Ministero
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NextData
un sistema nazionale per la raccolta, conservazione, accessibilità e diffusione dei dati ambientali e climatici in aree montane e marine

# Project of Interest NEXTDATA

## A national system for the retrieval, storage, access and diffusion of environmental and climate data from mountain and marine areas

**SUMMARY OF SECOND YEAR ACTIVITIES (2013)**

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A national system for the retrieval, storage, access and diffusion of environmental and climate data from mountain and marine areas


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**Partners for the whole project:**
CNR-DTA, CNR-ISAC, CNR-IAMC, URT Ev-K2-CNR, Università di Milano Bicocca, CMCC, INGV, ENEA
**Partners from the second year:**
CNR-IIA, CNR-IRPI, CNR-ISE, CNR-IDPA, CNR-IMAA, CINECA, ICTP, Università di Torino, ARPA VdA, Fondazione CIMA, Comitato Glaciologico Italiano, Parco Nazionale Gran Paradiso

Report on the project activity during the second year
**01-01-2013 / 31-12-2013**

**SUMMARY OF SECOND YEAR ACTIVITIES**


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ISAC

iAMC
Istituto per l'Ambiente Marino Costiero
Consiglio Nazionale delle Ricerche

Unità di Ricerca
EvK2CNR

DISAT

cmcc

ENEA

INGV

CNR-IIA

IRPI

CNR - Istituto per lo Studio degli Ecosistemi
I.S.E.
Verbania Pallanza

IDPA

imaa
istituto di
metodologie per
l'analisi ambientale

CINECA

ICTP
The Abdus Salam
International Centre
for Theoretical Physics

SIGILLVM VNIVERSITATIS TAVRINORVM

ARPA
Valle d'Aosta

RESEARCH FOUNDATION
cima
OBSERVE TO PREDICT,
PREDICT TO PREVENT.

VENETIARVM VNIVERSITAS
IN DOMO FOSCARI

CGI
1895

PARCO NAZIONALE GRAN PARADISO

## 1. GOAL OF THE PROJECT

Mountains are sentinels of climate and environmental change and many marine regions provide information on past climate variations. The Project of Interest NextData will favour the implementation of measurement networks in remote mountain and marine areas and will develop efficient web portals to access meteoclimatic and atmospheric composition data, past climate information from ice and sediment cores, biodiversity and ecosystem data, measurements of the hydrological cycle, marine reanalyses and climate projections at global and regional scale. New data on the present and past climatic variability and future climate projections in the Alps, the Himalaya-Karakoram, the Mediterranean region and other areas of interest will be obtained and made available. The pilot studies conducted during the project will allow for obtaining new estimates on the availability of water resources and on the effects of atmospheric aerosols on high-altitude environments, as well as new assessments of the impact of climate change on ecosystems, health and societies in mountain regions. The system of archives and the scientific results produced by the NextData Project will provide a unique data base for research, for environmental management and for the estimate of climate change impacts, allowing for the development of knowledge-based environmental and climate adaptation policies. The NextData Project has defined three Grand Challenges: (1) the construction of a system of archives and portals for distributing climate and environmental data on current conditions and ongoing changes in mountain regions; (2) the reconstruction of climate and its variability in Italy in the last two Millennia, with special focus on the last 100 years; and (3) the development of an ensemble of high-resolution downscaled temperature and precipitation fields from future climate scenarios over Italy for the next few decades.

## 2. PROJECT DESCRIPTION

### 2.1 Scientific topics

The NextData Project intends to (1) favour new and ongoing experimental measurements, observational campaigns and numerical simulations on the present climate in high-altitude regions, with special focus on Italian mountains and the Himalaya-Karakoram region; (2) develop new climatic reconstructions for Italy and for the Mediterranean region; (3) produce climatic projections for the next decades in the Alps and Apennines, for the whole Italian territory and for other mountain areas of interest. This will allow for obtaining a characterization of present climate and of its changes, a reconstruction of past climate variability in Italy, and an improved estimate of the climatic changes expected in the coming decades for the national territory, with special focus on mountain regions.

**Measurement and observation activities** are devoted to the characterization of the present climate in mountain regions and include:
(1) atmospheric, air quality and aerosol measurements in mountain regions. This will be based on global and regional WMO-GAW stations, newly installed stations in the framework of national and international monitoring networks, and measurement campaigns supported by the NextData Project;
(2) characterization of the state of the cryosphere (snow and glaciers) in the Alps and of the hydrological cycle in mountain areas, through the use of existing and newly measured data;
(3) measurement and quantitative observation of the state and dynamics of mountain ecosystems and biodiversity in high-elevation regions.

**Reconstructions of past climate variability** are devoted to the estimate of climatic conditions and their variability in Italy in the last two Millennia, and include:
(1) recovery of existing data and new measurements in mountain environments, with particular focus on non-polar mountain glaciers and peat-bog samples;
(2) recovery of existing data and new measurements in marine sediments from the Italian continental platform;
(3) identification and recovery of data and information from pollen data, dendroclimatology and lake sediments for the reconstruction of recent climate and environmental variability;
(4) reconstruction/reanalysis of the climatic variability of the Mediterranean Sea in the last 60 years.
(5) High-resolution reconstruction of the recent climatology of temperature and precipitation in Italy, and of its variability in specific protected areas;
(6) Numerical simulations of climatic variability in the last 1000 years.

