Dipartimento Scienze
del Sistema Terra
e Tecnologie per l'Ambiente

GRUPPO DI LAVORO
PALEOCLIMA

Paleoclimate activities at CNR-DSSTTA
(Annual report - 2020)

INTRODUCTION AND MOTIVATION

In the last century, our society has entered an epoch of global changes, during which humanity has fully acquired the ability to significantly modify the planetary environment. This new period has been named *Anthropocene*, to underline the relevance of humans as a factor of global planetary change. Human population has grown exponentially, the length of life has increased more rapidly than since the dawn of humanity, extreme poverty is still way too widespread but it has been reduced as never before. At the same time, we have forced huge biodiversity losses, polluted air, waters and soils, disrupted the nitrogen cycle, and induced global climatic changes by the emission of greenhouse gases such as carbon dioxide and methane. Climate change can combine with the other hazards, favoring the interplay of multiple risks with potentially dramatic consequences.

Under such circumstances, the only way to address the new challenges generated by climate change is to increase our quantitative knowledge of the Earth System, disentangling to multiple interacting processes governing its dynamics on all space and time scales, by means of measurements, monitoring and modelling, and develop the abilities to estimate future conditions to provide guidance for implementing mitigation and adaptation measures.

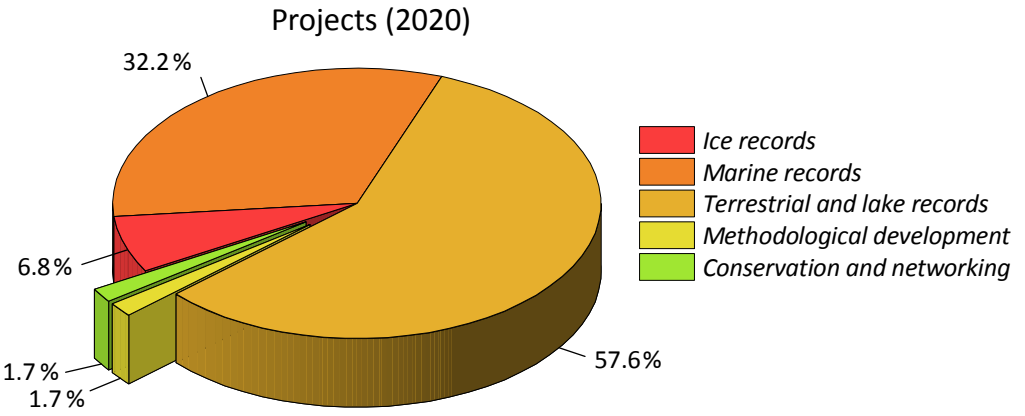
To provide meaningful estimates of future conditions, we need global and regional models, such as those developed by many climate centers in the world (including CNR) and collected for example in the CMIP and CORDEX international programs. However, the climate system is terribly complex, and a full understanding of its workings is still unreached. In particular, models have still troubles in properly dealing with climates that are significantly different from the current one, and in determining the conditions under which the Earth System can reach – and pass through – a tipping point such as collapses in the ocean circulation, generalized permafrost thaw and massive methane emission, or the collapse of the marine biological pump owing to ocean acidification.

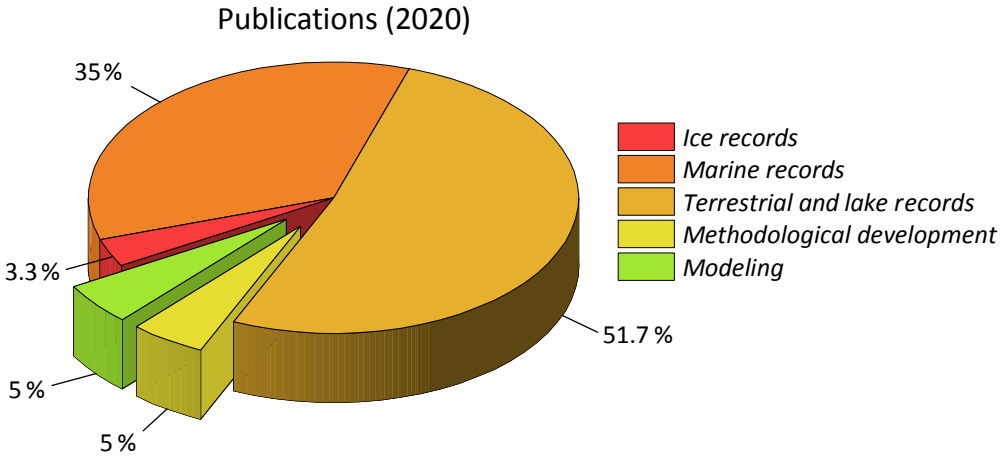
Here, the knowledge of past climates can come to help, providing quantitatively measured and measurable "analogues" for what can come in the future. Intense climate changes such as those occurred at the Paleocene-Eocene Thermal Maximum (PETM), or the Eocene-Oligocene cooling, or the many rapid deglaciation warming transitions at the end of the series of glacial maxima in the last million years, with their accompanying short-term fluctuations, provide a glimpse of the possible futures and of the tipping points of the planetary climate system, and can help improving climate models providing a knowledge window on the fully nonlinear processes characterizing the Earth System.

The paleoclimatic research community of DSSTTA CNR, here represented by the Paleoclimate Working Group, is active on many of these themes, and in particular, it focuses on three main issues: (a) the dynamics of climate during the Holocene and the glacial-interglacial cycles across the two main climate system reorganizations of the Quaternary (i.e., the Mid-Brunhes Event and the Middle

Pleistocene Transition), with a specific attention on the Mediterranean, Antarctic and Arctic regions; (b) the dynamics of rapid climate transitions (e.g., glacial terminations and sub-millennial scale variability) and extreme (warm) climate from the Permian to today; and (c) the investigation and calibration of chemical and biological proxies to reconstruct terrestrial and marine climate conditions in the past.

The report and pie charts that follow briefly summarize the research activities done in 2020.





1. ONGOING PROJECTS (2020)

1.1. Paleoclimatic-environmental archives

1.1.1. Ice records

Project	Brief description	Time scale	CNR-Institute	Partner
Beyond EPICA Oldest Ice Core: 1,5 Myr of greenhouse gas – climate feedbacks - 'Beyond EPICA' (H2020 #815384)	The overarching scientific objective driving Beyond EPICA is to obtain quantitative, high-resolution ice- core information on climate and environmental changes over the last 1.5 Myr, crossing the enigmatic reorganization of the climatic system of the Middle Pleistocene Transition.	Last 1.5 Myr	**ISP**	AWI UKRI-BAS IPEV, ENEA CNRS, UU NPI, SU UBERN UCPH ULB
The Italian contribution to the project "Beyond EPICA - Oldest Ice" (PNRA16_00124)	This proposal is the Italian national contribution to the H2020 Coordination and Support Action (CSA) "Beyond EPICA - Oldest Ice". The national consortium consists of five leading Italian institutes in the reconstruction of the past climate through ice cores. The challenge will be to prepare the ground for obtaining a 1.5 million-year-old ice core from East Antarctica.	Last 1.5 Myr	**ISP**	University of Firenze, Bicocca, Bologna, ENEA
Study of the Solar Forcing over the Holocene from a new Dome C Ice Core (SOLARICE) – (PNRA16_00008 - A2)	SOLARICE is a multi-year Franco-Italian scientific initiative aimed at retrieving and studying a late Holocene ice climate record from Concordia Station (East Antarctic Plateau). The objective of this project is to propose a new reconstruction of solar activity based on a high resolution ^{10}Be record. We will implement a multiproxy approach and quantify markers that characterize the evolution of the past local temperature, humidity sources, volcanic forcing, biomass burning and dust sources. The SOLARICE initiative provides an important contribution to the IPICS priorities (past 2k) and Antarctic 2k (within PAGES 2K).	Last 2 kyr	**ISP**	CEREGE, LGGE, LSCE University of Milan, Venice, Rome, Parma
C3 – Caves Cryosphere and Climate www.c3project.net	The project aim to the monitoring, studying, dating and modelling of caves interested by permanent ice deposits in the Eastern Alps, focusing especially on the area of Mount Canin massif, one of the most karstified areas of the entire alpine chain. One of the main target is also related to the paleoclimate potential given by such ice deposits, natural archives of the climate evolution during the late Holocene.	Holocene	**ISP** **ISMAR**	See website

