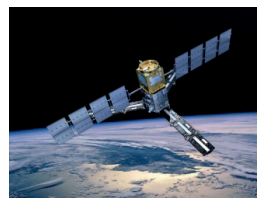


# ERCA

European Research Course on Atmospheres

30<sup>th</sup> session from  
**15<sup>th</sup> JANUARY >**  
**4<sup>th</sup> FEBRUARY**

*Grenoble, FRANCE*



# PRACTICAL GUIDE 2023

# PROGRAM and PRACTICAL INFORMATION

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> p 6    **ERCA Organisation**

---

> p 7    **ERCA Support**

---

> p 13   **ERCA Practical Information**

---

> p 27   **ERCA 2023 Program**

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> p 41   **List of Contributors**

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## ERCA ORGANISATION

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# ERCA SUPPORT

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> The Université Grenoble Alpes (UGA)

> The Centre National de la Recherche Scientifique (CNRS)

> Support from International Agencies

> Support from National Agencies

> Support from Local Agencies



The **Université Grenoble Alpes (UGA)** has recently emerged from the former three universities: Université Joseph Fourier, Université Pierre-Mendès-France and Université Stendhal. UGA has been the major support to ERCA for more than twenty years through the Université Joseph-Fourier (UJF). UGA trains more than 45,000 students and operates 80 research laboratories. It is rated as one of the leading French universities in international ranking (Reuters, Shanghai, Times Higher Education, QS...) and among the top 50 universities in the domain of environmental sciences in 2019 (ranked 24<sup>th</sup> in geosciences and 66<sup>th</sup> in environment / ecology in the 2019 National Taiwan university ranking).



The **Centre National de la Recherche Scientifique (CNRS)**, a leading French research operator, has always supported ERCA, providing staff and logistics. The **National Institute for Earth Sciences and Astronomy (INSU)** aims to design, promote and coordinate national and international research in the fields of Astronomy, Solid Earth, Ocean, Atmospheric and Space Sciences.

## Support from International Agencies



### Copernicus Academy.

As part of the Space Strategy for Europe, the European Commission has launched the Copernicus Academy.

The Copernicus Academy connects universities, research institutions, business schools, both private and non-profit organisations, in the Copernicus Participating Countries (EU27 + Norway & Iceland) and beyond. The goal of the network is to link research & academic institutions with authorities & service providers, facilitate collaborative research, develop lectures, training sessions, traineeships as well as educational and training material to empower the next generation of researchers, scientists, and entrepreneurs with suitable skill sets to use Copernicus data and information services to their full potential.

<https://www.copernicus.eu/en/opportunities/education/copernicus-academy>



Zentrum für Material- und Küstenforschung

### Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research (GKSS).

As a member of the Helmholtz Association of German Research Centres, the largest scientific organisation in Germany, the Helmholtz-Zentrum Geesthacht is engaged in long-term activities in the fields of materials and coastal research that are making a major contribution to resolving the large and pressing issues facing society and the scientific and business worlds.

## Support from National Agencies



**Université de Versailles, St-Quentin-en-Yvelines (UVSQ)** supports ERCA with its Observatory of Earth Sciences (OVSQ). OVSQ runs atmospheric observations at the Observatoire de Haute-Provence and its researchers organise the scientific activities proposed to ERCA participants.



**Aix-Marseille Université** is the largest university in France with over 75,000 students. It has five campuses between Aix and Marseille in South France. It is a multidisciplinary university, largely turned towards the Mediterranean world.



**Institut de Recherche pour le Développement (IRD)** has focused its research for over 65 years on the relationship between man and its environment, in Africa, Mediterranean, Latin America, Asia and the French tropical overseas territories. Its research, training and innovation activities are intended to contribute to the social, economic and cultural development of southern countries.



**Météo-France** is the French national meteorology and climatology service. Its main mission is to provide alerts and meteorological information for the security of people and goods. The Centre d'Etudes de la Neige (CEN) in Grenoble is the Météo-France centre dedicated to snow and avalanches.



**Observatoire de Haute Provence (OHP)** is a main observatory site for astronomy, environment, and the study of atmosphere. As a national facility for astronomy it welcomes visiting astronomers.

## Support from Local Agencies



The Institute for Environment Sciences (IGE), in Grenoble, is reputed for outstanding research in hydrology, oceanography, polar climates, and glaciology. It has a staff of more than 200 people. Researchers carry out experimental and modelling work, as well as field work in polar and mountain area.



The Observatoire des Sciences de l'Univers de Grenoble (OSUG) is a geosciences observatory within the University of Grenoble, grouping sixth laboratories. It supports ERCA with the Labex2020 program.



Grenoble Alpes Métropole operates the urban area around Grenoble.

# ERCA

## Practical Information

1. Your arrival in Grenoble
2. Your accommodation in Grenoble
3. ERCA 2023 Lectures at "Maison Climat Planète" (MCP)
4. Ice breaking party
5. Lunches during week days in Grenoble
6. Posters and presentation of your research activity
7. Panels / debates
8. Scientific practicals
9. Work in group on Projects
10. Observatoire de Haute Provence (OHP)
11. Gala Dinner
12. Your departure



**GRENOBLE** is a lively city, with a beautiful old city centre and is vibrant day and night. Although surrounded by mountains, the city is virtually flat and at low elevation (200m). This makes winters rather mild (few degrees above freezing), although they can be harsh if snow stays in the city, with temperatures staying below freezing possibly for weeks.

Moving about within the city is very convenient to use the tramway, or even a bike (The urban area is criss-crossed by bike paths and you can easily rent a bike for days or weeks).

Have a look around Grenoble: <https://www.grenoble-tourisme.com/en/>



**Urban transport:** <http://www.tag.fr>

NB: ERCA will provide you a ticket with 10 tram or bus trips:

- Validate/stamp your ticket in the bus using the machine near the driver
- For the tram, validate your ticket on the machine on the platform BEFORE embarking.

Everything you need if you fancy using a bike: <http://www.metrovelo.fr>

To travel out of the urban area, a very good network of buses is operated by the Conseil Général de l'Isère. Move around Grenoble: <http://www.transisere.fr>



**GRENOBLE** organised the winter Olympics Games in 1968. The mountains around Grenoble offer a **fantastic playground for skiing** (down-hill, cross-country and back-country skiing) and other outdoor activities.

