LMDZ Training January 2023

Who are you ?

You might want to think about forming groups with people with shared interests for tutorial 2

Rain effects on air-sea CO_2 exchanges

Laetitia Parc, PhD student (2nd year)
Supervisors: Hugo Bellenger, Laurent Bopp, David Ho
Laboratory: LMD

Current work : Study the interplay of **rain impacts on CO_2 fluxes** at the **ocean interface** through **local** study cases using field data.

- Based on an off-line **1D model**

Next objectives: Integrate this CO_2 **flux parametrization** module into the IPSLCM6 **global model**

- Use LMDZ coupled with NEMO-PISCES for global and regional studies

Objectives for the LMDZ training:

- Better understanding of the **model structure** and on how to use LMDZ, with a focus on **surface processes**.
- Being able to better **define the framework** of these global and regional studies.

Modéliser la variabilité des vents de surface en Antarctique

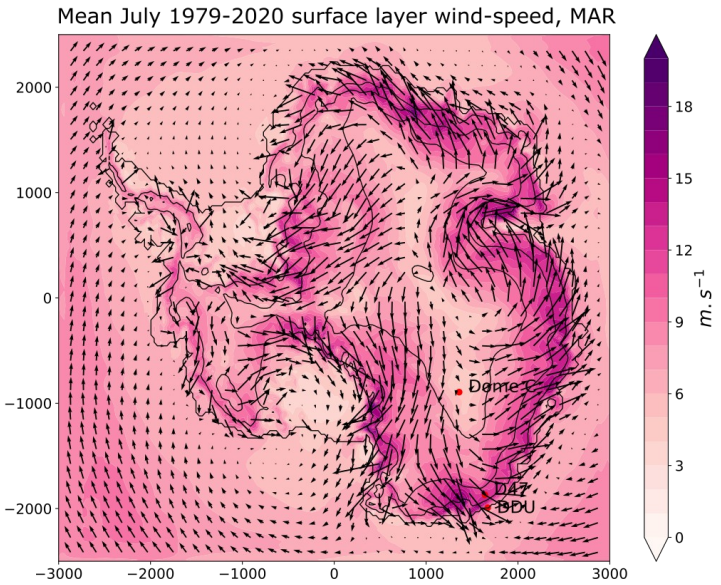
Cécile Davrinche
2ème année de thèse

LSCE

Sujet de recherche

Séparer la contribution de la grande échelle des processus de surface pour comprendre l'évolution du vent en Antarctique:

- Avec un modèle régional (MAR)
- En Terre Adélie



Intérêt pour LMDZ

Dans le cadre de ma thèse:

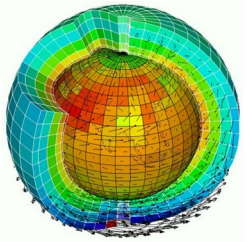
- Faire le lien entre mon modèle régional et les GCM
- Etudier les tendances d'évolution du vent sur une durée plus longue

Pour ma culture générale:

- Mieux comprendre les GCM et leurs modes de fonctionnements
- Pour d'éventuels post-docs
- Pour mieux comprendre la littérature

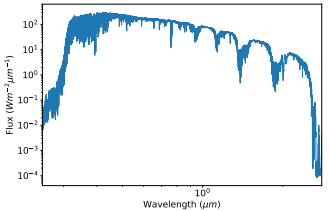
Climate and habitability of Earth-like exoplanets and their observability using future high-resolution spectrographs in reflected-light

Mathilde Houelle, PhD student (1st year), Geneva Observatory
Supervisors: Emeline Bolmont and Christophe Lovis



Climate modeling with the Generic PCM

- *Explore the effect of different parameters on the climate of temperate rocky exoplanets*
- *Contribute to the development of the model (stellar spectra...)*



High-resolution radiative transfer code
To generate synthetic high-resolution reflected-light spectra from the results of the Generic PCM simulations