1.1.2. Marine records

Project	Brief description	Time scale	CNR-Institute	Partner
INGV-AMUSED "An integrated, multidisciplinary study of past global climate changes from continental and marine archives in the Mediterranean region	The project aims to reconstruct the climatic variability in the central Mediterranean region during the mid-late Quaternary, with a focus on the Holocene, integrating paleoclimatic multi-proxy records acquired from different marine and terrestrial paleoenvironmental archives. For the marine record, marine sediment cores from the Southern Tyrrhenian Sea covering the last 2 ka will be studied.	Mid-Late Quaternary	**ISMAR IGAG IRPI ISP**	INGV University of Perugia, Padova, Ca' Foscari, Palermo
Response of carbonate ecosystems to the climatic and oceanographic changes of the Cretaceous period	Stratigraphic and isotopic study of southern-central Italy marine carbonates.	Cretaceous	**IGG**	University of Napoli, Bari
Biostratigraphy of the Late Jurassic-Early Cretaceous sequences	Radiolarian Biostratigraphy of the Late Jurassic-Early Cretaceous sequences in the Umbria Marche Basin: Bosso and Gorgo a Cerbara Sections.	Jurassic-Early Cretaceous	**IGG**	
PNRA_18_00233 - D - Antarctic Ice Sheets' dynamics: new data from provenance and paleontological analysis of IODP374 and DSDP Leg28 cores in the Ross Sea.	The project aims to constrain ice flow modelling on the basis of several provenance tools including clastology, AFT, U-Pb dating of detrital apatite and zircons applied to DsDP Leg 28, 270, 271, 271 cores. Data will be compared with results obtained with paleontological and clast analysis on IODP374 recovers.	Late Oligocene to Recent	**IGG**	University of Siena
Climate and tectonic forcings on sediment dispersal in the West Antarctic Rift System of South Victoria Land (DTA.AD001.105 (PNRA2015)	Multi-proxy study of sediment cores from the Antarctic continental margin in order to investigate the main Cenozoic climate optima	Cenozoic	**IGAG ISP**	University of Siena, FSU USA), OSU(USA)
UnderstandinG sapRopel dEposition in shAllow environemenTs (GREAT)	The project focused on sapropel events (S5, S6, S7) to understand the driving climate forcing and the large-scale expression of these anoxic events.	ca. 100-200 ka	**ISP**	ENI
Destino del permAFrost duraNte le tErminazioni glaciali (DAFNE) – Fate of the glacial permafrost during terminations	The project aims to provide observational evidence about the relocation of permafrost-derived carbon during past warming events in the Arctic real.	Last 20 kyr to present	**ISP**	
Deep-sea coral records of Southern Ocean climate and nutrient dynamics	The overarching scientific goal of the project is to provide new insights into the role of the Southern Ocean overturning circulation in modulating global climate. The geochemistry of deep-sea corals is used to understand how SO circulation has influenced past changes in global climate and its future role in controlling	Last 30 kyr	**ISP ISMAR**	The University of Western Australia

	ocean productivity in a warming world with rapidly increasing atmospheric carbon dioxide.			
CryptotepHra In Marine sEquences of the Ross Sea, Antarctica: implications and potential applications (CHIMERA) – (PNRA18_PRDE-6324306)	Multidisciplinary approach involving sedimentology, biostratigraphy, geochemistry, paleomagnetic investigations of sediment sequences and tephrochronology to study the cryptotephra records of the Ross Sea. The goal is to investigate the potential applications of cryptotephra as continental scale time-markers fundamental for synchronize and correlate marine records with Antarctic tephra archives extrapolating information into a regional to continental framework.	Pleistocene-Holocene	**ISP ISMAR**	INGV, University of Trieste
Edisto inlet Diatom laminations Sequences Through the Holocene (EDISTHO) – (PNRA18_00010)	The EDISTHO project focus on sediment cores collected inside the Edisto Inlet (Cape Hallett, Western Ross Sea, Antarctica). The aim is to investigate the glaciological and oceanic processes in the Edisto Inlet and their connection with the Ross Sea continental shelf as well as to link them to local, regional and global climatic changes and glacial dynamics.	Last 2000 yr	**ISP ISMAR**	University of Pisa, Trieste, Genova, OGS
Geochemical signals in Antarctic biogenic carbonates for paleoceanographic reconstructions (GRACEFUL) – (PNRA16_00069)	GRACEFUL project tackles critical aspects of the Antarctic climate change through a multi-disciplinary international research effort. Specifically, it aims at reconstructing changes in seawater temperature, pH and carbonate saturation state, nutrient content and water mass circulation in the past using a highly innovative approach.	Holocene last 100-200 yrs	**ISP ISMAR**	ENEA, ISPRA, University of Padova, Trieste
Antarctic biomineralizers as proxies of climate change and paleoclimate reconstructions: *in situ* monitoring and transplantation experiment (ICECLIMALIZERS) – (PNRA16_00011-A1)	ICECLIMALIZERS aims at investigating the role of selected species of calcifying organisms (bryozoans and coralline algae) from Terra Nova Bay as proxies for climate changes, especially ocean acidification. The project will also analyse those organisms to investigate their potential as paleoclimate archives.	Last 100-200 yr	**ISP ISMAR**	ENEA, University of Padova
The Po-Adriatic Source-to-Sink system (PASS): from modern sedimentary processes to millennial-scale stratigraphic architecture (PRIN2017-ASZAKJ)	PASS aims at establishing a framework in which different disciplines are combined in a unified working procedure that integrates for the first time sequence stratigraphy, sediment provenance and a quantitative assessment of modern sedimentary and oceanographic processes. PASS will quantitatively assess sediment fluxes across a ~1,000 km long, land-ocean continuum by applying a multiscale method to the post-glacial succession of the Po-Adriatic region. Defining the temporal and spatial variability of recent sediment transport processes, pathways and fluxes on yearly	Holocene-Last Glacial Maximum	**ISMAR ISP**	University of Bologna, Indiana University