**Future climate scenarios** include:
(1) Global and regional climate projections for the next decades for the areas of interest.
(2) High-resolution simulations for target mountain areas.
(3) Development and implementation of climate downscaling methods to provide high-resolution downscaled climate scenarios for Italy, with specific focus on mountain areas.
(4) Development and implementation of impact models to assess the response of the mountain environment to climate change, with specific focus on the cryosphere, the hydrological cycle, and ecosystems.

A central goal of the Project is to create a **system of archives and thematic portals** which will make environmental and climate data and scientific results openly available. The core of the system will be a General Portal for accessing the data and metadata, which will become an important Italian contribution to the international programme **GEO/GEOSS.**

The **pilot studies** carried out during the project, based on the use of the data and simulations obtained during the project, will address a suite of specific scientific and applied issues on the impacts of climate change on the mountain environment. In 2013, the project activities have been complemented by a set of new Special Projects, selected from those presented at the call for projects issued at the end of 2012. In October 2013, a new call has been published, and the Special Projects that will be selected will start their activities at the beginning of 2014.

The NextData Project includes an ensemble of intense **training activities**, based on the activation of research, Post-Doc and Doctorate fellowships, teaching at Master and PhD level courses, and the organization of summer schools and residential scientific and technological training courses. In June 2013, it was organised the summer school "Climate Change and the Mountain Environment" in Valsavarenche (Aosta, Italy).

The activities of the NextData Project are linked with international programmes and initiatives, such as the activities of **GAW-WMO**, **UNEP**, **ECRA**, **SHARE**, and are an important Italian contribution to the **Global Earth Observation System of Systems of GEO**, and particularly to the activities of **GEO-GNOME**: the GEO Network for Observations and information in Mountain Environments.

### 2.2. The *Grand Challenges*

During the second year, a set of *Grand Challenges* of the NextData Project was defined. These Grand Challenges address issues of central interest for the Italian territory and have the goal of harmonizing and guiding the project activities, especially for what concerns the impact on the national territory. The Grand Challenges defined so far are:

1. **Create a system of archives and portals**, connected through a General Portal, to access measured data, simulation and reanalysis results and scientific findings in an open-access, integrated and easy-to-use way. This system of archives will allow researchers, stakeholders, policy-makers and citizens to have full access to the available information on the present and past conditions of the mountain environment and on future projections.

2. **Italy-2k**: Provide information on the climatology and climate variability in Italy in the last two thousand years, by a blend of paleoclimatic data information (ice and sediment cores, pollens, peat bog data, dendroclimatology) and numerical simulations. Station data, numerical simulations and marine reconstructions/reanalyses will allow for a more detailed representation of climate variability in the last 100 years.

3. Develop a set of **downscaled climatic projections** for the whole Italian territory, using an ensemble of methods which include global and regional climate models, high-resolution non-hydrostatic models, statistical downscaling techniques and stochastic rainfall downscaling. The validated downscaled scenarios will be made available, together with the appropriate technical documentation, on the NextData portals. The high-resolution, downscaled climatic information will become an open-access national database of forcing conditions for climate impact studies (water resources, risk assessment, ecosystems, air quality).

## 2.3 Geographical regions of interest - second year

The activities of NextData are centered on specific mountain areas and on the Mediterranean region. During the second year, the main geographical areas of interest of the project have been:

**Italian Alps and Apennines**, where measurements of atmospheric parameters, air quality and biodiversity have been carried out, mountain glacier drilling has been supported and hydrological and snow cover data have been collected and the construction of a new database of Italian glaciers has started.

**Hindu-Kush Karakorum Himalaya (HKKH)**, where field measurements of atmospheric and air quality parameters have been conducted, hydrological and cryospheric data have been collected, gridded data sets on precipitation, temperature and snow cover have been analysed, together with the results of climate simulations.

**Mediterranean region**, where marine sediment cores have been identified and analysed, and the build-up of a new recontruction/reanalysis of the recent variability of the Mediterranean Sea has started.

Further measurement and field activities have taken place in the Bolivian Andes and the Rwenzori Mt. area in Uganda.

## 2.4 Structure of the project

The NextData Project is organized in two Sub-Projects, which during the first year included 11 Work Packages (WP). At the beginning of the second year, owing to the project needs identified in the first year and the activation of the Special Projects, three new WPs have been created. The project now includes 14 Work Packages devoted to the different activities.