RISTRETTO

High-resolution spectrograph simulator
To generate the expected observed high-resolution reflected-light spectra from the synthetic spectra


ELT (ESO/L. Calçada)

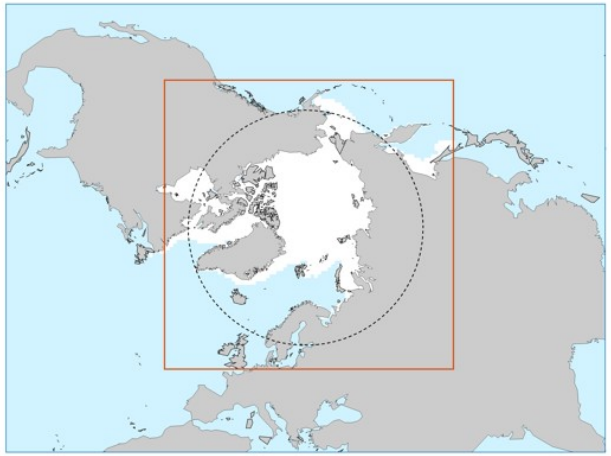
Simulate and prepare future observations of Earth-like atmospheres with high-resolution reflected-light spectrographs (VLT/RISTRETTO, ELT/ANDES)

Louis Marelle

CNRS researcher at LATMOS

Research interests

- Regional modeling of arctic atmospheric composition and climate (WRF/WRF-Chem)



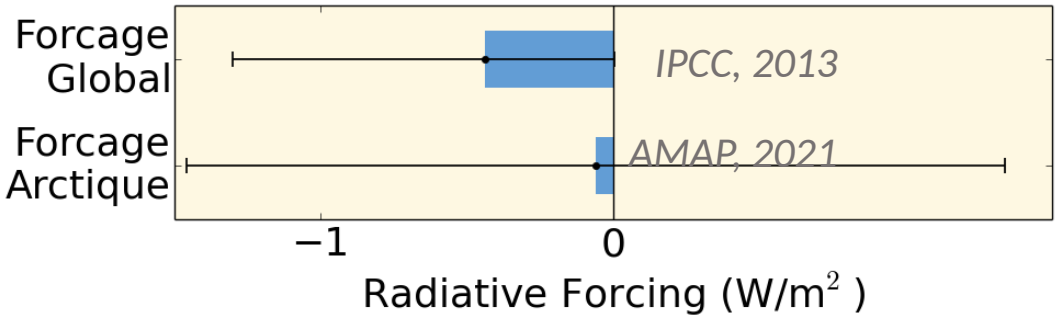
Typical regional arctic simulation domains using WRF-Chem

- Aerosol-cloud-precipitation interaction processes
- Arctic primary aerosols (natural and anthropogenic)
- Radiative forcing of aerosols and ozone
- Climate downscaling

Interest in LMDz

- Using LMDz-INCA to generate boundary & initial conditions for regional runs / projection downscaling
- Contributing to INCA development
- Arctic cloud-aerosol interactions and cloud feedbacks
- Quantifying aerosol radiative forcing