	to decadal time scales will help interpret their role in the past.			
Independent Assessment of Essential Variables - Copernicus Climate Change Service (C3S_511)	To provide in-depth scientific assessment on the essential climate variables covering from ocean, atmosphere, land and cryosphere.	Last 70 yr	**ISMAR**	CNR, NUIM, CSIC, ETH, ENEA, UCL, VUB, DLR, LMU, IO-PAN
Intercomparison of Global Ocean reanalyses in the tropical oceans	To understand the consistency and discrepancy between an ensemble of ocean reanalyses focusing on the tropical Oceans.	Last 30 yr (1993-2020)	**ISMAR**	
RECOnstrucción de las comunidades de MAR Profundo en Márgenes ContinentalES Ibéricos en las últimas décadas/siglos "RECOMARES".	Evaluation of medium and long-term changes (up to about 100-200 years ago) in the density of species/communities of zooplankton close to the Balearic Basin.	Last 200 yr	**ISMAR**	CSIC-Barcelona, Recursos Marins Renovables ENEA (La Spezia)
Human-Induced Changes Compromising the open ocean: generating Understanding from Paleoceanography "HICCUP	The HICCUP approach involves the set-up of the complex analyses of $\delta^{11}B$ in carbonates by MC-ICPMS and the establishment and refinement of calibrations for paleo-O_2 and paleo-pH. With this multi-proxy approach the HICCUP project will target specific topics encompassing the signature of anthropogenic acidification in sediment cores, the evaluation of glacial/interglacial changes or the inference of changes in deep water ventilation.		**ISMAR**	CSIC-Barcellona Biologia Marina i Oceanografia
TRANSMOW: TRAciNg chemical and isotopic Signature of Mediterranean Outflow Waters and its response to past climate transitions. Ref: PID2019-105523RB-I00	The project is focused to constrain how the geochemical signature of Nd isotopes and rare earth elements in the MOW is imprinted onto the fossil record of the last 20ky and the mid-Pleistocene Transition (MPT) a period of time between 0.8-1.2Myr when the glacial-interglacial periodicity of the planet changed drastically.		**ISMAR**	University of Barcelona
ERC Consolidator Grant "TIMED" Testing the role of Mediterranean thermohaline circulation as a sensor of transient climate events and shaker of North Atlantic Circulation". Proposal number: 683237	TIMED: Testing the role of Mediterranean thermohaline circulation as a sensor of transient climate events and shaker of North Atlantic Circulation. s. The main goals are to identify: (1) The natural range of MedTHC variability; (2) The forcings and inter-regional teleconnections driving MedTHC changes; (3) The associated impact onto the AMOC. The assessment of the forcings controlling MedTHC and the ensuing impact on the AMOC will allow us to gauge the consequences of future Mediterranean changes.	18- 14 ka BP; 9.5-6.5 ka BP and the last 2 kyr	**IRPI ISMAR**	University of Barcelona

1.1.3. Terrestrial and lake records

Project	Brief description	Time scale	CNR-Institute	Partner
A.dattamento C.lima A.zioni R.esilienti O.rvieto (ACARO) – PSR 2014-2020 Intervento 16.5.1	The project aims to evaluate which environmental factor mostly influenced the variations in the natural archive records (tree rings) and to interpret past and current tree adaptation to climate changes. Moreover, the study aims to investigate the relations between fires and climate change. The study is based on dendroclimatic and dendroecological analysis in South West Umbria region.	Last 100-300 yr	**IRET**	Alta Scuola, Landscape Office Agronomist STP SRL, CIRIAF-CRB
INGV-AMUSED "An integrated, multidisciplinary study of past global climate changes from continental and marine archives in the Mediterranean region	The project aims to reconstruct the climatic variability in the central Mediterranean region during the mid-late Quaternary, with a focus on the Holocene, integrating paleoclimatic multi-proxy records acquired from different marine and terrestrial paleoenvironmental archives. For the terrestrial archives, the lacustrine sequence from the Castiglione basin (Lazio) and speleothem from Lazio's caves will be studied.	280-0 kyr	**IGAG IGG**	INGV, University of Pisa
Research Südtirol/Alto Adige, Ufficio Ricerca scientifica, Provincia autonoma di Bolzano "Living with the supervolcano – How Athesian eruptions destroyed and preserved 15 million years of Permian life"	Study of lake basins in the Atesino porphyry complex, to reconstruct the climate change and ecosystems dynamics in the lower Permian in the southern Alps.	Lower Permian	**IGG**	Museo di Scienze Naturali dell'Alto Adige, University of Padova
Evolution of the Alpine glacial systems during the LGM	The chronological and stratigraphic study of the Alpine end-moraine systems is carried out in order to understand the evolution of the Alpine glaciated systems during the LGM. The multidisciplinary study is supported by exposure and radiocarbon dating and facies analysis.	Late Pleistocene	**IGG**	University of Torino, ETH, Austrian Geological Survey
Links between human and environment during the late Quaternary in the Iraqi Kurdistan)	Study of palaeoclimatic and palaeoenvironmental conditions in the Iraqi Kurdistan during the Quaternary and their link with the record of the human development and occupation, through integration of geoarchaeological, geomorphological and geochemical data.	Late Pleistocene - Holocene	**IGG**	University of Milano-Statale, University of Padova
Study on the Carnian Pluvial Episode (CPE)	Study of a Carnian (Late Triassic) important phase of global climate change, coincident with a time of major biological turnover (dinosaurs, calcareous nannofossils, and conifers). Identification of the main changes in the geological record worldwide during this interval and	Late Triassic	**IGG**	University of Padova, Leeds, Bristol, Güttingen, Ferrara, München, Chengdu,

	study of the synchronous Large Igneous Province volcanism.			Bolzano, Trento Museum
“MAMPFT” - Mikrosporen an MakroPflanzen-Fossilien der	Paleobotanical and palynological study of Permian and Lower and Middle.	Permian-Triassic	**IGG**	University of Padova, München
Study of volcanic eruptions clustering during the Quaternary	Stratigraphic and geochronological characterization of Alpine, Mediterranean and Etiopian volcanoes.	Quaternary	**IGG**	INGV, University of Torino
Geoarcheological and paleoclimatic study of the Georgian coastal environment	Reconstruction of coastal evolution and interplay with the human record during the Late Holocene.	Holocene	**IGG**	Tbilisi State University
Environmental changes in Accesa basin reconstruction of Pergusa lake	Reconstruction of environmental changes in southern Italy during the Late Holocene.	Holocene	**IGG**	University of Pisa
Environmental changes in the Accesa basin	Environmental changes in the Accesa basin during the Late Holocene.	Holocene	**IGG**	University of Pisa
Study of environmental changes in Ohrid Lake	Geochemical characterization of stable isotopes of organic carbon on sediment from Ohrid lake during Early Holocene.	Holocene	**IGG**	University of Pisa, Köln
A Província Magmática Paraná: petrogenese, cronologia e impacto ambiental do magmatismo toleitico, alcalino e silicico na Plataforma Brasileira	Geochemical, pertographical and paleomagnetic study of the environmental impact of volcanic activity in the Paranà region.	Cretaceous	**IGG**	University of Sao Paulo
PNRA18_00037 "Magma-Ice interaction: late Miocene ice thickness and eruption tempo in northern Victoria Land”	The project is designed for the reconstruction of the ice cover evolution by means of glacial volcanology, igneous petrology and geochronology studies, coupled with investigations of the effects of variable ice load on the eruptibility and composition of magma from shallow crustal chambers.	Mainly Late Miocene	**IGG**	University of Pisa, Perugia, INGV
La trajectoire écologique des lacs vue par les approches paléolimnologiques : réponses biologiques et écosystèmiques aux forçages locaux et globaux	L'Osservatorio dei Laghi OLA logo SOERE OLA ha l'obiettivo di fornire dati scientifici di qualità per comprendere e in fine modellare l'evoluzione dello stato e delle funzioni ecologiche di sistemi lacustri sottoposti contemporaneamente a un cambiamento delle pressioni di antropizzazione locale e climatica. I quattro grandi laghi naturali perialpini (laghi d'Annecy, del Bourget d'Aiguebelette e il Lemano) sono al centro di questo osservatorio, grazie anche all'iniziativa di monitoraggio ecologico avviata su questi sistemi da diversi decenni.	Last 200 yr	**IRSA**	CARRTEL Limnology Center, Thonon-les-Bains, France
Multiproxy paleolimnological	Il progetto interdisciplinare ha come obiettivo quello di ricostruire i legami tra variabilità paleoambientale, disturbi e radiazione adattativa delle specie	Last 14 kyr	**IRSA**	University of Bern

