

GEODETIC ACTIVITIES IN ANTARCTICA

RESEARCH GROUP: Stefano Gandolfi, Leonardo Martelli, Luca Poluzzi, Luca Tavasci, Luca Vittuari, Antonio Zanutta
 KEYWORDS: Antarctica, EPICA, Beyond EPICA – Oldest Ice, Global Change, VLNDEF; TALDICE, ITASE

The geodetic activities conducted by DICAM in Antarctica within the National Program of Research in Antarctica (PNRA) concern two main areas of research: the study of current geodynamics of Northern Victoria Land and the monitoring applications of glacial bodies for studies related to paleo-climate.

The network VLNDEF (Victoria Land Network for Deformation control) consists of 28 stations located (Figure 1). Within the experiments conducted to study the geodynamics of the Northern Victoria Land were tested different GNSS analysis techniques based on the use of carrier phases (differenced and un-differenced), particularly interesting for the remote areas of the Earth.

Concerning the applications devoted to Glaciology, the research group is involved in the study of the velocity field of the ice surface for a radius of 25 km around the site of perforation depth of the Antarctic ice sheet at Dome Concordia (European Project for Ice Core in Antarctica, EPICA) through the establishment of a control network properly designed and established in situ. The whole EPICA project involved researchers of ten European nations, and it allowed to realize a deep coring in ice of about 3270 m. The extracted cores highlighted the paleo-climatic history of the last eight climatic cycles of the planet occurred in lasts 820 000 years.

The scientific excellence of the whole project EPICA was rewarded by the committee of the European Science Foundation in 2007 with the prestigious Cartesio - Descartes Prize for Transnational Collaborative Research.

The group of research took part, starting from 1988, to several international projects, such as the study of the ice surface dynamics at Talos Dome, (place of a further deep ice-coring project named TALDICE) and to the International Trans-Antarctic Scientific Expedition (ITASE).

In 2016 UNIBO became partner of the Beyond EPICA – Oldest Ice (BE-OI) consortium. It is an EU H2020 CSA that delivers the technical, scientific and financial basis for a comprehensive plan to retrieve an ice core up to 1.5 million years old in a future project during the Beyond EPICA – Drilling Phase. This knowledge will improve future prognoses of climate development with soli d

quantitative data and will allow establishing more targeted strategies, to cope with the societal challenges of global change.

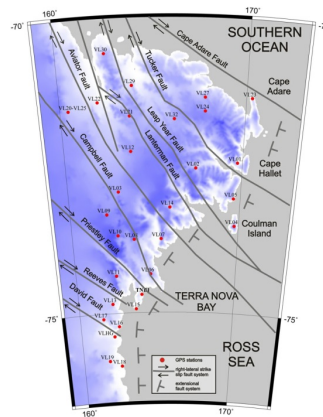


Fig. 1 – Position of the control points of the network VLNDEF, superimposed to the tectonic scheme investigated for the entire region (Zanutta et. al, 2008)

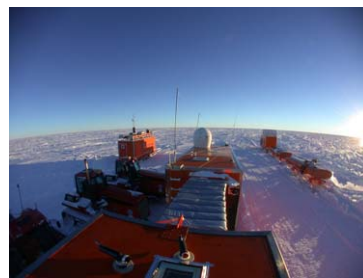


Fig. 2. –Tracked vehicles of ITASE project on the Antarctic plateau during the overnight stop, (picture by Vittuari).



Fig. 3. – Beyond EPICA – Oldest Ice (BE-OI) H2020 Project: Geophysical site definition phase, (picture by Vittuari).

MAIN PUBLICATIONS

Bitelli G., Gusella L., Mancini F., Pino I., Vittuari L. (2008). Analysis of multispectral satellite images for ice-streams velocity evaluation. *Terra Antarctica Reports*, 14, 7-10, ISBN 978-88-88395-10-4.

A. Capra, M. Dubbini, A. Galeandro, L. Gusella, A. Zanutta, G. Casula, M. Negusini, L. Vittuari, P. Sarti, F. Mancini, S. Gandolfi, M. Montaguti, G. Bitelli, VLNDEF Project for Geodetic Infrastructure Definition of Northern Victoria Land, Antarctica, in: *Geodetic and Geophysical Observations in Antarctica, An Overview in the IPY Perspective*, BERLIN HEIDELBERG, Springer-Verlag, 2008, pp. 37 – 72.