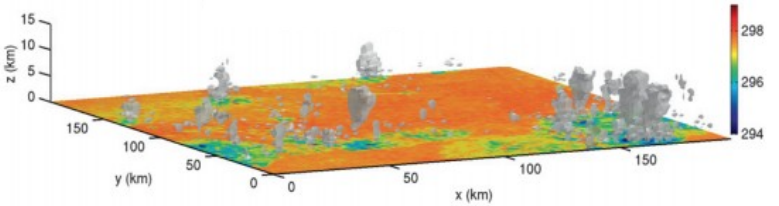
Cloud-aerosol radiative forcing



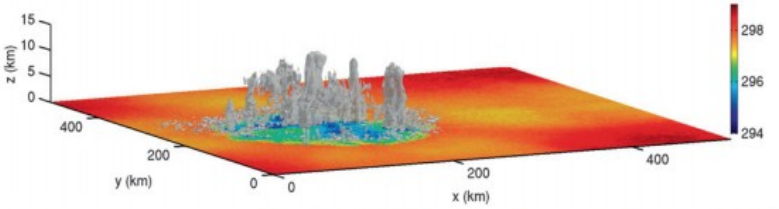
Giulio Mandorli

Supervisor Claudia Stubenrauch
Group ABCt
Period 07/2021 - 06/2024

Muller & Held 2012



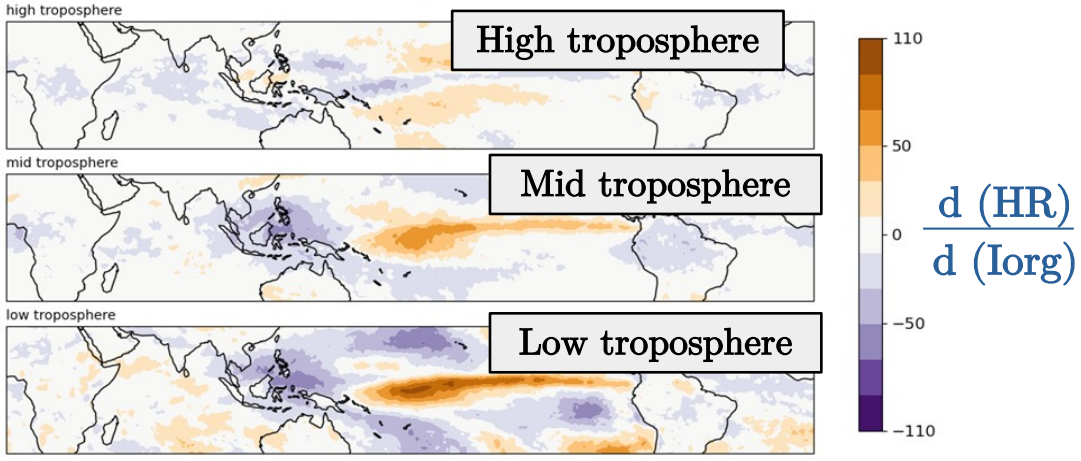
Convection
not organized



convection
organized

1) Machine learning
   → obtain cloud systems vertical structure.

2) Convective organization
   → relationship with tropospheric heating



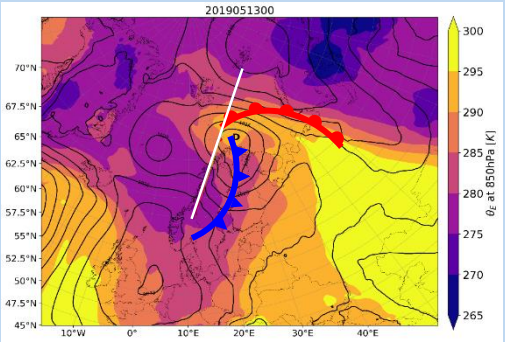
Meryl WIMMER : CNES Post-Doc at LMD

Supervisors : Gwendal RIVIÈRE (LMD), Etienne VIGNON (LMD), Julien DELANOË (LATMOS), Éric BAZILE (CNRM/Météo-France)