**Public transport to ski resorts:** <https://www.transaltitude.fr/en/>

## 1. YOUR ARRIVAL in Grenoble

### BY TRAIN:

From the railway station you can walk to the hotel or take the tram just outside the station (2 stops).



### BY PLANE:

Bus shuttles connect all airports: Lyon-St Exupéry (LYS), Geneva (GVA) or Grenoble-Isère (GNB) to the bus station which is close to the railway station.



## BUS SHUTTLE

### To Lyon-Saint Exupéry airport:

Every hour or 1/2h, travel time is approximately 1 hour.

→ <https://fr.ouibus.com/trajets/lyon-grenoble>  
→ <https://www.flixbus.fr/>

### To Geneva airport:

Only 5 times per day, travel time is approximately 2 hours.

<https://fr.ouibus.com/trajets/geneve-aeroport-grenoble>

### To Grenoble airport:

Actibus, few times per day, travel time is approximately 1 hour.

<https://www.actibus.com/grenoble-airport-shuttle/>

## 2. YOUR ACCOMMODATION in Grenoble



From the evening of Sunday 15<sup>th</sup> January to the morning of Tuesday 24<sup>th</sup> January 2023 and from Saturday 28<sup>th</sup> January to the morning of Saturday 4<sup>th</sup> February 2023, the participants will stay at:

**Aparthotel Adagio Grenoble Centre**

**6 rue Auguste Genin - 38000 Grenoble**

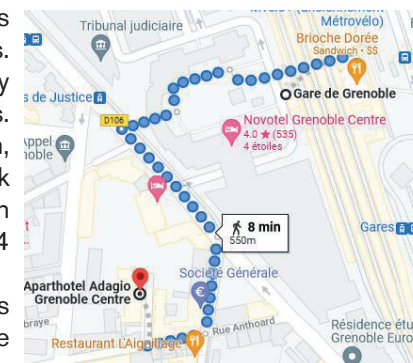
Phone: +33 4 76 39 20 00

→ <https://www.adagio-city.com/gb/hotel-B2R8-aparthotel-adagio-grenoble/index.shtml>

This hotel is located in the Europole business district, close to the city center and all amenities. This 3-star tourist residence offers completely furnished apartments with fully-equipped kitchens. Guests benefit from access to the fitness room, meeting room and, on request, a private car park (extra charge). Wireless internet is available in the residence. The reception staff are on hand 24 hours a day to cater for your needs.

If you arrive at the railway station or at the bus station (very close to each other), take the underground passage below the railway station, Cross Place Robert Schuman to Rue Pierre Sépard. Turn left and walk about 150m. Turn right onto rue Abbé Grégoire then right again onto Rue Anthoard. Walk about 50m, the Adagio hotel is in the first dead end on the right.

Note that if you want to arrive earlier or left later, you have to reserve and pay the nights.



A welcome buffet will be served to all the ERCA2023 participants on Sunday 15<sup>th</sup> January 2023 from 7 p.m. to 9 p.m. at "Aparthotel Adagio Grenoble Centre".



### 3. ERCA 2023 LECTURES at the "Maison Climat Planète (MCP)", UGA campus, from Tuesday 17<sup>th</sup> January

#### ■ How to get to Lectures from Aparthotel Adagio Grenoble Centre?

The lectures take place at:

**IGE - Maison Climat Planète**

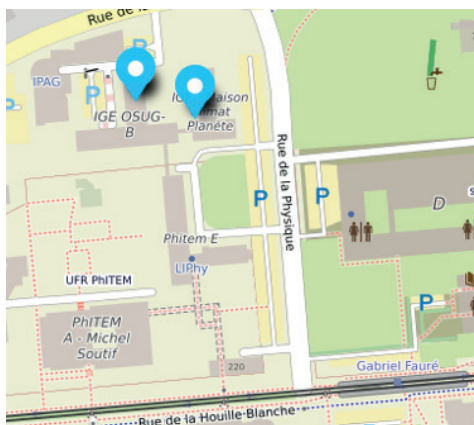
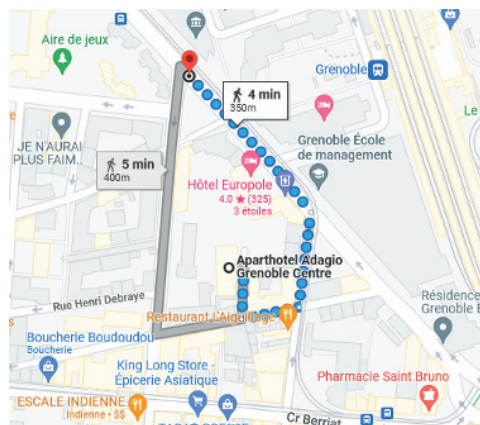
**70 rue de la physique**

**Domaine universitaire 38400 Saint-Martin-d'Hères**

You will need to use public transport. Tramway line B connects the hotel with UGA Campus, Saint Martin d'Hères.

From Aparthotel Adagio Grenoble Center:

- > Walk about 4 min to "**Palais de justice - Gare**" stop, tramway B line, "**Gières, Plaine des Sports**" direction.
- > Get off at "**Gabriel Fauré**" stop.
- > Walk about 2 min on "Rue de la Physique" to "IGE - Maison Climat Planète".



#### → ERCA OFFICE & CONTACT at LPSC

The ERCA office is initially located in the LPSC building, in the European Schools service on the "Polygone scientifique" of Grenoble. But, during the first week, on Monday 23<sup>th</sup> January and during the third week, a permanence will be ensured at the "Maison Climat Planète" by one or more members of the team, room n°116.

The ERCA contacts are: Clotilde BONHOURE-EFFANTIN, Isabelle GAUVIN, Youlia MAZET and Joseph GERMIANO.

In case of any question, you can also send an email to: [erca@univ-grenoble-alpes.fr](mailto:erca@univ-grenoble-alpes.fr)

#### → WIRELESS ACCESS in MCP building

The university will provide you with a personal wireless Internet access using your personal laptop, at the MCP building, valid during your stay in Grenoble.