Sub-Project 1 aims at creating an integrated observation system and it is divided into seven different Work Packages, according to the type of data measured. They are associated with diverse requirements of research, and of climate, environmental, experimental, instrumental and technological applications:

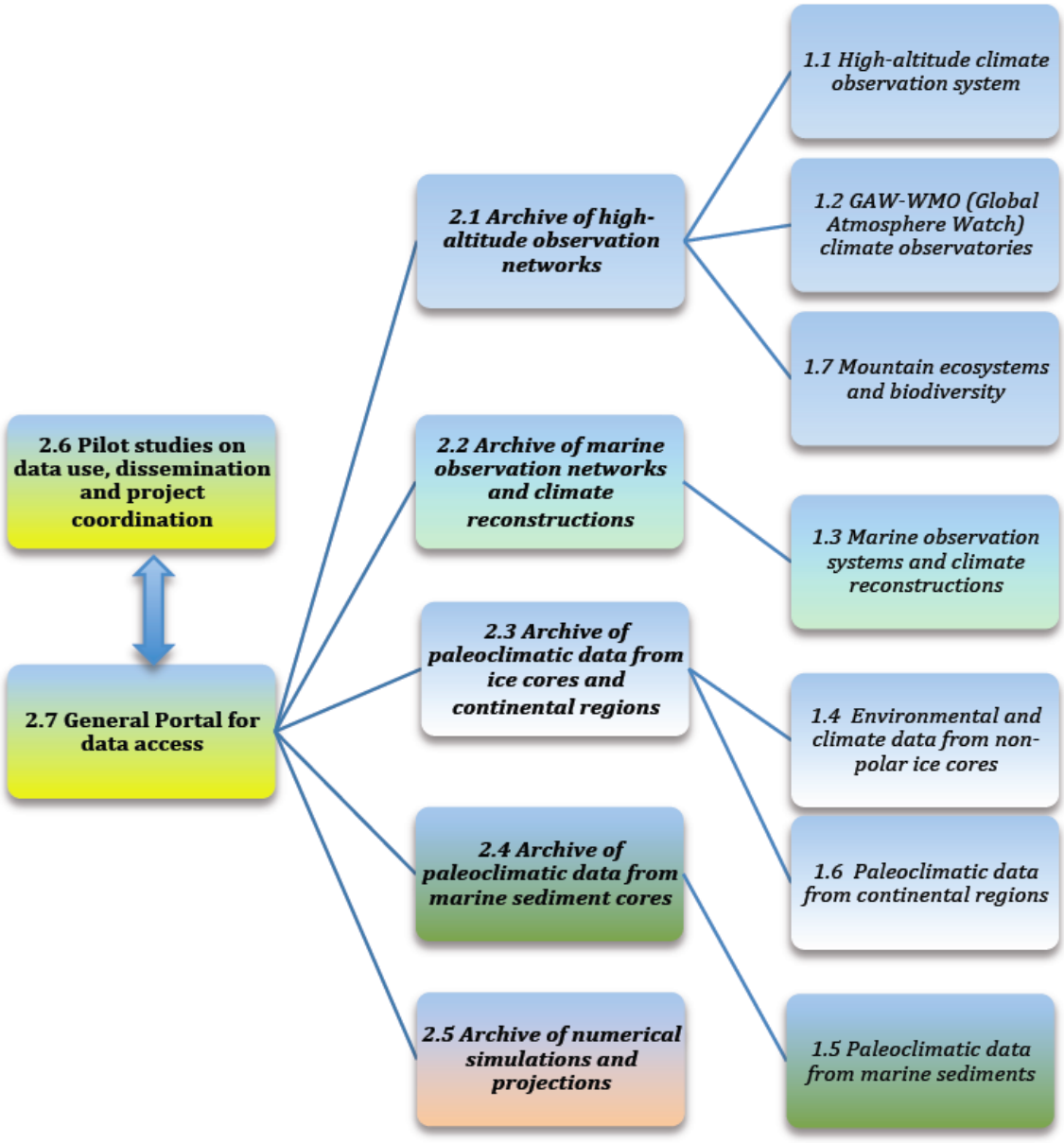
WP 1.1 High-altitude climate observation system
WP 1.2 GAW-WMO climate observatories
WP 1.3 Marine observation systems and climate reconstructions
WP 1.4 Environment and climate data from ice cores
WP 1.5 Paleoclimate data from marine sediments
WP 1.6 Paleoclimatic data from continental regions
WP 1.7 Mountain ecosystems and biodiversity

Sub-Project 2 is devoted to the creation of environmental and climatic archives, data analysis and interpretation and pilot studies:

WP 2.1 Archive of high-altitude observation networks
WP 2.2 Archive of marine observation networks and climate reconstructions
WP 2.3 Archive of data from non-polar ice cores
WP 2.4 Archive of paleoclimatic data from sediment cores

WP 2.5 Archive of numerical simulations and projections
WP 2.6 Pilot studies on data use, dissemination and project coordination
WP 2.7 General Portal for data access

The following figure shows a scheme of the structure of the NextData Project.




Structure of the NextData Project in 2013.

## 2.5 Project partners - 2013

**CNR-DTA**. State research institution. International excellence in the running of experimental and observation programmes in remote areas, the drilling of cores in marine sediments and processing of sediment cores, data analysis and paleoclimate research activities.