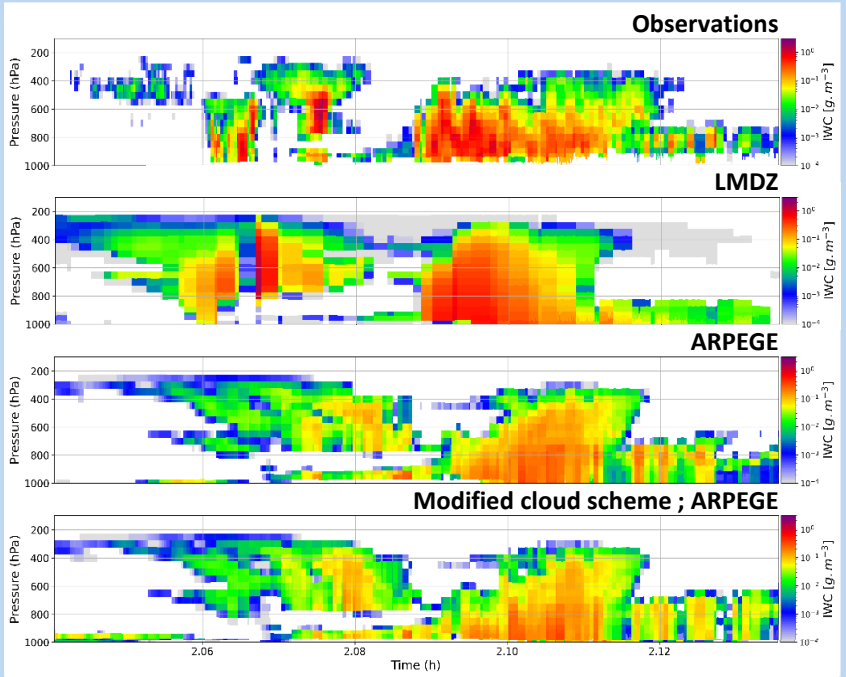
Impact of cloud microphysical scheme of ARPEGE and LMDZ on Arctic Cyclone dynamics: Comparison with aircraft and satellite (CloudSat – CALIPSO) data

PhD:
- at CNRM
- representation of model error due to physical parameterization in the regional Ensemble Prediction System operational at Météo-France (AROME-EPS)

Student supervision: Lukas Hofmann
- internship at LMD, from February to July 2022
- evaluation of LMDZ and influence of cloud scheme on Arctic Cyclone forecast skills



Satellite track above an Arctic Cyclone, the 13th May 2019
Black contours: MSLP, shading: θ_e at 850hPa



IWC along satellite track; observed and predicted data

Formation LMDZ 2023

Contact : meryl.wimmer@lmd.ipsl.fr

Xiaoting Chen

PhD student (1st year)

Supervisor: Claudia Stubenrauch **Laboratory:** LMD **Group:** ABCt

Research topic: Impact of diabatic heating of upper tropospheric clouds on general atmospheric circulation and climate

Current work:

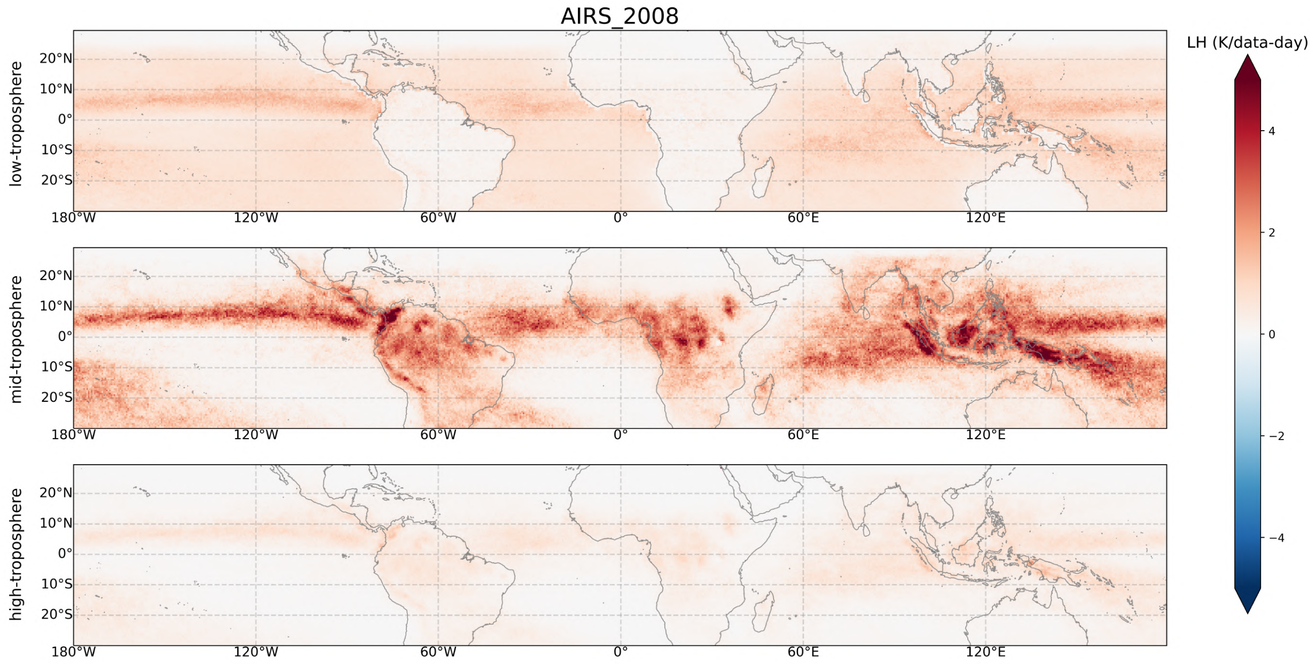
Deep neural network learning: optimized non-linear regression models

