



Project of Strategic Interest NEXTDATA

Scientific Report for the reference period **01/01/2012-31/12/2012**

Unit UNIMIB

WP 1.4 - Environment and climate data from ice cores

1. Scheduled activities, expected results and Milestones (as indicated in the Executive Plan)

Glaciers that flow from their catchment areas with negative mean annual temperatures can become formidable archives of climatic and environmental information. Over the past 150 years there has been observed an inexorable retreat of these glaciers with losses from 30% to 70% of the total volume. The anthropogenic influence amplifies this effect and leads to the need to protect such information, which, year after year, are destroyed. Given the impossibility of protecting the entire glacier, it is important to recover and store ice cores from the most important extra-polar glaciers on the Planet. The work will be initiated by the glaciers with easier logistics or where there are already activities related to this project (eg Alps, Himalaya and Karakorum), or radar measurement of the catchment area in order to define thickness, internal layering and feasibility of drilling. If, in the collection of data information are already present all the necessary information, drilling operations will be done in the first year, both as a test or to the bedrock.

Milestones

M1 (PM6): Drawing of the procedure of field activity.

M2 (PM12): List of glaciers drillable and planning of activities in the field.

2. Deliverables expected for the reference period

D1.4.1: Report of the field activities and drilling sites selection.

3. Activities which have been actually conducted during the reference period

3.1 Research activities

Compared to the Deliverable planned for the first year, which provided the only definition of field activities and the selection of the sampling sites, was made a drilling activities on the Colle del Lys (Valle d'Aosta) with ice core storage, and testing in the

field of logistics, ice core technical and management activities of mid-latitude glacier, to be well define the remote areas perspective and logistical difficulties.

In particular, the drilling at the Colle del Lys has allowed to making a 32 m borehole with ice cores of 8 mm in diameter, the sampling of the chips for low contamination analysis and establishes procedures for drilling in mountainous areas. The field activities have also permit to evaluate the used equipment and the critical points of the drilling system. The ice core drilled was logged for visual stratigraphy, where some ice lenses more than 10 cm thick was observed, and measured for the density profile. The density permit to identify the first 11 m depth with packing processes that provide a very scattered data, and the following 21 m with more linear and increasing density related to the sintering processes until 0.76 g/cm^3 . To evaluate the close-off depth a linear correlation was done until 0.85 g/cm^3 , estimate to be at 44-46 m depth. By the density profile, a water equivalent depth were calculate, and by annual accumulation rates obtained in previous ice cores, from 130 to 150 cm w.e., a depth-age relationship was calculate. For the first 32 m doeth the estimate age at the bottom is between 1994 to 2000, for the entire glacier, estimate to be around 120 m, the bottom age will be between end of '10 and beginning of '30 of XX Century. In collaboration with the WP 2.3, three glaciers for possible ice coring were identified. The Colle Gnifetti at 4550 m asl (Valle d'Aosta, Italy) in the European Alps, the Accumulation basin of the Baltoro Glacier (6700 m asl), close to the Gasherbroun I Mount in the Pakistan Karakorum, and the ChoYou Glacier, at 7000 m asl, in the Nepal Himalaya. Because the different logistic and working difficulties, the timing on single ice cores will be evaluate.

3.2 Applications; technological and computational aspects

In the first year it was possible to make a first test of remote camp layout on the glacier at Colle del Lys, helping for the future drilling activities in the Himalayas and Karakorum. Furthermore, it was verified the possibility to use solar panels for electricity production at high altitude. This part of project permits to improve energy production and storage, through new high performance batteries.

3.3 Formation

During the activities at the Colle del Lys were hosted two technicians from Nepal and Pakistan in order to train them on the technical and logistical aspects of drilling in ice. This has allowed us to build an initial working group for future activities in the Himalayas and Karakorum.

Three PhD grants was activate on the DISAT-UNIMIB, for the activities inside the WP 1.4 and WP 2.3.

3.4 Dissemination

The drilling at the Colle del Lys has been the subject of great media attention that reported a significant emphasis on NextData project activities.

3.5 Participation in conferences, workshops, meetings

None in the year.

4. Results obtained during the reference period

4.1 Specific results (Data libraries, Measurements, Numerical simulations, etc)

Defining the layout of a field activities of ice core drilling in remote areas. Evaluation of the problems of drilling in areas of high mountain and testing of the electrical power system for drilling probes.

Reconstruction of the visual stratigraphy, density profile, and preliminary depth-age relationship until 32 and 120 m depth.

Definition of three new ice core sites in European Alps, Karakorum and Himalaya.

4.2 Publications

None.

4.3 Availability of data and model outputs (format, type of library, etc)

None.

4.3 Completed deliverables

D1.4.1: Report on the field activities and drilling sites selection. Completed.

5. Comment on differences between expected activities/results/deliverables and those which have been actually performed.

Compared to the Deliverable scheduled for the first year, which provided the only definition of field activities, was made a mission of drilling on the Colle del Lys with storage of ice cores and testing in the field of logistics, technical and management of ice core on glacier, visual stratigraphy, density and depth-age relationship, and definition of 3 new possible drilling sites.

6. Expected activities for the following reference period

Atmospheric dust measurements of 2012 ice core at Colle del Lys; New ice core drilling at Colle Gnifetti and programming the next Himalaya-Karakorum ice core activities. Visual stratigraphy, density profile and preliminary depth-age relationship of the Colle Gnifetti 2013 ice core. Development of solar power system to improve the ice core system, and reduce the impact to the high mountain glaciers. Development for non-destructive measurements directly on ice core, mainly on the electrical properties and infrared measurements.