reconstruction of Lake Victoria's environmental history, East Africa	combinando approcci di paleogenomica, paleoleoecologia e paleolimnologia. A questo scopo vengono analizzati quattro nuclei di sedimenti lungo un transetto di profondità (da terra a costa), che coprono ca. gli ultimi 14.000 anni.			
Changes in paleoproductivity and lake regimes and its relation with past climate anomalies based on photosynthetic pigments in shallow lakes of the Pampa plain (Argentina) over the last millennium	Shallow lakes are complex ecosystems and have become the archetypical example of ecosystem with alternative stable states or regimes. Temperate shallow lakes may be dominated alternatively by charophytes, submerged angiosperms, green algae, diatoms or cyanobacteria. Clear and turbid regimes occur at low/intermediate and intermediate/high nutrient levels, respectively. Regime shift can be defined as the sudden drastic transition from one persistent dynamical regime to another and may be due to different mechanisms, such as drastic impact on the system or stepwise change in some important external condition.	Last 1000 yr	**IRSA**	CONICET- Mar del Plata, Argentina
Sedimentary perspective on UV radiation and organic carbon fluctuations in mountain lakes	The project explores connections between solar radiation, aquatic carbon cycling and climate change focusing on mountain lakes in Arctic (Finnish Lapland) and alpine (Italian Alps) environments.	Last 200 yr	**IRSA**	University of Helsinki
The Nam Co Drilling Project, Tibet (NamCore): A One Million Year Sedimentary Record From The Third Pole (NAM-CORE), ICDP-2020/05	Almost one third of the world's population depends on water supplied from rivers originating in the Tibetan Plateau, i.e., mainly monsoonal precipitation. Therefore, how the Asian Monsoon system will develop in the future has socio-economic significance. It is essential to refine future climate change scenarios (e.g., IPCC) and the consequences of a changing climate for ecosystems and human societies by validation against improved knowledge of the timing, duration and intensity of past climatic variability and environmental impact on long geologic time scales and under different boundary conditions. Nam Co, one of the largest and deepest lakes on the Tibetan Plateau, records the temporal development of large-scale atmospheric circulation systems due to its location in the modern monsoon regime.	1 Myr	**IRSA**	University of Greifswald, Institute For Geography Chinese Academy of Geosciences, Institute For Tibetan Plateau Research ICDP program
Geo-ecosystems in Transition on the Tibetan Plateau (TransTiP)	Lake sediments will provide information about long-term hydrological variability and evolution of water quality. Quantification of runoff, meltwater and groundwater contributions to the hydrological budget will allow to test the effects of hydrological events on the aquatic ecosystem as well as help to	Last 2000 yr	**IRSA**	Institute of Geosystems and Bioindication (IGeo) Technische Universität Braunschweig,

	disentangle these components archived in lake sediment records. Overall, the identification of the local components of the water balance and an integral approach of surface and subsurface flow modeling with water balance studies will provide assessments of past and future dynamics of water fluxes and water quality.			Braunschweig, Germany nstitute of Tibetan Plateau Research Chinese Academy of Sciences, P.R. China
Multiproxy high-resolution evidence from annually laminated sediments discloses Southern European ecosystem responses to climate change at Monticchio, Italy	Laminated sediments recovered from the maar lake Lago Grande di Monticchio in southern Italy not only provide detailed information about the regional climatic and environmental development but also about the explosive activity of nearby (100-540 km) Quaternary Italian volcanoes. A total of 345 distal tephra layers are intercalated in the sediments of the 133 ka Monticchio record.	Last 130 kyr	**IRSA**	GFZ-Potsdam University of Portsmouth Università La Sapienza University of Uppsala University of Bern
Development of a High-Resolution, Multi-Century Paleo-Fire Reconstruction from Tropical Australian Stalagmites	The project focuses on stalagmites in a well-studied cave in northwest Australian to develop a multi-century-long record of fire activity from polycyclic organic compounds. In addition, these stalagmites provide a detailed record for constructing a 3000-year history of summer monsoon rainfall. By combining the records contained in the stalagmites, researchers will provide the first millennial record of the role of human activity and monsoonal rains in shaping the landscape and ecology of the dry tropics.	Last 1000 yr	**ISP**	Cornell College (NSF)
Past Climate Change and Glaciation at the Alps-Dinarides junction. Slovenian Research Agency (ARRS) – J1 - 2479	On a regional level, we will deliver new findings of how Pleistocene glaciations and Holocene glaciers shaped the environment and how they reacted to past climate variability. This knowledge, although being focused on the south-eastern Alps and northern Dinarides, will also help to better understand past, present and future mountain glacier dynamics on a European scale.	Late Pleistocene	**ISP**	Geological Survey of Slovenia
Impact of centennial to millennial scale climate variability on vegetation and sedimentation: a high-resolution approach from a lake record	Microbotanical and geochemical proxies from the Lake Fimon record provide information on the response of terrestrial and freshwater ecosystems to climate variability pervading the last glaciation. Past climate parameters (january-july T, annual P) will be quantitatively estimated through the Modern Analogue Technique and compared with other independent records of climate at hemispheric scale.	LGM to Late Glacial	**IGAG**	University of Milano Bicocca, Bern, Basel, Reading
Romanelli Cave – Grandi Scavi Sapienza	The project aim is the critical revision of the lith-, chrono and morpho-stratigraphy of the Romanelli Cave in Apulia, southern Italy, representing a key site of the Italian	Last 270 kyr	**IGAG**	University Roma Sapienza

	Paleolithic. The paleoclimatic study is based on a multi-proxy, morphological, stratigraphic, geochronological, paleontological and geochemical analyses.			
Contributing to the project Europeo NeuMed-Uuniversity of Siena (DTA.AD001.297)	The project aims at reconstructing the ancient landscape of the south-western Maremma Toscana area, in Tuscany, central Italy, and, specifically, at individuating the changing in the lagoon, pond, fluvial stream and coastal line sub-systems induced by the natural and anthropogenic factors.	Holocene-historical times	**IGAG**	University of Siena
Coastal line evolution and its impact on the human settlement (DTA.AD001.272)	Study of the human-environment interactive system in the area of the Laguna di Salpi, southern Italy, within the framework of the European project Life on the lagoon: reconstructing the biography of human landscape dynamics on the Salpi Lagoon-Italy (supported by National Endowment for Humanities, USA), and of the Tiber delta.	Holocene-historical times	**IGAG**	UniFG, McGill University, Davidson College
DIAMOND "Neolithic Demography and hydrological change In Apulia" (Accordo CNR/MoS biennio)	The aims of the DAIMOND project is to reconstruct the hydrological variability during the Lower Holocene and assess its potential role as driving environmental factors of the cultural and demographic evolution of the Neolithic of the Apulian and Montenegro regions. The study is based on stable isotope (O and C) data from speleothems collected and the statistical analyses of the radiocarbon data collected in both regions.	Lower Holocene	**IGAG**	Montenegro Science Ministry
Climatic change and environmental evolution of the Plio-Pleistocene lake system of the L'Aquila Basin	The project aims to reconstruct the paleoenvironmental and paleoclimatic history from the late Pliocene-Lower Pleistocene lacustrine succession of the San Nicandro Formation (AQ) hosted in L'Aquila Basin, central Italy, through a multy-proxy approach that integrates, sedimentological, micropaleontological, tephrochronological, bio-geochemical and magnetostratigraphical investigations.	~1.6-3.0 Ma	**IGAG ISMAR**	University of Roma-3, Pisa, Firenze, Gif-sur-Yvette, INGV
FUTURE "Fucino Tephrochronology Unites Quaternary Records" (MIUR – PRIN 2017)	The general objective of FUTURE is to assemble a high-precision 40Ar/39Ar dated tephrochronological record for the last ~430 kyr anchored to a detailed paleoclimate multiproxy record that may be regionally to globally spread via tephrostratigraphic, paleomagnetic and cosmogenic nuclide peak synchronization and paleoclimatic alignments.	Last 430 kyr	**IGAG IGG**	University of Pisa, Roma-Sapienza, Napoli
Timing and dynamic of the Glacial Termination IX	The goal is to reconstruct, at high temporal resolution, the quantitative temperature variation through the T-IX (ca. 805-790 ka), by means geochemical and geochronological analyses of the	810-770 ka	**IGAG IGG**	University of Pisa, Melbourne, Gif-sur-Yvette