**CNR-ISAC**. State research institution. International excellence in the field of climate observations in remote regions, measurement of atmospheric parameters and air quality, design, management and implementation of measurement campaigns, development of innovative technologies for data measurement and transmission, data analysis, numerical simulations of the global climate and high-mountain climates, downscaling techniques and analysis of climate change impacts on the mountain environment. It is involved in the management of European projects and participates in international programmes (GAW-WMO, ABC-UNEP, SHARE, ACTRIS, GEO/GEOSS, GEWEX, EC-Earth, ECRA).

**CNR-IAMC**. The Institute for the Coastal and Marine Environment (IAMC) has five territorial branches and one research unit, with headquarters in Naples. With over 190 staff members and more than 80 postdoctoral researchers, IAMC conducts research on biological, geological, chemical and physical scientific topics and technology transfer. Supported by modern technical equipment, both in the laboratory and at sea, the Institute's mission is to conduct interdisciplinary research in coastal marine science, with a primary emphasis on Southern Italy and the Mediterranean.

**URT Ev-K2-CNR**. CNR institution of research for Third Parties. International excellence in the implementation of climate monitoring and measurement campaigns in remote high-mountain areas, the set up and management of experimental facilities in extreme environments, the running of the participation in international measurement programmes (SHARE, GAW-WMO, UNEP, bilateral programmes). It conducts activities in high-altitude areas in the Alps, Apennines, Hindu-Kush Himalaya Karakorum, Rwenzori, and the Andes.

**DISAT-UNIMIB**. State university. The group involved in the project has international excellence in paleoclimate research based on ice cores, in ice drilling and data analysis, in the development of techniques for the drilling and analysis of ice cores in extreme environments.

**ENEA UTMEA**. National Agency for new technologies, energy and sustainable economic growth: Governmental research institution. The ENEA UTMEA groups involved in the project have competences of international excellence in the measurement of atmospheric parameters in remote areas, the development and use of numerical regional-scale and climate models, Earth-atmosphere interactions in the Mediterranean area, paleoclimate studies by means of ice-core analysis, and participation in the management of international projects.

**CNR-IIA**: IIA is involved in the monitoring and modelling of atmospheric pollution on all scales. The Institute has a long history of air quality studies, instrument and technology and methodology design. The Institute is involved in polar research projects, and at the high altitude monitoring site (Ev-K2-CNR) in the Himalayas. A key thematic area is the development of methodologies and interoperable systems for data sharing, data brokering, and dissemination of environmental knowledge. The Institute contributes to GEO, the Group on Earth Observations which coordinates the building of a Global Earth Observation System of Systems(GEOSS).

**CNR-IRPI**: Research Institute for Geo-hydrological Protection. The Institute's mission is to plan, promote and conduct scientific research and technological development in the field of geo-hydrological risks. It has over 20 years of experience in studies of glacial and periglacial areas, in the Alps and in other mountains around the world, with a focus on changes over time, as terrestrial indicator of climate change, and as an essential knowledge to investigate present and future hazards in such areas, also in the framework of international projects (GLACIORISK, PERMADATAROC, GLARISKALP, GEONATHAZ).

**CNR-ISE**: CNR-ISE develops basic and applied research activities in the field of water and land ecosystems, and it is involved in understanding how ecosystems react to the impact of global climate change and anthropogenic pressure. A key thematic area is development of methodologies to study anthropogenic impacts, climate changes and their effects on water bodies. The Institute is involved in research projects at high altitude sites in several areas of the globe.

**CNR-IDPA**: The Institute for the Dynamics of Environmental Processes of CNR (CNR-IDPA) in Venice is active in the field of interdisciplinary environmental research with the main research themes including: environmental chemistry (e.g. heavy metals and persistent organic pollutants in polar and temperate ice and snow, lagoon, marine and lake waters, etc.), climate change (e.g. long-term paleoclimate and atmospheric chemistry from ice cores) and analytical chemistry (e.g. development of mass spectrometry-based advanced analytical methodology for trace and ultra-trace determinations in environmental and biological matrices).

**CNR-IMAA**: The Institute of Methodologies for Environmental Analysis (IMAA) is specialized in the development and integration of technologies for Earth observations from satellite, airborne and ground base platforms. The IMAA takes advantage of advanced research infrastructures such as the atmospheric observatory named CIAO (CNR-IMAA Atmospheric Observatory) and the system for direct receiving and on-line archiving of satellite data (eg NOAA, EOS, METOP, NPP, MSG). IMAA coordinates and participates in several FP7 projects, and in networks and programs for research and monitoring.

**CINECA**: Cineca is a non profit Consortium, made up of 56 Italian universities, and 3 Institutions. Today it is the largest Italian computing centre. It operates in the technological transfer sector through high performance scientific computing, the management and development of networks and web based services, and the development of complex information systems for treating large amounts of data. It develops advanced Information Technology applications and services, acting like a trait-d'union between the academic world, the sphere of pure research and the world of industry and Public Administration.

