exists. One of these barriers is related to a poor understanding of possible impacts of climate change at the local hydrological scale, and a poorly characterized uncertainty associated with such impact studies. To improve this, we show how uncertainty can be propagated for assessing hydrological impacts of climate change at the local scale. We illustrate the approach for two catchments of the Mediterranean region - which is considered as a hotspot for climate change – and demonstrate how uncertainty can be decomposed in uncertainty coming from the hydrological model and uncertainty coming from the climate model.

4. Contribution to IUGG General Assembly in Prague, June 22 to July 2, 2015

One of our effective members, Dr. Kris Vanneste, attended the IUGG General Assembly as Belgian National Representative for the IUGG Council. Resolutions adopted by the council can be found at <http://www.iugg.org/resolutions/IUGGResolutions2015.pdf>.

As Belgium did not pay its annual contribution to the IUGG, Belgium was not allowed to vote and attended the meeting as a "regular member in an observer status".

The other Belgian representative delegates were also present or provided a procuration to another delegate:

- Philippe Huybrechts for the International Association of Cryospheric Sciences
- Carine Bruyninx was represented by Juliette Legrand for the International Association of Geodesy
- Johan De Keyser was represented by Fabien Darrouzet for the International Association of Geomagnetism and Aeronomy
- Martine De Mazière for the International Association of Meteorology and Atmospheric Sciences
- Thierry Camelbeeck was represented by Fabienne Colin for the International Association of Seismology and Physics of the Earth's Interior
- Pierre Delmelle for the International Association of Volcanology and Chemistry of the Earth's Interior

5. Future perspectives

- The next BNCGG General Assembly is planned on Thursday January 21, 2016.
- The next IUGG General Assembly will be held in Montreal, Canada in 2019.
- Next Scientific Assemblies of the IUGG Associations are
 - o IACS, 13-17 February 2017 Wellington, New Zealand
 - o IAG/IASPEI, 30 July-4 August 2017, Kobe, Japan
 - o IAGA/IAMAS/IAPSO, 27 August-1 September 2017 Cape Town, South Africa
 - o IAHS, date on discussion, Port Elizabeth, South Africa
 - o IAVCEI, 14-18 August 2017, Portland, USA
- The mandates of our effective and associated members have to be renewed every 4 years. The last time was in 2012, so it will be the case again in 2016. Letters for renewal have been sent in December 2015.
- The BNCGG, in cooperation with the BNCAR, plans to organise a joint conference in the Spring of 2016 about the scientific research at the Belgian Antarctic Base "Princess Elisabeth".