You also will be able to use the Eduroam wireless network if your university is a member of this network (check with your IT or on the [www.eduroam.org](http://www.eduroam.org) web page).

#### → Lectures ONLINE during the session

Due to the current health situation, some of our lecturers will not be able to come in person to Grenoble. They will therefore be giving their course online. You will therefore need to have your laptop with you every day to be sure you can take the course on ZOOM. It would also be ideal if you have headphones with a microphone with you. However, the course will also be broadcast in the room through a videoconference system.

The link on the ZOOM room to follow the lectures ONLINE is:

<https://univ-grenoble-alpes-fr.zoom.us/j/3789518885>, Password : ERCA2023!

#### → OFFICIAL OPENING, Monday 16<sup>th</sup> January at 9.45 a.m.

The official opening will take place in the amphitheater of the IMAG building on the UGA Campus at the address:

**700 Avenue Centrale,  
38400 Saint Martin d'Hères.**

#### ■ How to go to the IMAG Auditorium?

From the Aparthotel Adagio Grenoble Center:

- > Take the B line tramway from "**Palais de justice - Gare**" stop, direction "**Gières Plaine des Sports**".
- > Get off at "**Gabriel Fauré**" stop.
- > Walk 900m, see map enclosed.



A buffet will be served at lunch time for this first day of classes



## 4. ICE-BREAKING PARTY

An ice-breaking party will be held on Monday 16<sup>th</sup> January at 6:30 p.m. at "Café des Arts", 36 Rue Saint-Laurent, Grenoble, on the right bank of Isère in the old Italian area.

### ■ How to go to "Café des Arts"?

#### → From the IMAG building:

Take the B line tramway from "Gabriel-Fauré", "Presqu'île" direction.  
Get off at the stop "Notre Dame-Musée".

#### → From the Adagio Grenoble Centre Aparthotel:

Take the B line tramway from the "Palais de justice - Gare" stop.

#### → Walking from "Notre Dame-Musée":

Turn left down "Place de Lavalette" road. Cross the river Isère on the "Pont de la Citadelle". Turn right along "Quai Xavier Jouvin" and walk about 50 metres.

**You have arrived!**

**Café des Arts**  
36 rue Saint Laurent  
38000 Grenoble



We ask you to prepare **ONE** pdf slide entitled **"Me, My project, my dream"** which presents you personally and professionally.  
Your name should figure clearly on it and you can add your pictures and short presentation of your scientific project and your dream. It is up to you to decide whether you make it serious or funny.

The principle is to keep it short and sweet.

Your slide is to be saved in pdf format only, as a file called:

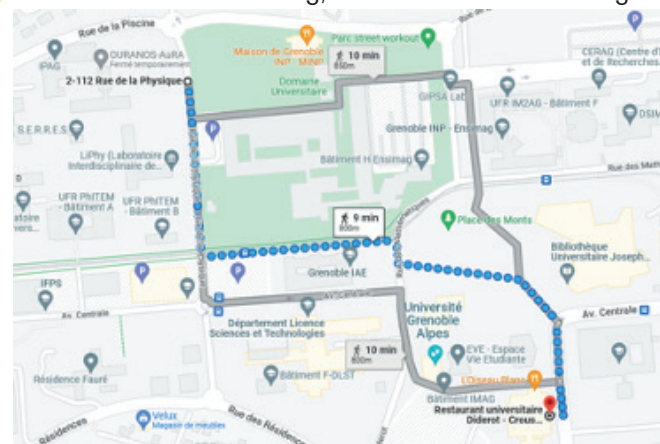
**"ERCA2023\_iceBreaking\_myname.pdf"**

and sent by email to [erca@univ-grenoble-alpes.fr](mailto:erca@univ-grenoble-alpes.fr) before the **3<sup>rd</sup> January 2023**.

## 5. LUNCHES ON WEEKDAYS in Grenoble



From Mondays to Fridays (except on Monday 16<sup>th</sup>), the participants and the lecturers will have lunch at the Diderot University restaurant, located at about 4 minutes walking, 400 m from MCP building.



Participants and lecturers will usually have lunch all together after the last morning presentation from about 12:45 to 2:15 p.m. ERCA will provide you with lunch tickets. Each ticket allows you to choose your lunch from several dishes (starters, main courses, cheese, fruits, desserts...).

**Dinners and lunches during the week-ends are not covered by ERCA.** There are numerous restaurants (including pizzerias and fast-foods) and food shops in downtown Grenoble.

Also, you will have cooking facilities at Adagio Grenoble Centre Aparthotel.

## 6. POSTERS and PRESENTATION of your Research Activity



You will be asked to present your research work with a poster. The poster session will take place on **Tuesday 17<sup>th</sup> January in the MCP hall, first floor.**

Please, bring your poster printed since it is not possible to print it on place. Alternatively, you can print it in private printing shops in Grenoble, but you have only 2 days to do it and it will be at your expense.

### Indications for your poster:

- Size should be (close to) A0 format (84×119 cm), with a vertical orientation (portrait).
- Use a logical plan: Title and Authors (with affiliation), abstract, keywords, introduction, development, conclusion, references.
- Title and authors should be displayed across the top of the poster with letters at least 2.5 cm high to be readable.
- The main text should be around 1 cm high to be easily readable from 2-3 metres.
- Make the abstract very concise.
- The introduction should provide enough background to understand the purpose of the study.
- Do not give so many results that their significance is obscured.
- Be sure to explain any tables.
- Discussion and conclusions should be very brief and clear.
- Tables and figures should have brief titles and not contain too much data.
- Use of colours is helpful, particularly in diagrams and graphs.
- Prepare your poster with your advisor and test it with non-specialist colleagues.

## 7. PANELS / DEBATES



ERCA organises 2 scientific debates each Monday at 6:30 p.m in the cozy atmosphere of the French bar "**Café des Arts**" downtown.

The debates will be accompanied by a dinner.

(for directions, see page 18 : [4. ICE-BREAKING PARTY](#))

**Café des Arts**  
**36, rue Saint Laurent**  
**Grenoble**

*(on the right bank of river Isère, in the old Italian area)*

### ■ How to go to "Café des Arts"?

See page 18



**Café des Arts**  
36 rue Saint Laurent  
38000 Grenoble

## 8. SCIENTIFIC PRACTICALS

Tutorials will be organised on Monday 30<sup>th</sup> January 2023 in the afternoon. There will be 4 different practicals: you will have to select one by answering a Doodle sent before by ERCA organisers.