	lacustrine sediments, spanning the 810-770 ka interval, hosted in the Sulmona Basin (central Italy).			
Chronology and nature of the glacial terminations of the last 800 kyr	The project aims to improve the knowledge on chronology and nature of the Middle Pleistocene Glacial Termination by means of tephrochronological analysis and stratigraphical investigations of the Tiber River aggradational formations.	800-12 ka	**IGAG**	INGV, University of Roma-1
TIMLIG - Timing of the Last Interglacial sea level high-stand	The goal of TIMLIG is to reconstruct, at high temporal resolution, the sea level oscillations during the Last Interglacial along the Tyrrhenian Sea coast.	130-80 ka	**IGAG**	INGV, University of Pisa
Guattari Cave Neanderthals	Chronology and paleoclimatic framework of the Neanderthal occupation/remains along the Circeo Coast, central Italy.	130-60 ka	**IGAG**	University of Roma2, Pisa, Roma1, INGV

1.2. Methodological development

Improved polycyclic aromatic hydrocarbons and n-alkanes determination in speleothems through cleanroom sample processing	In this work, we developed a novel method for the simultaneous determination of 18 polycyclic aromatic hydrocarbons (PAHs) and 26 n-alkanes (C10−C35) and then tested it on "clean" calcite and aragonite stalagmite samples from cave KNI-51 in the Australian tropics. The method involves subsampling by using a hand-held drill, complete dissolution of the matrix in hydrochloric acid, then liquid−liquid extraction, and GC-MS analysis.	**ISP**	Cornell College

1.3. Conservation and networking

ICE-Memory	It is an international research project recognized by UNESCO. The aim of this project is to create a sanctuary for non-polar ice core samples in Concordia, the Franco-Italian research station in Antarctica, in order to allow future generations of scientists to continue to analyze them. Ice memory's international team plans to drill 20 glaciers over the next two decades.	**ISP**	University Ca' Foscari CNRS IRD IPEV

2. MEETING AND WORKSHOP ORGANIZATION

Title	**Institute**
Virtual Paleomeeting – Extreme climates and rapid transitions: insights from the geological record from the deep to the recent past. (29/04/2020)	**IGG**

3. PUBLICATIONS (2020)

References	Topic	Institute
1. Aiello G., Amato V., Barra D., Caporaso L., Caruso T., Giaccio B., Parisi R., Rossi A. (2020). Late Quaternary benthic foraminiferal and ostracod response to palaeoenvironmental changes in a Mediterranean coastal area, Port of Salerno, Tyrrhenian Sea. *Regional Studies in Marine Science*, 40, 101498	**Marine record**	**IGAG**
2. Aldega L., Brandano M. & Cornacchia I. (2020). Trophism, climate and paleoweathering conditions across the Eocene-Oligocene transition in the Massignano section (northern Apennine, Italy). *Sedimentary Geology*, 405, 1-10.	**Marine record**	**IGG**
3. Amato V., Aiello G., Barra D., Caporaso L., Caruso T., Giaccio B., Parisi R., Rossi A. (2020). Holocene paleogeographic evolution of an ancient port city of the central Mediterranean area: Natural and anthropogenic modifications from Salerno city, southern Italy. *Geoarchaeology*, 35(3), 366-383.	**Marine record**	**IGAG**
4. Amitai Y., Yam R., Montagna P., Devoti S., Lopez Correa M., Shemesh A. (2020). Spatial and temporal variability in Mediterranean climate over the last millennium from vermetid isotope records and CMIP5/ PMIP3 models. *Global and Planetary Change*, 189, 103159.	**Marine record**	**ISP** **ISMAR**
5. Argiriadis E., Martino M., Segnana M., Poto L., Vecchiato M., Battistel D., Gambaro A., Barbante C. (2020). Multi-proxy biomarker determination in peat: Optimized extraction and cleaup method for paleoenvironmental application. *Microchemical Journal*, 156, 104821.	**Methodological development**	**ISP**
6. Badino F., Pini R., Bertuletti P., Ravazzi C., Delmonte B., Monegato G., Reimer P., Vallè F., Arrighi S., Bortolini E., Figus C., Lugli F., Maggi V., Marciani G., Margaritora D., Oxilia G., Romandini M., Silvestrini S., Benazzi S. (2020). The fast-acting "pulse" of Heinrich stadial 3 in a mid-latitude boreal ecosystem: ecoclimatic patterns and fire regimes. *Scientific Reports*, 10, 18031.	**Terrestrial record**	**IGAG** **IGG**
7. Badino F., Pini R., Ravazzi C., Margaritora D., Arrighi S., Bortolini E., Figus C., Giaccio B., Lugli F., Marciani G., Monegato G., Moroni A., Negrino F., Oxilia G., Peresani M., Romandini M., Ronchitelli A., Spinapolice E.E., Zerboni A., Benazzi S. (2020). An overview of Alpine and Mediterranean palaeogeography, terrestrial ecosystems and climate history during MIS 3 with focus on the Middle to Upper Palaeolithic transition. *Quaternary International*, 551, 7-28.	**Terrestrial record**	**IGAG** **IGG**
8. Baneschi I., Magny M., Zanchetta G. (2020). Are stable isotopes of lacustrine carbonate a good tracer of lake hydrology and lake level variability? The Lake Ledro case (Northern Italy). *Alpine and Mediterranean Quaternary*, 33 (1), 99-106.	**Terrestrial record**	**IGG**
9. Baroni C., Bondesan, A., Carturan L. and Chiarle, M. (2020). Annual glaciological survey of Italian glaciers (2019) - Campagna glaciologica annuale dei ghiacciai italiani (2018). *Geografia Fisica e Dinamica Quaternaria*, 43 (1), 45-142. doi: 10.4461/GFDQ.2020.43.4	**Terrestrial record** **Cryosphere monitoring**	**IGG**
10. Baroni, C., Brunetti, M., Cerrato, R., Coppola, A., Betti, G., Salvatore, M.C. (2020). A long-term chronology of *Pinus pinea* L. from Parco della Versiliana (Pietrasanta, Italy) derived from treefall induced by a windstorm on March 4th-5th, 2015, *Dendrochronologia*, 62, 125710.	**Terrestrial record**	**IGG** **ISAC**
11. Bertolin, C., Camuffo, D. (2020). Urban Climate and Health: Two Strictly Connected Topics in the History of Meteorology. *Sustainability in Energy and Buildings*, 565-579. DOI: 10.1007/978-981-32-9868-2_48.	**Terrestrial record**	**ISAC**
12. Bini M., Zanchetta G., Regattieri E., Isola I., Drysdale R. N., Fabiani F., Genovesi S. & Hellstrom J. C. (2020). Hydrological changes during the Roman Climatic Optimum in northern Tuscany (Central Italy) as evidenced by speleothem records and archaeological data. *Journal of Quaternary*	**Terrestrial record**	**IGG**