WP 2.3 - Archive of data from non-polar ice cores and long-term biological data

1. Scheduled activities, expected results and Milestones (as indicated in the Executive Plan)

This WP will deal with the construction and usability of archives containing ice-core and biological data. With regard to the data from ice cores, a first will be to establish a WebGIS dedicated to the non-polar glacial archive. For this purpose, archives and scientific literature

will be thoroughly reviewed to identify all non-polar sites where cores have been retrieved. Subsequently, they will be used to extract all the necessary metadata for the characterization of the sites, particularly those linked to the analyses and processing undertaken. A Geodatabase will be developed, mapping the glacial mountain areas of the main alpine chains (Himalayas, Andes, Alps, etc.), based primarily on satellite and aerial images at various definitions. All the data obtained will be channelled into an upgradeable WebGIS, which will interact closely with the SHARE GeoNetwork portal, as support to the basic non-polar core archive.

2. Deliverables expected for the reference period

D2.3.1: Preparation of the database of glacier suitable of ice core drilling

3. Activities, which have been actually conducted during the reference period

3.1 Research activities

During the first year a thoroughly research work has been carried out about existent archives and scientific literature of ice cores drilled in non-polar glaciers. All the available repository has been evaluated and at the end, data coming from the World Glacier Monitoring Service (WGMS) has been initially downloaded and successively analysed in order to evaluate the principal characteristics and topic information. The WGMS data have been subdivided according to the glacier geographic position and typology of ice core analysis. In the same time Disat ice core archive and other literature data have been collected and will be stored into the same database as the others during the second year. In the second part of the first year, the ice core data base conceptual model has been designed according to the requirements of the other WPs. In fact, three Working Packages have to create a database where data coming from drill core has to be stored and, for this reason, a lot of meeting have been organized to discuss together about the best solution. In this way it will be make easier and coherent the internet access by end users of the core data. In the same time, the world glaciers spatial data have been initially collected using GLIMS (Global Land Ice Measurements from Space) free Database and successively stored into a Geodatabase that will published through an internet wemapping site using the Open Geospatial Consortium (OGC) services. As well, the free availability of ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer), LANDSAT TM e Landsat Enhanced Thematic Mapper Plus satellite images for the Himalayan and the Alps have been evaluated in order to understand the world glacier cover.

3.2 Applications; technological and computational aspects

The research activities will lead to the creation of a database that will be made available to users via the Internet portal.

3.3 Formation

Three PhD contract has been activated; Starting date 1 January 2013.

3.4 Dissemination

At this moment, it has not yet carried out dissemination activities.

3.5 Participation in conferences, workshops, meetings

Staff member of W.P 2.3 has attended three meetings regarding the design of the drill core database.

4. Results obtained during the reference period

4.1 Specific results (Data libraries, Measurements, Numerical simulations, etc)

It has been developed the conceptual model of the database, which will subsequently be placed on line and configuration of the Database.

4.2 Publications

None.

4.3 Availability of data and model outputs (format, type of library, etc)

Preliminary database (Microsoft © Excel format) of the drill ice core derived from World Glacier Monitoring Service.

4.4 Completed deliverables

Preparation of the database of glacier suitable of ice core drilling.

5. Comment on differences between expected activities/results/deliverables and those which have been actually performed.

The main deliverables of the first year scheduled the transmission of information to the Portal General. Due to the delay in the agreement signing between CNR and UNIMIB (September 2012) some activities have been shifted, especially those related to database data entry since the need to buy a dedicated server. So data will be transmitted to the general portal within the first six months of the second year. Therefore, the activities relating to the census of biological data (plant seed bank) for the project were postponed until the second year.

6. Expected activities for the following reference period

In the second year of activity the research and collection of information on drill ice core in non-polar glaciers will be carried out and, after the complete installation of WDB database on Disat server, the metadata data entry of ice core will start on the GeoNetwork portal. It will also set up the cartographic geodatabase of world glaciers, which will be correlated, using Glims data, with that already drilled. At the same time will start the collection of available satellite data (images, DTM, etc.) regarding the main glaciers of Alpine and Himalayan chain, which will increase the GeoDataBase and that will be used for the analysis led to the creation of Decision Support System for the identification of drillable glaciers. In particular, it will be collected satellite images such as ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) LANDSAT TM and Landsat Enhanced Thematic Mapper Plus used, in the recent past, for the construction of Glims database. In

addition, some data processing will be done using multi-temporal MODIS images, and in particular surface temperature and albedo of the glaciers will be assessed. For the evaluation of glaciers topography is necessary to use an accurate digital terrain models so initially available national models will be evaluated. As well the digital Terrain model derived from SRTM mission (Shuttle Radar Topography Mission) will also be archived since it is an homogenous information on a global scale with a spatial resolution of 30 m. Starting from topographic surface, derived maps as slopes, aspect, shape, relief energy and convexity / concavity will be obtained and these maps will be integrated with other parameters, derived from satellite imagery to obtain information about the drillability of the glacier .

During the second year will start the search of a site to storage ice cores and biological data and also laboratories for sampling and analysis will be identified so that it will be possible conducted a feasibility study for the creation of a Ice and paleoclimatic Museum related to mountain research.