### DESCRIPTION OF THE PRACTICALS

#### Snow Monitoring station at the Col de Porte Station (Isabelle Gouttevin, CEN)

A wide range of automated and manual snow and meteorological observations are co-located at the Col de Porte station (1,325m above sea level, about 30km away from Grenoble) and serve as: testbed for new instrumentation, establishment of driving/evaluation data for snowpack model development, build-up of climatologically relevant dataset... The practical at Col de Porte will consist of an illustration of key snow-related processes (surface energy and mass balance) together with existing and novel instrumentation to probe them (challenges for radiation, precipitation, and wind measurements).

Participants in this practical must be equipped with mountain gear (warm shoes & clothes, solar glasses). The participants will be picked up by a special bus after lunch at the Diderot University Restaurant and transported to the Col de Porte. The same bus will return them to the hotel by 5:00 p.m.

#### Advanced Spectroscopy (Roberto Grilli, IGE)

Fast and selective in situ trace gas measurements are a permanent issue in atmospheric chemistry. In recent years, ultrasensitive laser spectroscopic techniques have been developed (Cavity Ring Down Spectroscopy, Cavity Enhanced Absorption Spectroscopy,...). By means of the coupling of a laser to a high finesse optical cavity, the effective absorption length is enhanced up to tens of kilometers, while the actual cavity length is less than 1m allowing for a compact set-up. This tutorial will explore one of these techniques (OF-CEAS: Optical Feedback Cavity Enhanced Absorption Spectroscopy), which has been developed in Grenoble at LIPhy. OF-CEAS, enables the design of a compact instrument with very high detection sensitivity and molecule specificity, a response time smaller than 1s, with a gas sampling volume smaller than

20 cm<sup>3</sup>. Additional advantages are that the method does not require routine calibration with certified gas mixtures and that the resulting robust instruments can be operated by non-specialist. After being introduced to the principle of this technique, you will simulate absorption spectra for gas mixtures to understand the key parameters influencing the instrument performances, and then test those performances on an OF-CEAS analyzer dedicated to breath analysis. Similarities and differences to the other cavity based techniques will be stressed, as well as potential future applications.

#### Weather Radar (Fred Cazenave ou Brice Boudevillain, IGE)

Weather Radars are nowadays an integral part of weather monitoring. They are used as elements of meteorological networks by national weather forecast services, as alert systems for precision agriculture, and as a security element for many human activities such as airports. They also provide spatialised estimates of precipitation, extremely important for the forecast of hydrological risks such as floods. These systems undergo continuous development and improvements, such as the use of ever higher frequencies for higher resolution measurements, the use of polarisation for the detection of the shape of precipitating hydrometeors, and the use of Doppler techniques to measure the displacement of precipitating elements.

In this tutorial, you will get to see a dual polarisation X band weather radar installed on the roof of IGE's building, discuss the capabilities and limitations of such an installation, and get a first exposure to data retrievals from such an instrument, based either on actual data from the day (weather permitting) or on pre-existing data.

#### Air Quality Model Introduction (Lya Lugon, CERE-ENPC)

This practical is addressed to every student interested in discovering air quality modeling in urban areas. It will introduce the main aspects to handle an air-quality simulation at the street level, taking into account pollutant dispersion and chemical interactions. This approach can be used to evaluate the efficiency of actions aiming to reduce pollutant concentrations in urban areas, such as Low Emission Zones (LEZ). For this, we will use the open-source model MUNICH (Model of Urban Network of Intersecting Canyons and Highways) to calculate the concentrations of different pollutants in a network of streets. All work will be done in a Unix environment, and the analysis of input and output data will be done using pre-prepared Python scripts.



## COMMON DATA PRACTICAL

### Common Numerics: Data Access and Usage (Rémy LAPERE)

You will have some hands-on sessions with copernicus data analysis, which will involve the use of Jupyter notebooks. You may want to bring your personal computer for this, and have installed in advance the necessary tools. The easiest way to get that done is through the anaconda scientific software distribution (<https://www.anaconda.com/download/>). Please install the 3.7 version. If you have a hard time installing, do not worry: we will take some time on the spot to help out the few of you who get really stuck. We will also provide a local cloud solution for those practicals, but its effectiveness will depend on the number of simultaneous Wi-Fi connections, so having as many locally installed solutions as possible will definitively help.

## 9. WRITING A COLLABORATIVE PROJECT

In your future life as a scientist, you will spend time building cooperations, possibly with colleagues from other countries and/or other backgrounds, to develop research projects that you will define. ERCA is an opportunity to do so on one of the following subjects:

- Air Quality and Social Costs in a Changing Climate
- Nanosatellite Fleet for Observing Climate and Atmospheric Chemistry
- Environmental and Climate Services: use for Scientific Goals, Development and New Services.

Working in groups, you will be expected to prepare a thorough bibliographic review and write a research plan to answer the proposed call for research.

## 10. OBSERVATOIRE de Haute Provence (OHP)

The **Observatoire de Haute-Provence** is located near Forcalquier, about 200 km south of Grenoble, on a remote plateau within a typical Mediterranean oak forest in the Southern Alps : <http://www.obs-hp.fr>

All participants will be transported by a special bus on Tuesday 24<sup>th</sup> of January 2023 in the morning. Departure at 7.45 a.m. at the Grenoble Bus station, 11 place de la Gare, 38000 Grenoble.

You will leave the Observatory in the morning of Saturday 28<sup>th</sup> January, around 8.45 a.m. from Maison Jean Perrin at OHP, arrival in Grenoble at the Bus station, 11 place de la gare, 38000 Grenoble at around 2 p.m. (depending on road conditions).

### → OHP - ACCOMMODATION



Participants will stay at the Observatory itself ("Maison Jean Perrin" and Annexe Building). Rooms with single, double or triple occupancy, with or without private bathroom facilities. Breakfast, lunches and dinners will be served at "Maison Jean Perrin".