**ICTP**: The Abdus Salam International Center for Theoretical Physics. International institution funded by the Italian Government, UNESCO and IAEA. Competences of international excellence in high-resolution numerical simulations of regional climate in the areas involved in the project, including the Himalayan zone.

**Università di Torino**: The groups participating in the project conduct research aimed at assembling historical hydrometeorological data, land surface parameterization models, and field energy and mass flux monitoring.

**ARPA VdA**: Regional Agency for Environmental Protection of the Aosta Valley. Expertise in environmental monitoring and prevention. The ARPA VDA group involved in the project

(Climate Change Unit) has expertise in monitoring climate change effects in the alpine region, and, in particular, in monitoring and modeling snow properties.

**Fondazione CIMA**: CIMA Research Foundation is a non-for-profit organization under the Italian Legal Regulations. The Foundation supports and promotes research, technological development, and high level training in weather forecasting and observations, hydrology, climate, natural and man-made risk, ecosystem and social system modelling, environmental chemical processes, and renewable energy sources. The CIMA group involved in the project has experience in snowpack modelling, operational hydrometeorological chains, integration of satellite observations, models and ground measurements.

**Comitato Glaciologico Italiano**: the ITALIAN GLACIOLOGICAL COMMITTEE (CGI) has been working in Italy since 1895, with the task of promoting and coordinating research in the field of glaciology. First born as a commission of the Italian Alpine Club (CAI) for the study of Italian glaciers, the CGI became an independent organism in 1915, with the support of the National Research Council (CNR) and of other organizations and associations interested in the glaciological research.

**Parco Nazionale Gran Paradiso**: The Gran Paradiso National Park has its vigilance service since several decades, allowing for continuous monitoring of the protected area. PNGP conducts scientific research applied to nature conservation and cooperates with several universities and research Institutions. Current projects focus on monitoring and measurement of habitats and ecosystems, censuses of target species (Alpine ibex, chamois) and eco-ethology of species with conservation interest. In 2006, PNGP started a new long-term project on the measurement of animal biodiversity and its changes.

## 3. ACTIVITIES AND RESULTS IN THE SECOND YEAR (2013)

### 3.1 Research activities: measurements, climate reconstructions, numerical simulations

Owing to the reduction in funding with respect to what was originally planned, at the beginning of 2013 some activities have been modified and a revised Executive Plan for the second year was prepared. In 2013, all activities planned in the revised Executive Plan were carried out and most of the corresponding results, Deliverables and milestones were obtained. Activities include measurement and observation of atmospheric, cryospheric, hydrological and ecological variables, the collection of paleoclimatic proxy data from marine sediments, mountain ice cores and other terrestrial archives, the set-up of the reanalysis/reconstruction of the Mediterranean Sea dynamics, the preparatory phase for reconstructing the climatology of Italy in the last two Millennia, and the census and realization of numerical climatic simulations at global and regional scale. The reports of the different Work Packages provide detailed descriptions of the activities and the results obtained in the second year.

#### *WP 1.1: High altitude climate observation system*

The in-situ activities of mountain meteo-climatic measurements in the regions of interest (Alps, Italian Apennines, Hindu-Kush Karakoram Himalaya, Rwenzori, Andes) were continued. The Automatic Weather Station (AWS) at Mt. Stanley (Rwenzori) was re-activated. Due to the very challenging operative conditions, the possible re-activation of the South Col AWS (Himalaya) requires further in-depth analysis. New measurement programmes concerning the investigation of atmospheric composition were started in Nepal (Kathmandu) and in Pakistan (Deosai Plateau) with the aim of reinforcing the investigation of Short Lived Climate Forcers/Pollutants (SLCF/SLCP) in these climatic hot-spot regions. During the second year of activity, the Atmospheric Observatory at Chacaltaja (Bolivia), managed by the La Paz University, was upgraded to Regional Station of the GAW/WMO Programme. During the reference period, URT Ev-K2-CNR and CNR-ISAC Bologna participated to Institutional meetings in the framework of international initiatives on atmospheric composition networks in mountain regions (ABC-UNEP, GAW/WMO, GEO, CCAC).

#### *WP 1.2: GAW-WMO climate observatories*

The observation and study activities have continued at the GAW-WMO global stations Monte Cimone (GAW ID: CMN) and Nepal Climate Observatory – Pyramid (GAW ID: PYR). In this framework, activities were carried out concerning instrument calibrations and data validations for trace gases (greenhouse and reactive), atmospheric aerosol (chemistry and physics), meteorological parameters and solar radiation fluxes (short-wave and long-wave), according to the guidelines of the GAW-WMO Programme.

#### *WP 1.3: Marine observation system and climate reconstructions*

During the second year of the NextData Project, the WP1.3 activities focused on completing the feasibility study of a Mediterranean RR to cover a time period of 60 years from 1953 to 2012. This involved validating the atmospheric forcing and implementing a localization technique in the *OceanVar* data assimilation scheme, as described in D1.3.3. In the meantime, the RR system has been calibrated to assure good quality data to be delivered to the users through the NextData Infrastructure. One of the main issues in the NextData RR implementation was the choice of the atmospheric forcing dataset, which should include the entire RR time period proposed (1953-2012).

