

Académie Royale de Belgique

Comité National Belge
de
GÉODESIE et de GÉOPHYSIQUE

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Belgisch Nationaal Comité
voor
GÉODESIE en GÉOFYSICA

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Annual report 2014

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 2014

Dates and main conclusions

The traditional annual BNCGG General Assembly has been held on January 22 in the Meridian room of the Royal Observatory of Belgium. The introductory conference was given by Prof. Pierre Delmelle, Earth and Life Institute, Université Catholique de Louvain.

A second BNCGG meeting was organized on June 19 at the Royal Observatory of Belgium with two conferences given resp. by Dr. Steven Dewitte (RMI and BNCGG vice-president) and Dr. Frédéric Clette (ROB).

A third meeting was organized on Oct. 16 with conferences given resp. by Dr. Arnauld Beth (Institut de Recherche en Astrophysique et Planétologie, Toulouse) and Dr. M. Crucifix (Earth & Life Institute and Georges Lemaître Centre for Earth and Climate Research).

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

Volcanic flank collapse and ocean fertilization by volcanic ash: is there a common denominator?

Pierre Delmelle, Earth & Life Institute, Université Catholique de Louvain
January 22, 2014

Subsurface magmas that feed active volcanoes expel sulphur and halogen gases either passively or explosively. At non-erupting volcanoes, these gases can form highly acidic condensates which further interact with the country rock. By drastically altering the mineralogy of the original rock, these hydrothermal reactions also modify the rock mechanical properties. There is evidence that the presence of hydrothermally altered rocks in a volcanic edifice decreases its stability and therefore, increases the risk of catastrophic flank collapse. However, our understanding of the relationship between volcanic flank collapse and hydrothermal alteration is still poor. At erupting volcanoes, a mixture of hot magmatic gas and silicate ash materials is suddenly injected in to the atmosphere. Various reactions between sulphur and halogen gases and ash particles take place within the eruption column, and later during lateral dispersion of the ash cloud. These interactions are not well documented but may have a dramatic impact on the capacity of ash to deliver key nutrients upon deposition in the surface ocean. This seminar presented recent research activities aimed at obtaining new insights into the role of chemical rock alteration and (i) volcanic flank collapse and (ii) volcanic fertilization of the ocean.

Total Solar Irradiance measurements: quantification of the solar radiative forcing of the earth's climate from 30 years of observations from space

Steven Dewitte, Royal Meteorological Institute of Belgium and BNCGG Vice-President
June 19, 2014

The Total Solar Irradiance (TSI) quantifies the amount of the energy the earth receives from the sun, normalised for the annual sun-earth distance variations. Variations of the TSI therefore correspond to a solar radiative forcing of the climate on earth. The TSI is measured from space since 1978, with a stability that gradually increased in time. We will present our current best understanding of the long term TSI variations. The current solar cycle 24 is unusually low, and it followed an unusually long minimum after solar cycle 23. It appears that the 11 year solar cycle TSI variation, with an average amplitude around 1 W/m² is itself modulated with a 100 year modulation of 1 W/m². TSI variations do not seem to explain the Little Ice Age around 1700, nor the 'break in global warming' since around 2000.

The sunspot number time series: a full recalibration of the primary 300-year record of solar activity

Dr. Frédéric Clette, Royal Observatory of Belgium
June 19, 2014

The sunspot number series is a unique reference for retracing quantitatively the level of solar activity, as an input to analyses and models in various disciplines, from solar physics to Earth climate. Over the past 3 years, a new joint effort has been initiated by the World Data Center SILSO, at the Royal Observatory of Belgium, jointly with a community of about 40 researchers worldwide, in order to revisit the existing series, as it was initially produced at the Zürich Observatory. By including new data and new diagnostics, several sources of inhomogeneities have been identified, some of them causing large biases by up to 40%, affecting entire sections of the series. This seminar reviewed those new findings and also considered some of the implications, like the absence of a progressive upward trend in solar activity cycles over the past 250 years in the resulting recalibrated sunspot number.