	Science, 35(6), 791-802.		
13.	Bini M., Zanchetta G., Drysdale R.N., Giaccio B., Stocchi P., Vacchi M., Hellstrom J.C., Couchoud I., Monaco L., Ratti A., Martini F., Sarti L. (2020). An end to the Last Interglacial highstand before 120 ka: Relative sea-level evidence from Infreschi Cave (Southern Italy). *Quaternary Science Reviews*, 250, 106658	**Transitional marine-terrestrial record**	**IGAG**
14.	Bohleber P., Roman M., Šala M., Barbante C. (2020). Imaging the impurity distribution in glacier ice cores with LA-ICP-MS. *Journal of Analytical Atomic Spectrometry*, 35, 2204-2212.	**Methodological development**	**ISP**
15.	Braakhekke J., Ivy-Ochs S., Monegato G., Gianotti F., Martin S., Casale S., Christl M. (2020). Timing and flow pattern of the Orta Glacier (European Alps) during the Last Glacial Maximum. *Boreas*, 49, 315-332.	**Terrestrial record**	**IGG**
16.	Camuffo, D. (2020). Key problems in early wine-spirit thermometers and the 'True Réaumur' thermometer. *Climatic Change* 163:1083–1102 DOI 10.1007/s10584-020-02910-3.	**Terrestrial record**	**ISAC**
17.	Camuffo, D., della Valle, A., Becherini, F. (2020). A critical analysis of the definitions of climate and hydrological extreme events. *Quaternary International*, 538, 5-13 10.1016/j.quaint.2018.10.008.	**Terrestrial record**	**ISP ISAC**
18.	Camuffo, D., Becherini F., della Valle, A. (2020). Relationship between selected percentiles and return periods of extreme events. *Acta Geophysica*. DOI 10.1007/s11600-020-00452-x.	**Terrestrial record**	**ISP ISAC**
19.	Camuffo, D., della Valle, A., Becherini F., Rousseau, D. (2020). The earliest temperature record in Paris, 1658–1660, by Ismaël Boulliau, and a comparison with the contemporary series of the Medici Network (1654–1670) in Florence. *Climatic Change* 162:903-922 DOI 10.1007/s10584-020-02756-9.	**Terrestrial record**	**ISP ISAC**
20.	Camuffo, D., della Valle, A., Becherini F, Zanini V. (2020). Three centuries of daily precipitation in Padua, Italy, 1713-2018. History, relocations, gaps, homogeneity and raw data. *Climatic Change* 162:923-942 DOI 10.1007/s10584-020-02717-2	**Terrestrial record**	**ISP ISAC**
21.	Camuffo, D., Becherini F., della Valle, A. (2020). Temperature observations in Florence, Italy, after the end of the Medici Network (1654-70): the Grifoni record (1751-66). *Climatic Change* 162:943-963 DOI 10.1007/s10584-020-02760-z	**Terrestrial record**	**ISP ISAC**
22.	Capotondi, L., Bonomo S., Budillon, G., Giordano, P., Langone, L. (2000). Living and dead benthic foraminiferal distribution in two areas of the Ross Sea (Antarctica). *Rendiconti Lincei. Scienze Fisiche e Naturali*, 31(4), 1037-1053 DOI: 10.1007/s12210-020-00949-z.	**Marine record**	**ISMAR**
23.	Carrozzo D, Musazzi S, Lami A, et al (2020). Changes in Planktivory and Herbivory Regimes in a Shallow South American Lake (Lake Blanca Chica, Argentina) Over the Last 250 Years. *Water* 12:597. https://DOI.org/10.3390/w12020597.	**Lake record**	**IRSA**
24.	Cerrato, R., Salvatore, M.C., Gunnarson, B.E., Linderholm, H.W., Carturan, L., Brunetti, M., Baroni, C. (2020). *Pinus cembra* L. tree-ring data as a proxy for summer mass-balance variability of the Careser Glacier (Italian Rhaetian Alps). *Journal of Glaciology*, 66(259), 714–726.	**Terrestrial record**	**ISAC IGG**
25.	Delmonte B., Winton H., Baroni M., Baccolo G., Hansson M., Andersson P., Baroni C., Salvatore M.C., Lanci L. and Maggi V. (2020). Holocene dust in East Antarctica: Provenance and variability in time and space. *The Holocene* 30 (4), 546–558. doi: 10.1177/0959683619892670	**Ice record**	**ISP IGG**
26.	Duhamel M., Colin C., Revel M., Siani G., Dapoigny A., Douville E., Wu J., Zhao Y., Liu Z., Montagna P. (2020). Variations in eastern Mediterranean hydrology during the last climatic cycle as inferred from neodymium isotopes in foraminifera. *Quaternary Science Reviews*, 237, 106306. https://DOI.org/10.1016/j. quascirev.2020.106306.	**Marine record**	**ISP**
27.	Gangi D, Plastani MS, Laprida C, et al (2020). Recent cyanobacteria abundance in a large sub-tropical reservoir inferred from analysis of	**Lake record**	**IRSA**