### *WP 1.4: Environment and climate data from non-polar ice cores*

The mineral dust concentration in the first 20 m of the Colle del Lys ice core, drilled in 2012, was investigated (CdL2012). On 30 September and 1-2 October 2013, a new drilling was realized in a cave of the Canin Massif, where a permanent ice deposit is located. The choice of the drilling site was defined thanks to several GPR surveys at the surface of the ice deposit. In this way it was possible to extract the longest core ever drilled from ice caves in the Italian Alps. With the aim of creating an archive of palynological data for northern Italy over the last 3,000 years, a survey to identify already existing records was carried out. The detected palynological records were critically analysed, with a specific attention for the quality of the chronology - i.e. the number of absolute datings associated with the records. A "Minimal Glacier Model" was developed and applied to the Careser Glacier (Ortles-Cevedale, Eastern Italian Alps).

### *WP 1.5: Paleoclimate data from marine sediments*

The research activities developed in WP1.5 during the second year of the project allowed to obtain important paleoclimatic information for the last 2000 years, with particular focus on the Mediterranean and the Italian coastal areas. During the second year, several analyses have been conducted on the cores C5, C5_SW104, C6 e C6_SW104, extracted from the Gulf of Gaeta (Central Tyrrhenian Sea) by CNR-IAMC using the CNR Urania vessel in February 2013. The oceanographic cruise NEXTDATA-2013, onboard the CNR Urania vessel, took place from 12 to 22 September 2013, in specific sectors of the continental platform in the Gulf of Taranto and the Sicily Channel, and allowed the recovery of new sediment cores which will be analysed in the third and fourth years.

### *WP 1.6: Paleoclimatic data from continental regions*

The Ortles firn / ice core has been processed by cutting 114 sections, each one 0.70m long, into subsamples for stable isotopes, pollen, therpens discrete analysis, as well as for the continuous flow analysis. Both the Coltrondo and Danta di Cadore peat cores have been fully processed, providing sub-samples for physical, biological and chemical measurements. A detailed check of the available literature from several national and international databases was performed, dealing with lakes located in the whole Italian territory.

### *WP 1.7: Mountain ecosystems and biodiversity*

Monitoring of animal biodiversity in mountain regions was continued in the three protected areas which participate in the study, namely the Gran Paradiso National Park (PNGP), Alpe Veglia e Devero Park (PNVD) and the Alpi Cozie Park, in the area of Orsiera-Rocciavrè (PNOR). The involvement of 3 new protected areas (Stelvio National Park, Val Grande National Park, Dolomiti Bellunesi National Park) was started, sharing working protocols and the overall goals of the monitoring program. The simulation of temperature increase scenarios was completed, using the data collected from the monitoring activities of 2007-2008. Such data have been analysed to assess the risk of modifications in alpine animal biodiversity in response to temperature rise, by modelling the effect of climate warming on species richness and community composition using a multi-taxa approach. For what concerns the effects of climate change on alpine plants, it was studied the effect of temperature and water availability on plant reproductive performance, seed germination, seed longevity and viability, seedling recruitment and survival.

### *WP 2.1: Archive of high-altitude observation networks*

During the second year of the project, the activities of WP 2.1 continued the build-up of the project archives for in-situ and ground data. In particular, it was started the creation of two new climate archives dedicated to the data from:

- Ice cores from mountain glaciers (WP 2.3).
- Marine sediment cores from the Mediterranean area (WP 2.4).

Since the Share GeoNetwork system is already used for the data of the high-altitude stations, it was decided to use the same approach and database with a targeted customization to collect different data. Therefore, the realization of the new archives started from a customized change in the open-source WDB database (*Weather and Water Database*).

### *WP 2.2: Archive of marine observation networks and climate reconstructions*

The activities performed during the second year were mostly dedicated to the implementation and design of the NextData-INGV Geoportal. The NextData-INGV Geoportal will be a web application to discover and visualize the Reconstruction-Reanalyses (RR) data for the Mediterranean Sea for the past sixty years from 1953 up to 2012. During the second year of the project, INGV completed the Reanalyses of the Mediterranean Sea starting from 1987 up to 2012, partially supported by the NextData Project, and started to produce the RR since 1953. Both datasets were delivered in NetCDF format, adopting international standards concerning in particular standard_name and CF conventions and following the data distribution policy of the project for gridded datasets. Both datasets have been made available through an INGV dedicated server using the THREDDS protocol.

### *WP 2.3: Archive of data from non-polar ice cores*

The research activities of WP 2.3 have followed two lines; the first one is the construction of the Ice core Database (IDB) to archive data and metadata on mountain ice cores, the second is the definition of a methodology to evaluate glacier suitability to ice core drilling. The database structure was defined during the first year in agreement with other WPs, so that in the second year of activities the realization of IDB and its publication on the UNIMIB research unit Portal has been carried out. The second research activity focused on the implementation of a methodology to estimate glacier suitability to ice core drilling, along with a literature review of the principal factors that determine the glacier suitability to drilling.