Analytical modeling of terrestrial planets' upper atmospheres: analysis of the scarce collisions and influence of the stellar radiation pressure

Dr. Arnaud Beth (IRAP, Institut de Recherche en Astrophysique et Planétologie, Toulouse)
Octobre 16, 2014

The external part of the atmosphere, the exosphere, is not a well-known region. The densities are too low for many instruments compared with their detection capabilities, and the modeling of the particles dynamics can be complex. During his PhD thesis, A. Beth focused on two problems: the production of "satellite" particles from the scarce collisions in the lower exosphere and the influence of the radiation pressure on the exosphere structure. In the first part of his talk, he presented the results about the influence of the scarce collisions near the exobase on the density profiles at higher altitudes for the Earth, Titan and Mars, through the production of "satellite" particles, that are neglected in the collisionless models. In a second part, he showed the effect of the radiation pressure on the structure of the exosphere with a semi-analytical approach. The radiation pressure changes the ballistic particle density profiles and implies strong asymmetries at high altitudes. It increases also the thermal escaping flux, which we determined analytically at the subsolar point. Finally, the presentation also showed its influence on the Three-Body problem and on the stability of the atmospheres, in particular for hot Jupiter exoplanets.

Understanding the current challenges in climate modelling: dynamics, thermodynamics and statistics

Dr. M. Crucifix (Earth & Life Institute and Georges Lemaître Centre for Earth and Climate Research)

October 16, 2014

From the 26th to the 29th August 2014 a workshop entitled 'Advances in Climate Theory' was held at the Belgian Royal Meteorological Institute. The workshop was organized and funded by the European Research Council, through the Starting Grants 'ITOP' and 'Namaste', focusing on the dynamics of the Pleistocene climate, and on the thermodynamics of the climate system, respectively.

The STOCHCLIM project started in 2014 and funded by the Belgian Policy Office, and the BNCGG, were also associated to this workshop.

The workshop gathered approximately 50 participants, including 15 international invited speakers. Retrospectively the Workshop could have been called 'Advance in climate theories' : the climate is a physical, complex system that poses challenges to many areas of physics, mathematics, statistics and engineering. There is not A theory, but rather many theoretical frameworks that may be mobilized to answer specific questions.

This conference first provided an overview of these different frameworks and then gave a critical summary of important objectives and challenges faced by climate science today.

Specifically, the frameworks are illustrated by examples taken from talks delivered during the workshop, the present objective to demonstrate the variety of possible approaches for studying and characterizing climate dynamics: mean field theory, dynamical system analysis, spectral analysis of observations, climate simulation and parameterisations, and Bayesian statistical inference. While every framework comes with its own technical challenges, cross-cutting subject definitely emerge as recurrent thematic: multi-scale (and fractal) dynamics, prediction, regional dynamics and interdecadal variability

4. Possible General Assemblies of the Scientific Union in 2014

No IUGG GA.

5. Other activities in 2014

Representation at Scientific Assemblies

No scientific assemblies were held in 2014.

Possible organisation of a IUGG GA in 2019 in Brussels

On March 26, 2013 the BNCGG Bureau met the Secretary General of the International Union of Geodesy and Geophysics (IUGG), in the presence of the Director General of the Royal Observatory of Belgium.

The object of his visit in Brussels was the following: In 2019 IUGG will turn to be 100. IUGG was born in Brussels and the executives of IUGG thought that perhaps it would be a good idea to celebrate this wonderful event in Brussels on or around 28 July 2019 (the date of the birth of the Union). He was asked by the IUGG Bureau to negotiate with us about any potential actions.

After a vote amongst the effective BNCGG members, the BNCGG decided not to organize an IUGG General Assembly because no suitable locations in Brussels for the conference could be found.

6. Future perspectives

- The next BNCGG General Assembly is planned on Thursday January 22, 2015.
- The next IUGG General Assembly will be held in Prague, Czech Republic from June 22 to July 2, 2015.
- 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 will be sent in November 2015.