	sediment cores. *J Paleolimnol*. DOI.org/10.1007/s10933-020-00110-8.		
28.	Gentili R., Baroni C., Panigada C., Rossini M., Tagliabue G., Armiraglio S., Citterio S., Carton A., Salvatore M.C. (2020). Glacier shrinkage and slope processes create habitat at high elevation and microrefugia across treeline for alpine plants during warm stages. *CATENA*, 193, 104626. doi: 10.1016/j.catena.2020.104626	**Terrestrial record**	**IGG**
29.	Girard V., Saint Martin S., Buffetaut E., Saint Martin J.-P., Néraudeau D., Peyrot D., Roghi G., Ragazzi E., Suteethorn V. (2020). Thai amber: Insights into early diatom history? [L'ambre de Thaïlande : une fenêtre sur l'histoire des premières diatomées ?]. BSGF - *Earth Sciences Bulletin*, 191.	**Marine record**	**IGG**
30.	González Sagrario M de los Á, Musazzi S, Córdoba FE, et al (2020). Inferring the occurrence of regime shifts in a shallow lake during the last 250 years based on multiple indicators. *Ecological Indicators* 117:106536. https://DOI.org/10.1016/j.ecolind.2020.106536.	**Lake record**	**IRSA**
31.	Halac S, Mengo L, Guerra L, et al (2020). Paleolimnological reconstruction of the centennial eutrophication processes in a sub-tropical South American reservoir. *Journal of South American Earth Sciences* 103:102707. https://DOI.org/10.1016/j.jsames.2020.102707.	**Lake record**	**IRSA**
32.	Jamšek Rupnik P., Žebre M., Monegato G. (2020). Evolution of sedimentary environment in Modrejce near Most na Soči (Soča Valley, Julian Alps) during the Pleistocene. *Geologija*, 63/2, 295-309.	**Terrestrial record**	**IGG**
33.	Karádi V., Cau A., Mazza M., Rigo M. (2020). The last phase of conodont evolution during the Late Triassic: Integrating biostratigraphic and phylogenetic approaches. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 549, 109144; DOI.org/10.1016/j.palaeo.2019.03.045.	**Marine record**	**IGG**
34.	Lanci L., Delmonte B., Salvatore M.C., Baroni C. (2020). Insight Into Provenance and Variability of Atmospheric Dust in Antarctic Ice Cores During the Late Pleistocene From Magnetic Measurements. *Frontiers in Earth Science*, 8, 1-13. doi: 10.3389/feart.2020.00258	**Terrestrial record**	**IGG ISP**
35.	Li X., Matsuoka A., Bertinelli A., Chiari M. and Wang C. (2020). Correlation of Early Cretaceous radiolarian assemblages from southern Tibet and Central Italy. *Cretaceous Research*, 105, 104046; DOI: 10.1016/j.cretres.2018.12.016.	**Marine record**	**IGG**
36.	Lurcock P., Florindo F., Margaritelli G., Vallefuoco M., Di Rita F., Insinga D. D., Petrosino P., Bonomo S., Cascella A., Ferraro L., Magri D., Pelosi N., Cosentino C., Lirer F. (2020). A 4,500-year record of palaeomagnetic secular variation and relative palaeointensity from the Tyrrhenian Sea Geomagnetic Field Variations in past: New data, applications and recent advances. *Geological Society of London Special Pubblication*, Tema, E., Di Chiara, A. & Herrero-Bervera, E. (Eds) Geomagnetic Field Variations in past: New data, applications and recent advances Geological, 497, DOI.org/10.1144/SP497-2019-255.	**Marine record**	**IRPI ISMAR**
37.	Makri S, Lami A, Tu L, et al (2020). Holocene phototrophic community and anoxia dynamics in meromictic Lake Jaczno (NE Poland) using high-resolution hyperspectral imaging and HPLC data. *Biogeosciences Discussions*. DOI.org/10.5194/bg-2020-362.	**Lake record**	**IRSA**
38.	Mannella G., Zanchetta G., Regattieri E., Perchiazzi N., Drysdale R. N., Giaccio B., Leng M.J. & Wagner B. (2020). Effects of organic removal techniques prior to carbonate stable isotope analysis of lacustrine marls: a case study from palaeo-lake Fucino (central Italy). *Rapid Communications in Mass Spectrometry*, 34(7), e8623.	**Terrestrial record**	**IGAG IGG**
39.	Mannella G., Zanchetta G., Regattieri E., Perchiazzi N., Drysdale R.N., Giaccio B., Leng M.J., Wagner B. (2020). Effects of organic removal techniques prior to carbonate stable isotope analysis of lacustrine marls: A case study from palaeo-lake Fucino (central Italy). *Rapid Communications in Mass Spectrometry*, 34(7), 10.1002/rcm.8623.	**Terrestrial record**	**IGAG**

40.	Margaritelli, G., Cacho, I., Català, A., Barra, M., Bellucci, L.G., Lubritto, C., Rettori, R., Lirer, F. (2020). Persistent warm Mediterranean surface waters during the Roman period. *Scientific Reports* 10, 10431.	**Marine record**	**IRPI ISMAR**
41.	Margaritelli, G., Lirer, F., Schroeder, K., Alberico, I., Dentici, M.P., Caruso, A. (2020). *Globorotalia truncatulinoides* in Central - Western Mediterranean Sea during the Little Ice Age. *Marine Micropaleontology* 161, 101921.	**Marine record**	**IRPI ISMAR**
42.	Maselli V., Normandeau A., Nones M., Tesi T., Langone L., Trincardi F., and Bohacs K. M. (2020). Tidal modulation of river-flood deposits: How low can you go?. *Geology*, 48(7), 663-667	**Marine record**	**ISP ISMAR**
43.	Matsuoka A., Li X., Chiari M., Bertinelli A. (2020). Radiolarian occurrences from the Jurassic–Cretaceous transition beds in the Maiolica Formation of the Bosso Valley section, Northern Apennines, central Italy. *Cretaceous Research*, 114, 104500; DOI: 10.1016/j.cretres.2020.104500.	**Marine record**	**IGG**
44.	Monegato G., Mozzi P., Paiero G., Rossato S. (2020). Sedimentary evidence of glacial lake outburst floods (GLOFs) during the Last Glacial Maximum in the Venetian-Friulian Plain (NE Italy). *Quaternary International*, 538, 44-52.	**Terrestrial record**	**IGG**
45.	Montagna P. and Douville E. (2020). Geochemical proxies in marine biogenic carbonates: New developments and applications to global change. *Chemical Geology*, 533, 119411.	**Marine record**	**ISP**
46.	Pace B., Valentini A., Ferranti L., Vasta M., Vassallo M., Montagna P., Colella A., Pons-Branchu E. (2020). A large paleoearthquake in Central Apennines, Italy, recorded by the collapse of a massive cave speleothem. *Tectonics*, https://DOI.org/10.1029/2020TC006289.	**Marine record**	**ISP**
47.	Pereira A., Monaco L., Marra F., Nomade S., Gaeta M., Leicher N., Palladino D.M., Sottili G., Guillou H., Scao V., Giaccio B. (2020). Tephrochronology of the central Mediterranean MIS 11c interglacial (∼425–395 ka): New constraints from the Vico volcano and Tiber delta, central Italy. *Quaternary Science Reviews*, 243, 106470.	**Terrestrial record**	**IGAG**
48.	Petrini M., Colleoni F., Kirchner N., Hughes A.L.C., Camerlenghi A., Rebesco M., Lucchi R-G-. Forte E., Colucci R.R., Noormets R. (2020). Oceanic conditions driving the last deglaciation of the Barents Sea ice sheet: results from an ensemble of transient ice sheet model simulations. *Quaternary Science Reviews*. 238, 106314. https://DOI.org/10.1016/j.quascirev.2020.106314.	**Modeling study**	**ISMAR ISP**
49.	Razum I., Miko S., Ilijanić N., Petrelli M., Röhl U., Hasan O. and Giaccio B. (2020). Holocene tephra record of Lake Veliko jezero, Croatia: implications for the central Mediterranean tephrostratigraphy and sea level rise. *Boreas*, 49(3), 653-673.	**Transitional marine-terrestrial record**	**IGAG**
50.	Rigo M., Onoue T., Tanner L.H., Lucas S.G., Godfrey L., Katz M.E., Zaffani M., Grice K., Cesar J., Yamashita D., Maron M., Tackett L.S., Campbell H., Tateo F., Concheri G., Agnini C., Chiari M. and Bertinelli A. (2020). The Late Triassic Extinction at the Norian/Rhaetian boundary: Biotic evidence and geochemical signature. *Earth-Science Reviews*, 204, 103180; DOI: 10.1016/j.earscirev.2020.103180.	**Marine record**	**IGG**
51.	Sadatzki H., Maffezzoli N., Dokken T., Simon M., Berben S., Fahl K., Kjær H., Spolaor A., Stein R., Vallelonga P., Vinther B. Jansen E. (2020). Rapid reductions and millennial-scale variability in Nordic Seas sea ice cover during abrupt glacial climate changes. *Proceedings of the National Academy of Sciences*, 117, 29478-29486.	**Marine record**	**ISP**
52.	Salomon F., Vittori C., Noirot B., Pleuger E., Rosa C., Mazzini I., Carbonel P., Djerbi H., Bellotti P. and Goiran J. (2020). Reconstruction of the Tiber Deltaic stratigraphic successions near Ostia using the PADM chart and tracking of the bedload-derived facies (Rome, Italy). *Geomorphology*, 365, 107227.	**Transitional marine-terrestrial record**	**IGAG**
53.	Segnana M., Oeggl K., Poto L., Gabrieli J., Festi D., Kofler W., Cesco Frare P., Zaccone C., Barbante C. (2020). Holocene vegetation history and human impact in the eastern Italian Alps: a multi-proxy study on the Coltrondo	**Terrestrial record**	**ISP**