### *WP 2.4: Archive of paleoclimate data from sediment cores*

During the second year, the analysis of international databases and of the national and international scientific literature was completed. This provided the basic information which will be used for the paleoclimatic studies based on the analysis of sedimentary cores in the Mediterranean basin. The cores were identified according to the criteria defined during the first year of the project.

### *WP 2.5: Archive of numerical simulations and projections*

In the course of the second year, all partners have contributed to the successful completion of the activities planned within WP 2.5. In particular, the partners have implemented and made available the climate data server, with homogeneous and coherent archiving and access protocols, whose characteristics were defined during the first year of the project. This has made possible the setting of a network of THREDDS servers, which represents the backbone of the model climate data archive of the NextData Project and that will be accessible from the General Portal. At the end of the second year of the project, the archiving of the global climate simulations was completed and several climatic downscaling procedures were implemented.

***WP 2.6: Pilot studies on data use, dissemination and project coordination***

The research activities related to the pilot studies (a), (b), (c) and (d) started at the beginning of the first year, and those of the pilot study (e) on the multi-secular climatic simulation for the Mediterranean area started at the end of the first year. All these research studies continued in the second year. The selection of the Special Projects presented at the NextData calls at the end of 2012 finished in early 2013, and the accepted projects started their activity in 2013. The research activities of the pilot studies (f), (g), and (h), related to the newly activated Special Projects, started in the second year. The WP2.6 continues to update the project web site and the availability of data and numerical results from thematic archives. In 2013, several internal workshops and project meetings on specific themes were organized, and a general project meeting was held in November 2013. In October 2013, new calls for other Special Projects were issued. The accepted proposals start their activities in early 2014.

***WP 2.7: General Portal for data access***

The design of the General Portal was completed. It was started the identification of the user requirements in the functional and non-technical areas based on their needs, captured in the form of detailed use and service cases, identifying the adequate tools for data management, processing and visualization. The system and user requirements specification for the NextData e-infrastructure, including the requirements for interoperability with GEO and INSPIRE initiatives, was defined. The NextData e-infrastructure architecture for data sharing was designed. The Brokering framework developed by CNR-IIA on the top of the CINECA computational platform was installed. The first prototype of the General Portal, including basic functionalities, was developed.

## 3.2 Project web site

The project web site, designed and implemented during the first year, was continuously updated during the second year, providing information on the project activities. The web site is accessible at the links *http://www.nextdataproject.it* and *http://www.nextdataproject.eu*.

The web site contains (in Italian and English):

a) general description of the project and its structure;
b) list of participating institutions;
c) list of Scientific Advisors;
d) description of the activities of the different WPs;
e) description of the data collected by the project archives;
f) results of the pilot studies;
g) scientific reports of the different WPs;
h) project Deliverables;
i) project news;
l) slides and dissemination, schools and conferences;
m) calls for research proposals.

The web site includes a link to the different data archives and thematic portals of the project. During the third year, the web site will be linked to the General Portal of the project.

### 3.3 Activities of the Special Projects - Call of November 2012

Following the selection of the proposals submitted to the Call for Proposals of November 2012, the Special Projects listed below started their activities in the first months of 2013. As described in the Executive Plan, the selection of the proposals was based on the reviews of the Scientific Advisors and of the Executive Commitee of the NextData Project.

P1. NextData System of Systems Infrastructure (ND-SoS-Ina). PI: Stefano Nativi, CNR-IIA.

P2. NextSnow. PI: Vincenzo Levizzani, CNR-ISAC.

P3. Database for reconstructing the spatial-temporal evolution of the Glacial Resource in the Italian ALPs over the last 100 years in the Framework of the NextData Project (DATAGRALP). PI: Marta Chiarle, CNR-IRPI.

P4. Development of ensembles of regional climate change scenarios, with focus on variability, extremes and uncertainties in areas of complex topography, RECCO (REgional Climate in Complex Orography). PI: Silvia Trini Castelli, CNR-ISAC.

P5. The use of sedimentary proxies in high altitude lakes for inferring the environmental changes during the late Holocene. PI: Andrea Lami, CNR-ISE.

P6. Multy-proxy reconstruction of Eastern Alpine Holocene climate. PI: Carlo Barbante, CNR-IDPA.

P7. High Resolution Climate Information for Mountain Areas (HR-CIMA). PI: Michele Brunetti, CNR-ISAC.

### 3.4 Project meetings

A general meeting of the participants in the NextData Project was organized on 12/11/2013. The advancement of the project activities and critical issues were discussed in the meeting.

Many technical meetings were organized, to discuss internal issues of the various WPs, to coordinate the activities of the different WPs which deal with similar topics and to enhance interaction with the participants in the Special Projects. Meetings with scientists not directly involved with NextData were also organized.

### 3.5 Training activities

In 2013, new Doctorate fellowships were activated, and boursaries and Post-Doc fellowships were activated or continued as described in the individual reports of the different WPs. Doctorate Theses on topics related to the NextData Project are ongoing.