### → DEMONSTRATIONS, OBSERVATIONS, VISITS, EVENTS...

OHP is one of the main French astronomical observatories, with several optical telescopes and various other instruments. The location in the southern Alps is renowned for clear sky conditions. In addition, the "Laboratoire Atmosphères, Milieux, Observations Spatiales" (LATMOS) of Paris runs extensive experimental facilities for the study of the middle and upper atmospheres.



The PYTHEAS Observatory runs experimental facilities to study the Mediterranean forest (oak observatory O3HP).

During the day there will be demonstrations of instruments used for atmosphere observations. At night, there will be observations of the sky. **A torch light will be very useful in the evening to walk through the observatory. If any, binoculars would be also useful for sky observations.**



**It can be very cold and windy during night observations!**  
Do not forget warm clothes, gloves, hat, socks  
and solid boots for observations.

On Friday 27<sup>th</sup> January 2023, a special Dinner will be organised at Saint-Michel l'Observatoire. *(to be confirmed)*

## 11. GALA DINNER

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On Friday 3<sup>rd</sup> February, a gala dinner in a restaurant in Grenoble, is organised for all participants and organisers.

## 12. YOUR DEPARTURE

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Your room at Adagio aparthotel centre is booked by ERCA until the morning of Saturday 4<sup>th</sup> February, 2023.

# ERCA PROGRAM

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> WEEK 1: GRENOBLE

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> WEEK 2: MONDAY AT GRENOBLE

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> WEEK 2: OBSERVATOIRE de Haute Provence (OHP)

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> WEEK 3: GRENOBLE

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**NB: the program is always subject to change due to cancellations or serious weather perturbations.**

On Monday 16<sup>th</sup> January, Opening Day with buffet at IMAG building.

From Tuesday 17<sup>th</sup> January, lectures in Grenoble are at Maison Climat Planète, Salle de Réunion – n°117, first floor.

## WEEK 1: GRENOBLE

### → Official Opening

Monday 16 <sup>th</sup> January 2023	
9:45-10:15	<b>Welcome Coffee</b> IMAG Building, 700 rue Centrale, University Campus, 38400 Saint-Martin-d'Hères
10:15-11:00	<b>Official Opening</b> at Amphitheatre at IMAG building by ERCA Director and representatives of ERCA main support
11:00-12:15	<b>Julia Steinberger</b> Living well within Limits
12:45-14:15	Official opening Buffet
14:15-15:30	<b>Eugene Clothiaux, (1/3)</b> Atmospheric Radiation: Basic Physics and Concepts
15:30-15:45	Break
15:45-17:00	<b>Francis Codron (1/2),</b> Fundamentals on Atmospheric Dynamics
18:30	<b>Ice-Breaking Party</b> Café des Arts, downtown, 36, rue Saint Laurent, Grenoble (map on page 18)

	Tuesday 17/01	Wednesday 18/01	Thursday 19/01	Friday 20/01
8:30-9:45	<b>Eugene Clothiaux (2/3)</b> Radiation through Clear and Cloudy Atmospheres	<b>Markus Quante (1/2)</b> Introduction to Cloud and Precipitation Physics	<b>Stéphane La Branche</b> Climate Change and Social Sciences	<b>Jed Kaplan(2/2)</b> The Co-Evolution of the Earth System and Human Civilisations over the Preindustrial Holocene
9:45-10:15	Coffee break	Coffee break	Coffee break	Coffee break
10:15-11:30	<b>Francis Codron (2/2)</b> Fundamentals on Atmospheric Dynamics	<b>Anne Monod (2/2)</b> From Atmospheric Photochem to Secondary Organic Aerosol	<b>Stéphane La Branche</b> Climate Change and Social Sciences	<b>Julien Le Sommer</b> Role of the Oceans in the Climate System: Processes and Time-Scales
11:30-12:45	<b>Anne Monod (1/2)</b> Introduction to Atmospheric Chemistry and Photochemistry	<b>Jed Kaplan(1/2)</b> The Role of Land Surface Processes in the Climate System: Global Modelling of Biogeophysical and Biogeochemical Feedback	<b>Markus Quante (2/2)</b> The Role of Clouds in Climate and Environment	<b>Gerhard Krinner</b> Global Climate models: how are they evolving?
12:45-14:15	Lunch at Diderot RU	Lunch at Diderot RU	Lunch at Diderot RU	Lunch at Diderot RU
14:15-15:30	<b>SESSION POSTER</b>	<b>Eugene Clothiaux (3/3)</b> Radiation and Remote Sensing: A Few Current Applications 15:30-15:45 Break	<b>Remy Lapere</b> Common practical numerics: environmental data analysis basics	<b>PROJECT</b>
15:45-17:00		<b>PROJECT INTRODUCTION</b>		

### → Saturday 21<sup>st</sup> January 2023: snowshoes day trip organised by ERCA

ERCA will organise a snowshoe day trip to Chamrousse.



#### Do not forget to bring:

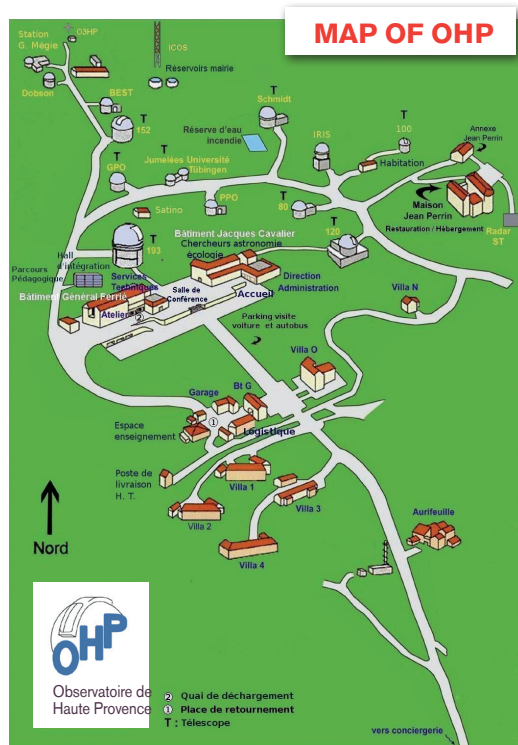
- Warm and waterproof clothes (gloves are very important)
- Waterproof shoes/boots (if possible, sturdy ankle boots)
- Sun glasses and cream (if the weather is sunny...)
- A backpack
- A bottle of water and your own picnic

Participants will be taken to Chamrousse by special bus. Meeting point at 8:45, rue de la Frise, Grenoble, behind the train station, in front of the Starbucks Coffee. You should be back at the Adagio Aparthotel at 5:30 p.m.