	peat bog, Comelico Superiore, Italy. *Vegetation History and Archaeobotany*, 29, 407-426.		
54.	Serafini G., Amalfitano J., Cobianchi M., Fornaciari B., Maxwell E.E., Papazzoni C.A., Roghi G., Giusberti L. (2020). Evidence of opportunistic feeding between ichthyosaurs and the oldest occurrence of the hexanchid shark notidanodon from the upper jurassic of northern Italy. *Rivista Italiana di Paleontologia e Stratigrafia*, 126 (3), 629-655.	**Marine record**	**IGG**
55.	Sisma-Ventura G., Antonioli F., Silenzi S., Devoti S., Montagna P., Chemello R., Shemesh A., Yam R., Gehrels R., Dean S., Rilov G., Sivan D. (2020). Assessing Vermetid reefs as indicators of past sea-levels in the Mediterranean. *Marine Geology*, 429, 106313.	**Marine record**	**ISP**
56.	Sternai P., Caricchi L., Pasquero C., Garzanti E., van Hinsbergen D.J.J., Castelltort S. (2020). Magmatic forcing of Cenozoic climate?. *J. Geophysical Research - Solid Earth*, 125, e2018JB016460, DOI: 10.129/2018JB016460.	**Modeling study**	**ISAC**
57.	Stilwell J.D., Langendam A., Mays C., Sutherland L.J.M., Arillo A., Bickel D.J., De Silva W.T., Pentland A.H., Roghi G., Price G.D., Cantrill D.J., Quinney A., Peñalver E. (2020). Amber from the Triassic to Paleogene of Australia and New Zealand as exceptional preservation of poorly known terrestrial ecosystems. *Scientific Reports*, 10 (1), 5703.	**Terrestrial record**	**IGG**
58.	Tesi T., Belt S. T., Gariboldi K., Muschitiello F., Smik L., Finocchiaro F., Giglio F., Colizza E., Gazzurra G., Giordano P., Morigi C., Capotondi L., Nogarotto A., Köseoğlu D., Di Roberto A., Gallerani A., Langone, L. (2020). Resolving sea ice dynamics in the north-western Ross Sea during the last 2.6 ka: From seasonal to millennial timescales. *Quaternary Science Review*s, 237, 106299	**Marine record**	**ISP ISMAR**
59.	Vallé F., Furlanetto G., Pini R., Brunetti M., Maggi V., Ravazzi C. (2020). Reconstructing the last 3000 years climate change in N-Italy from fossil pollen archive. *Geografia Fisica e Dinamica Quaternaria*, 42(2), 235–244.	**Terrestrial record**	**IGAG ISAC**
60.	Vecchiato M., Gambaro A., Kehrwald N., Ginot P., Kutuzov S., Mirkhalenko V., Barbante C. (2020). The Great Acceleration of fragrances and PAHs archived in an ice core from Elbrus, Caucasus. *Scientific Reports*, 10, 1-10.	**Ice record**	**ISP**
61.	Vicente-Serrano S.M., Domínguez-Castro F., Murphy C., Hannaford J., Reig F., Peña-Angulo D., Tramblay Y, Trigo R., MacDonald N, Luna Y., Guijarro J.A., McCarthy M., Van der Schrier G., Turco M., Camuffo D., Noguera I, El Kenawy A., García-Herrera R., Becherini F., della Valle A. (2020). Long-term variability and trends in meteorological droughts in Western Europe (1851-2018). *International Journal of Climatology*, DOI: https://DOI.org/10.1002/joc.6719.	**Terrestrial record**	**ISP ISAC**
62.	Zangrando R., Zanella V., Karroca O., Barbaro E., Kehrwald N., Battistel D., Morabito E., Gambaro A., Barbante C. (2020). Dissolved organic matter in the deep TALDICE ice core: A nano-UPLC-nano-ESI-HRMS method. *Science of the Total Environment*, 700, 134432.	**Methodological development**	**ISP**
63.	Žebre M., Colucci R.R., Giorgi F., Glasser N.F., Racoviteanu A.E., Del Gobbo C. (2020). 200 years of Equilibrium-Line Altitude variability across the European Alps (1901−2100). *Climate Dynamics* https://DOI.org/10.1007/s00382-020-05525-7	**Historical data and Modeling study**	**ISP**

4. ONGOING PhD THESIS

Istituto di Scienze Polari (ISP)

Costanza Del Gobbo - PhD in Earth System Physics
Paleoclimatic simulation of small scale weather patterns in the southeastern Alps at the end of the LGM
ICTP, University of Trieste - Cotutor ISP

Alessio Nogarotto - PhD in Polar Sciences
Coupling of marine and ice records for sea ice reconstructions
University of Ca' Foscari Venice - Cotutor ISP

Chiara Pambianco - PhD in Polar Sciences
Deglacial carbon cycle in polar regions
University of Ca' Foscari Venice - Cotutor ISP

Istituto di Geoscienze e Georisorse (IGG)

Luca Forti - PhD in Earth Sciences
Geoarchaeological and palaeoenvironmental reconstruction of the Late Quaternary climate-environmental-human nexus in Iraqi Kurdistan
DST A-Desio, UniMi Statale - Cotutor IGG

Sarah Kamleitner - PhD in Earth Sciences
Timing and extent of LGM glaciers N and S of the Alps
ETH Zurigo - Cotutor IGG

Mina Mazaherijohari - PhD in Earth and Marine Sciences
Carnian Pluvial Episode in Iran (Turan plate and Iran plate) and western Tethys domain
UniFe - Cotutor IGG

Andrea Montanaro - PhD in Earth Sciences
Triassic to Middle Jurassic global perturbation in the carbon cycle from platform carbonates
DISTAR UniNa - Cotutor IGG

Lukas Rettig - PhD in Earth Sciences
The reconstruction of the Equilibrium Line Altitude in the southern side of the Alps during the LGM
Geosciences UniPD - Cotutor IGG

Istituto di Geologia Ambientale e Geoingegneria (IGAG)

Lorenzo Monaco - PhD in Earth Sciences
Middle Pleistocene Mediterranean tephrochronology and timing of the peri-Tyrrhenian explosive volcanism
University of Roma (La Sapienza) - Cotutor IGAG

Massimo Novellino – PhD in Earth Sciences
The last and the current interglacial in the northern Adriatic basin. New integrated records from marine and terrestrial environments
Geosciences UniPD – Cotutor IGAG

Istituto di Ricerca per la Protezione Idrogeologica (IRPI)

Helena Checa Sánchez - PhD in Science and Technology for Physics and Geology
Characterizing deep-ocean circulation changes during the last Sapropel in the central Mediterranean Sea using novel micro-paleontological and geochemical tools
University of Perugia - Cotutor IRPI