It was organised the Summer School "Climate change and the mountain environment", held in Valsavarenche (Aosta Valley) in the period 18-28/6/2013, with the participation of several lecturers of high international scientific level, many of which are involved with the activities of NextData, and participants at doctoral and post-doctoral level.

### 3.6 Dissemination

The Project of Interest NextData was presented at various scientific meetings and to the general public, in particular:

Lectures on climate dynamics, University of Budapest, January 2013.
Meeting of the GEO Ecosystems Task at ISRE35, Beijing, 21 April 2013.
Annual assembly of LTER-Italy, Bologna, 8 May 2013.
CNR Open Access meeting, Rome, 9 May 2013.
Presentation at the annual meeting of the Italian Glaciological Committee, Gressoney (AO), 5 July 2013.
Presentation at WCRP, WMO, Geneva, 10 July 2013.
International Conference High Summit, Lecco, October 2013.
Presentation at COP 19, Warsaw, November 2013.
IGFA-Belmont Forum, Cape Town, December 2013 (The Scoping Workshop of the Belmont CRA "Mountains as sentinels of change" is being organized for June 2014, supported by the NextData Project).

A short documentary movie by M. ANDREINI and P. FIORATTI has been produced, which describes some of the essential aspects of high mountain ecosystems and focuses on the specific adaptations to the high altitudes. The movie, in Italian and English, is available for download at the NextData Web Site.

The volume "What is Global Warming?" by A. PROVENZALE, E. MANGHI, A. LOSACCO and G. D'ANNA, printed in Italy by Editoriale Scienza, has been translated into English and printed in Nepal for free distribution in some of the mountain schools in Nepal e Pakistan, to celebrate the "World Environment Day 2013".

## 4. INTERNATIONAL COLLABORATIONS DURING THE SECOND YEAR

The atmospheric and air quality measurement activities have been carried out in the framework of international programmes such as **WMO-GAW** e **ABC-UNEP**, as described in the individual WPs.

Climate simulation activities have been carried out in the framework of the **CMIP5** program and of the European Consortium **EC-Earth**. Some of the climate simulations have been carried out in collaboration with the LRZ Supercomputing Center in Munich (Germany). Some of the regional climate simulations are part of the international programme **CORDEX**.

The activities on the different aspects of the hydrological cycle are closely linked with the Collaborative Project "Changes in the hydrological cycle" of the European Climate Research Alliance (**ECRA**).

The activities of climatic reconstruction in Italy for the last two Millennia (Italy-2k) are conducted in sinergy with the international initiative **PAGES-2k**.

The NextData Project has been actively involved in the proposal for a new Collaborative Research Action (CRA) of the **Belmont Forum** on the theme "Mountains as sentinels of change", which will be discussed and possibly approved in 2014.

The NextData General Portal will be an important Italian contribution to the "Global Earth Observation System of Systems" (**GEOSS**) which is being built by the "Group on Earth Observations" (**GEO**). In particular, there will be a strong interaction between NextData and the **Ecosystems Task** of GEO, contributing to the new global initiative **GEO-GNOME**: the GEO Global Network for Observations and information in Mountain Environments.

## 5. SCIENTIFIC ADVISORS OF THE NEXTDATA PROJECT

The list of Scientific Advisors of the NextData Project was defined in the first year and it can be found on the project web site.

## 6. SECOND CALL FOR PROPOSALS

With the aim of further stimulating the participation of the Italian scientific community to the activities of the NextData Project, on 17/10/2013 a new Call for Proposals was published on the web sites of CNR, of CNR-DTA and of the NextData Project. The call invited proposals for Special Projects with a duration of two years. The call was intended for research consortia led by a CNR Institute.

The call topics were:

(1) Harmonization and recovery of existing data and conduction of new measurements on the state and ongoing changes of Italian mountain ecosystems; development of a system of archives and access services to the data and research results on mountain ecosystems on the national territory, with special focus on the sites of Long-Term Ecological Research (LTER-Italy); inclusion of the data in archives which should be coherent with the archival system of the NextData Project.

(2) Harmonization of existing data and conduction of new measurements on $CO_2$ and water vapour fluxes in mountain ecosystems in pilot sites, to estimate gas exchanges and atmosphere-vegetation dynamics in mountain environments, and inclusion of the data in archives which should be coherent with the archival system of the NextData Project.

(3) Harmonization of existing data on animal biodiversity and trophic webs in mountain ecosystems, and inclusion of the data in archives which should be coherent with the archival system of the NextData Project.

(4) Harmonization of existing data and possible conduction of new measurements on hydro-meteorological parameters and runoff in mountain catchments in the Apennines, focusing on pilot sites, and inclusion of the data in archives which should be coherent with the archival system of the NextData Project.

(5) Reconstruction of historical time series on ground deformation for pilot sites in mountain regions and links with precipitation data, and inclusion of the data in archives which should be coherent with the archival system of the NextData Project.