## WEEK 2: Monday at Grenoble

Monday 23/01 (Grenoble)	
8:30-9:45	<b>Andreas Richter:</b> Satellite Measurements of Troposphere Composition: Principles, Results, and Future Developments
9:45-10:15	Coffee break
10:15-11:30	<b>Mathieu Barthelemy:</b> Nanosatellites and Newspace Approaches to Earth Observation
11:30-12:45	<b>Andreas Richter:</b> Nitrogen Oxides in the Troposphere: Sources, Distribution, Impacts, and Trends
12:45-14:15	Lunch at Diderot RU
14:15-17:00	<b>IGE visit</b>
18:30	<b>Debate at Café des Arts:</b> <b>Isabelle Ruin:</b> Environmental Risk and Social Preception

## WEEK 2: Observatoire de Haute Provence (OHP)



### → Observatoire de Haute-Provence (OHP)

Discover OHP: <http://www.obs-hp.fr>

OHP is one of the main French astronomical observatories, with several optical telescopes (diameter: 1.93 m; 1.52 m; 1.20 m and 0.80 m) and various other instruments. It is located at a place which is renowned for clear sky conditions.

The “Laboratoire Atmosphères, Milieux, Observations Spatiales” (LATMOS) of Paris (University of Versailles-Saint-Quentin-en-Yvelines/CNRS/University Pierre-et-Marie-Curie) also has extensive experimental facilities for the study of the middle and upper atmospheres here. The main instruments which are operated at OHP by LATMOS are described on page 32.





Discover LATMOS: <http://www.latmos.ipsl.fr>

### Mie-Rayleigh Temperature Lidar

The lidar is an active system including a laser and a telescope receiver. In this case the emitted laser beam is a visible wavelength that permits stratospheric aerosols to be measured by backscattering below 30km, by assuming molecular scattering, and temperature above (30-80 km) by using the perfect gas law. Temperature time series obtained at OHP since 1978 are the longest ever obtained with this technique. This system is also able to measure water vapour and temperature in the presence of aerosols.

### Dobson and SAOZ Spectrometers

Total ozone is measured using the differential technique with two different instruments. The well-known Dobson spectrometer directly observes the sun at a couple of wavelengths: one absorbed and the other non-absorbed by ozone. The total ozone quantity can be derived from the data if the absorption cross section is known. The SAOZ spectrometer (Système d'Analyse par Observation Zénithale i.e. Analysis by Zenith Observation) is based on the same principle except that the full spectrum is observed. In that case there are less interferences with other absorbents and the total column of other chemical constituents such as NO<sub>2</sub> can be derived. The SAOZ spectrometer points towards the zenith direction. During sunset and sunrise, the optical path is increased and the sensitivity maximised. The SAOZ spectrometer is well adapted for polar regions during winter when sun elevation is always small.

Discover the PYTHEAS Observatory: <http://www.pytheas.univ-amu.fr>

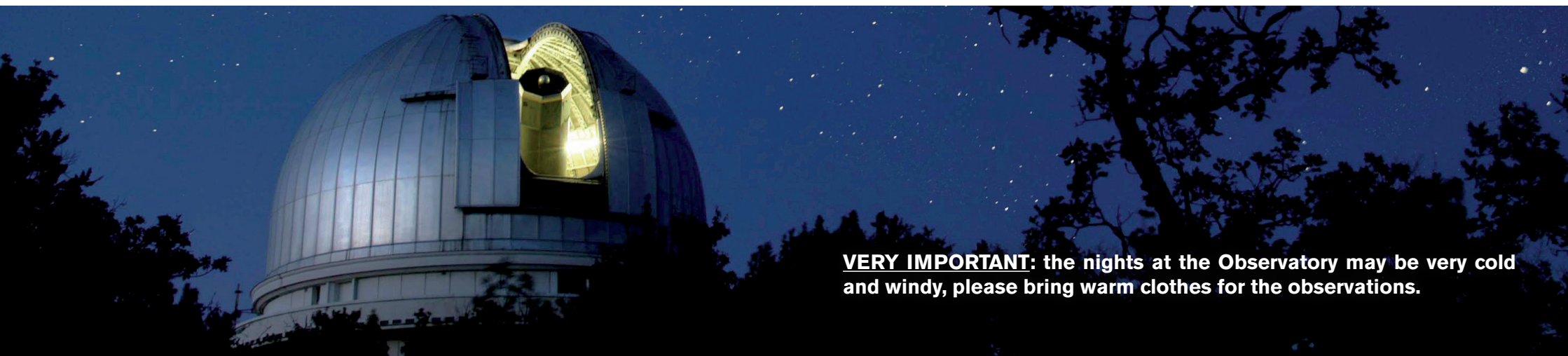
### Ozone Lidar

Ozone profiles can be derived using the DIAL techniques. Two lasers are required: one emitting in the ozone absorption band and the other at a non absorbed wavelength. The differential absorption profile can be inverted into ozone density profiles. The two lidars are dedicated to two different altitude ranges: the troposphere and the stratosphere. The two systems use two different pairs of wavelengths because the range (and hence required laser power) and the ozone density (larger in the stratosphere) are different. The laser used for the stratosphere is more powerful, with a wavelength not too strongly absorbed by ozone in order to reach the stratosphere.

### Wind Lidar

It is a spectral lidar. The method is based on the measurement of the Doppler shift of the backscattered beam. This is achieved by using two narrow bandwidth Fabry-Perot filters on each wing of the Gaussian envelope. The ratio of the two signals provides a direct measurement of the wind. Two directions and the zenith (for calibration) are sounded successively every two minutes to obtain the meridional and zonal winds.

**The PYTHEAS Observatory of Marseille also runs experimental facilities to study the Mediterranean Forest (Oak Observatory O3HP).**



**VERY IMPORTANT:** the nights at the Observatory may be very cold and windy, please bring warm clothes for the observations.