Danesi S., Dubbini M., Morelli A., Vittuari L., Bannister S., *Joint Geophysical Observations of Ice Stream Dynamics*, in: *Geodetic and Geophysical Observations in Antarctica*, BERLIN HEIDELBERG, Springer-Verlag, 2008, pp. 281 – 298.

Frezzotti M., Urbini S., Proposito M., Sarchilli C., Gandolfi S. (2007). Spatial and temporal variability of surface mass balance near Talos Dome, East Antarctica. *Journal of Geophysical Research* vol. 112 ISSN: 0148-0227.

Frezzotti M., Pourchet M., Flora O., Gandolfi S., Gay M., Urbini S., Vincent C., Becagli S., Gagnani R., Proposito M., Severi M., Traversi R., Udisti R., Fily M. (2004). New estimations of precipitation and surface sublimation in East Antarctica from snow accumulation measurements. *Climate Dynamics*. vol. 23, pp. 803 - 813 ISSN: 0930-7575.

Frezzotti M., Pourchet M., Flora O., Gandolfi S., Gay M., Urbini S., Vincent C., Becagli S., Gagnani R., Proposito M., Severi M., Traversi R., Udisti R., Fily M. (2005). Spatial and temporal variability of snow accumulation in East Antarctica from traverse data. *The Journal of Glaciology*. Vol. 51(172), pp. 113 - 124 ISSN: 0022-1430.

King M.A., Z. Altamimi, J. Boehm, M. Bos, R. Dach, P. Elosegui, F. Fund, M. Hernández-Pajares, D. Lavallée, P.J. Mendes Cerveira, N. Penna, R.E.M. Riva, P. Steigenberger, T. van Dam, L. Vittuari, S. Williams, P. Willis, *Improved Constraints to Models of Glacial Isostatic Adjustment: A Review of the Contribution of Ground-based Geodetic Observations*, «SURVEYS IN GEOPHYSICS», 2010, 31, pp. 465 – 507.

K.G. Strassmeier, K. Agabi, L. Agnoletto, A. Allan, M. I. Andersen, W. Ansorge, F. Bortoletto, R. Briguglio, J.-T. Buey, S. Castellini, V. Coudé du Foresto, L. Damé, H. J. Deeg, C. Eiroa, G. Durand, D. Fappani, M. Frezzotti, T. Granzer, A. Gröschke, H. J. Kärcher, R. Lenzen, A. Mancini, C. Montanari, A. Mora, A. Pierre, O. Pirnay, F. Roncella, F.-X. Schmider, I. Steele, J.W. V. Storey, N. F. H. Tothill, T. Travouillon, L. Vittuari, and M. Weber, *Telescope and instrument robotization at Dome C, «ASTRONOMISCHE NACHRICHTEN»*, 2007, AN 328, No. 6, pp. 451 – 474.

Urbini S., Frezzotti M., Gandolfi S., Vincent C., Sarchilli C., Vittuari L., Fily M. (2008). Historical behaviour of Dome C and Talos Dome (East Antarctica) as investigated by snow accumulation and ice velocity measurements. *Global and Planetary Change*. vol. 60 (2008), pp. 576 - 588 ISSN: 0921-8181. doi:10.1016/j.gloplacha.2007.08.002.

Vittuari L., Vincent C., Frezzotti M., Mancini F., Gandolfi S., Bitelli G. & Capra A. (2004) – Space Geodesy as a tool for measuring ice surface velocity in the Dome C region and along the ITASE traverse. *Ann. of Glaciol.*, 39, 402-408.

Zanutta A., Vittuari L., Gandolfi S., *Geodetic GPS-based analysis of recent crustal motions in Victoria Land (Antarctica)*, «GLOBAL AND PLANETARY CHANGE», 2008, 62, pp. 115 – 131.

RESEARCH PROJECTS

PNRA - Project: Paleoclimatic Records from Icecore Data Elaboration (PRIDE). RU of Geodesy (PI L. Vittuari).

PNRA 2013/AC2.01: Integrated Geodetical and Geophysical analysis for site modeling and deep ice core interpretation (IGG@Dome). PI of the entire Project: L. Vittuari.

H2020-EU: Beyond EPICA – Oldest Ice (BE-OI) SC5-05-2016 - A 1.5 million year look into the past for improving climate predictions. CSA - Coordination and support action. From 2016-10-01 to 2019-09-30

LINKS AND CONTACTS

luca.vittuari@unibo.it
antonio.zanutta@unibo.it
stefano.gandolfi@unibo.it