## DAY 1

## Tuesday 24/01/2023

7:45	Departure from Grenoble Bus station, 11 place de la Gare at 8:00 SHARP
12:15	Arrival at "Maison Jean Perrin", OHP
12:30-14:00	Lunch at Maison Jean Perrin
14:00-15:00	Settling the participants in their rooms at Maison Jean Perrin
15:00-15:45	<b>Alain Sarkissian: Presentation of the "Observatoire de Haute-Provence"</b> at movie theater
15:45-16:00	Coffee break
16:00-17:00	<b>Sergey Khaykin: Lidar Technique for Atmosphere Observations</b> at movie theater
17:00-18:00	<b>Luc Favre: Astronomical Observations at OHP and elsewhere</b>
18:00-18:30	Free Time
18:30-20:00	Dinner at Maison Jean Perrin
20:00-23:30	<b>Introduction to Observatorial Astronomy.</b> <b>The participants are splitted into 4 groups.</b> <b>Visit to the lidars and observation with 80 cm and 120 cm optical telescopes.</b>
20:00-21:30	<b>Group 3:</b> 120 cm Telescope (Luc Favre) <b>Group 4:</b> 80 cm Telescope (Alain Sarkissian) <b>Group 1:</b> Ozone lidars (Philippe Keckhut) <b>Group 2:</b> Temperature and wind lidars (Sergey Khaykin)
21:30-22:00	Break
22:00-23:30	<b>Group 1:</b> 120 cm Telescope (Luc Favre) <b>Group 2:</b> 80 cm Telescope (Alain Sarkissian) <b>Group 3:</b> Ozone lidars (Philippe Keckhut) <b>Group 4:</b> Temperature and wind lidars (Sergey Khaykin)

## DAY 2

## Wednesday 25/01/2023

10:00-10:40	<b>Ozone Balloon Launch</b>
10:40-10:50	Coffee break at Gérard Mégie
10:50-11:30	<b>Group 1:</b> Lidars (Philippe Keckhut) <b>Group 2:</b> Atmospheric Spectroscopy from Scratch (Didier Voisin) <b>Group 3:</b> Preparation of Ozone Sondes (Sergey Khaykin) <b>Group 4:</b> Visit of Oak Observatory (Jean-Philippe Orts)
11:30-12:10	<b>Group 4:</b> Lidars (Philippe Keckhut) <b>Group 1:</b> Atmospheric Spectroscopy from Scratch (Didier Voisin) <b>Group 2:</b> Preparation of Ozone Sondes (Sergey Khaykin) <b>Group 3:</b> Visit of Oak Observatory (Jean-Philippe Orts)
12:10-12:30	Free Time
12:30-14:00	Lunch at Maison Jean Perrin
14:00-14:40	<b>Group 3:</b> Lidars (Philippe Keckhut) <b>Group 4:</b> Atmospheric Spectroscopy from Scratch (Didier Voisin) <b>Group 1:</b> Preparation of Ozone Sondes (Sergey Khaykin) <b>Group 2:</b> Visit of Oak Observatory (Jean-Philippe Orts)
14:40-15:20	<b>Group 2:</b> Lidars (Philippe Keckhut) <b>Group 3:</b> Atmospheric Spectroscopy from Scratch (Didier Voisin) <b>Group 4:</b> Preparation of Ozone Sondes (Sergey Khaykin) <b>Group 1:</b> Visit of Oak Observatory (Jean-Philippe Orts)

## DAY 2 (continued)

Wednesday 25/01/2023	
15:20-15:40	Coffee break
15:40-16:40	<b>Philippe Keckhut: Monitoring Atmospheric Changes using the synergy between ground-based and satellite experiment</b> at movie theater
16:40-17:40	<b>Alain Sarkissian: Spectroscopic measurements of stratospheric constituents</b> at movie theater
17:40-18:30	Free Time
18:30-20:00	Dinner at Maison Jean Perrin
20:00-23:30	<b>Visit to the lidars and observation with 80 cm and 120 cm optical telescopes.</b>
20:00-21:30	<b>Group 4:</b> 120 cm Telescope (Luc Favre) <b>Group 3:</b> 80 cm Telescope (Alain Sarkissian) <b>Group 2:</b> Ozone lidars (Philippe Keckhut) <b>Group 1:</b> Temperature and wind lidars (Sergey Khaykin)
21:30-22:00	Break
22:00-23:30	<b>Group 2:</b> 120 cm Telescope (Luc Favre) <b>Group 1:</b> 80 cm Telescope (Alain Sarkissian) <b>Group 4:</b> Ozone lidars (Philippe Keckhut) <b>Group 3:</b> Temperature and wind lidars (Sergey Khaykin)

## DAY 3

Thursday 26/01/2023	
10:40-11:00	Coffee break
11:00-11:45	<b>Irène Xueref-Rémy : Observing Atmospheric Gases</b> at movie theater
11:45-12:00	Free Time
12:00-14:00	Lunch at Maison Jean Perrin
14:00-14:45	<b>Group 1:</b> Dobson and SAOZ spectrometers (Alain Sarkissian) <b>Group 2:</b> Practical on CO2 measurements (Irène Xueref-Rémy) <b>Group 3:</b> Visit of the 152 cm telescope (Luc Favre) <b>Group 4:</b> Balloon trajectories (Sergey Khaykin)
14:45-15:30	<b>Group 2:</b> Dobson and SAOZ spectrometers (Alain Sarkissian) <b>Group 3:</b> Practical on CO2 measurements (Irène Xueref-Rémy) <b>Group 4:</b> Visit of the 152 cm telescope (Luc Favre) <b>Group 1:</b> Balloon trajectories (Sergey Khaykin)
15:30-15:45	Coffee break at Gérard Mégie
15:45-16:30	<b>Group 3:</b> Dobson and SAOZ spectrometers (Alain Sarkissian) <b>Group 4:</b> Practical on CO2 measurements (Irène Xueref-Rémy) <b>Group 1:</b> Balloon trajectories (Sergey Khaykin) <b>Group 2:</b> Visit of the 152 cm telescope (Luc Favre)
16:30-17:15	<b>Group 4:</b> Dobson and SAOZ spectrometers (Alain Sarkissian) <b>Group 1:</b> Practical on CO2 measurements (Irène Xueref-Rémy) <b>Group 2:</b> Visit of the 152 cm telescope (Luc Favre) <b>Group 3:</b> Balloon trajectories (Sergey Khaykin)
17:15-18:00	Free Time
18:00-20:00	Dinner at Maison Jean Perrin
20:00-23:00	<b>PRACTICALS: NEW GROUPS, selection by thema</b> (depends on weather conditions)
23:00-4:00	<b>GROUP AA :</b> Obs with the T80 telescope (Alain Sarkissian) <b>GROUP BB :</b> Obs with the T120 telescope (Luc Favre)



## DAY 4

Friday 27/01/2023

9:20-10:00	<b>Irene Xueref: Carbon Cycle</b>
10:00-10:20	Coffee break
10:20-11:50	<b>PRATICALS</b> GROUP CC : Spectral Analysis (Alain Sarkissian) GROUP DD : Lidar Inversion (Sergey Khaykin)
11:50-12:00	Free Time
12:00-14:00	Lunch at Maison Jean Perrin, buffet of local food
14:00-15:30	GROUP DD : Spectral Analysis (Alain Sarkissian) GROUP CC: Lidar Inversion (Sergey Khaykin) GROUP AA: Surface - atmosphere fluxes (Ilja Reiter) GROUP BB: Image processing (Luc Favre)
15:30-16:00	Coffee break
16:00-17:00	Visit of the 193 cm telescope (Luc Favre)
17:00-17:45	Open discussion
17:45-18:30	Free Time
18:30-00:00	Closing dinner

## DAY 5

Saturday 28/01/2023

8:45	Departure from Maison Jean Perrin for Grenoble
14:00	Arrival at Grenoble Bus station, 11 place de la Gare

## WEEK 3: GRENOBLE

	Monday 30/01	Tuesday 31/01	Wednesday 01/02	Thursday 02/02	Friday 03/02
8:30-9:45	<b>Lya Lugon (1/2)</b> Atmospheric chemistry modeling	<b>Peter Brimblecombe (1/2)</b> Air pollutants and their health impact	<b>Olivier Chanel</b> How climate change challenges economists	<b>Stefan Kollet</b> Hydrology as a Boundary Condition for the Atmosphere	<b>Stefan Kollet</b> Hydrology as a Boundary Condition for biogeochemical cycles
9:45-10:15	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
10:15-11:30	<b>Project</b>	<b>Sergey GULEV (1/2)</b> Climate change and the Hydrologic Cycle	<b>Lya Lugon (2/2)</b> Aerosols atmospheriques	<b>Thomas Bauska (1/2)</b> Ice-Core Records as Archives of Past Climate and Atmospheric Composition	<b>Yoav Yair (2/2)</b> Lightning in the Solar System and Beyond
11:30-12:45		<b>Xavier Basagaña</b> Air quality from epidemiology POV	<b>Sergey GULEV (2/2)</b> Climate Change and the Hydrologic Cycle	<b>Peter Brimblecombe (2/2)</b> Cultural heritage and climate	<b>Thomas Bauska (2/2)</b> Ice-Core Records as Archives of Past Climate and Atmospheric Composition
12:45-14:15	Lunch at Diderot RU	Lunch at Diderot RU	Lunch at Diderot RU	Lunch at Diderot RU	Lunch at Diderot RU
14:15-15:30	Practicals (choise): -Snow monitoring Station -Advanced Spectroscopy -Weather Radar -Air Quality model introduction	<b>Ralf Ebinghaus (1/2)</b> Emission Sources, Regional and Global Distribution of Mercury (Hg)	<b>Ralf Ebinghaus (2/2)</b> Emission Sources, Regional and Global Distribution of Persistent Organic Pollutants (POPs)	<b>Yoav Yair (1/2)</b> From Ions to Thunderstorms: a Review of Atmospheric Electricity	<b>Project presentations</b>
15:30-15:45		Break	Break	Break	
15:45-17:30		<b>Caroline Brimblecombe</b> Scientific and technical writing	<b>Project</b>	<b>Project</b>	<b>Project presentations</b>
	Debate at Café des Arts <b>Thierry Lebel:</b> The Scientist and the Expert				<b>Good bye Party at Le Buis'trot at 19h00</b>

→ IGE visit

On Monday 23<sup>rd</sup> January 2023 the participants will visit the IGE (glaciology section) from 14:15 to 17:00.

Meeting point at Maison Climat Planète, first floor hall.

**The Institute of Environmental Geosciences (IGE):** <http://www.ige-grenoble.fr>

*Address: 54 Rue Molière, Domaine Universitaire, 38400 Saint-Martin-d'Hères, on the University Campus, very close to tramway B stop "Les Taillées".*

IGE is a public research institute of the National Centre for Scientific Research (CNRS), the University of Grenoble-Alpes (UGA), the Institut Polytechnique de Grenoble (G-INP), and the Institut de Recherche et Développement (IRD).

IGE is reputed for outstanding research in hydrology, oceanography, polar climates, and glaciology. You will visit the glaciology department, which is especially known for the reconstruction of past changes of climate and atmospheric composition during the last climatic cycles from polar ice cores. These studies are based on the well preserved frozen atmospheric archives which have been obtained by ice drilling in the central plateau areas of Antarctica and Greenland.

The current investigations are focused on the cryosphere, that is, polar climates, ice caps, and mountain glaciers, with the study of the physical and mechanical properties of the ice, modelling of ice caps, chemical exchanges between the low atmosphere and snow and ice fields, remote sensing of snow and ice covered areas in polar and temperate regions, mass balance of Alpine and Andean glaciers as well as high latitude climate modelling and atmospheric chemistry modelling.

Of particular importance are polar field campaigns organised in the frame of international programmes such as the European Programme for Ice Coring in Antarctica (EPICA), as well as field parties in the Alps, the Arctic, the Andes and the Himalayas.

Research conducted at IGE contributes to a better understanding of important scientific issues which are fundamental to our society as a whole, such as the greenhouse effect, climate and environmental changes, atmospheric pollution at global and regional scales, as well as risks associated with glaciers.


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## ERCA 2023

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