=> apply to the time series of CIRS-AIRS and CIRS-IASI data

=> estimate latent heating rates

Next step:

Quantify the dynamical response of the climate system to atmospheric heating from these UT cloud systems (by using LMDZ zoomed-in version)



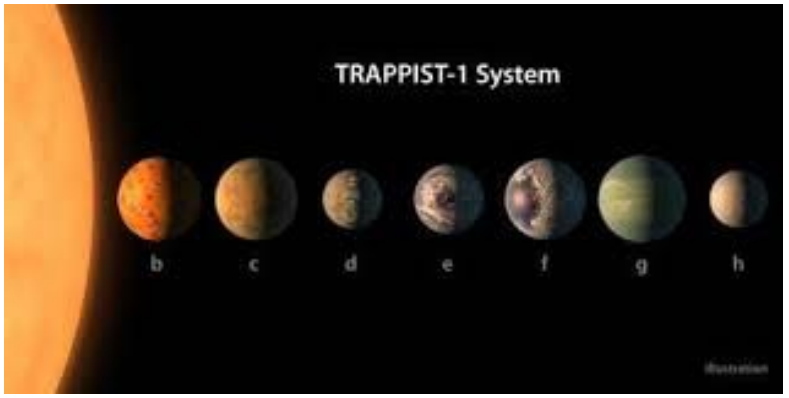
Alice Maurel - 1st year PhD student
Clouds on rocky exoplanets

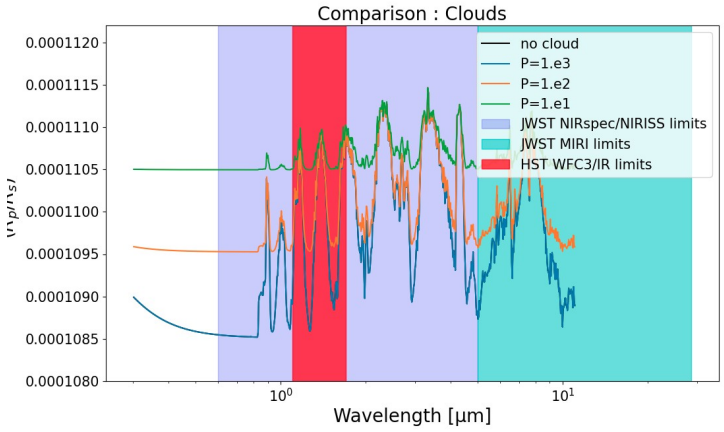
Supervisors : Jean-Philippe Beaulieu (IAP), Martin Turbet (LMD), Pierre Drossart (IAP)

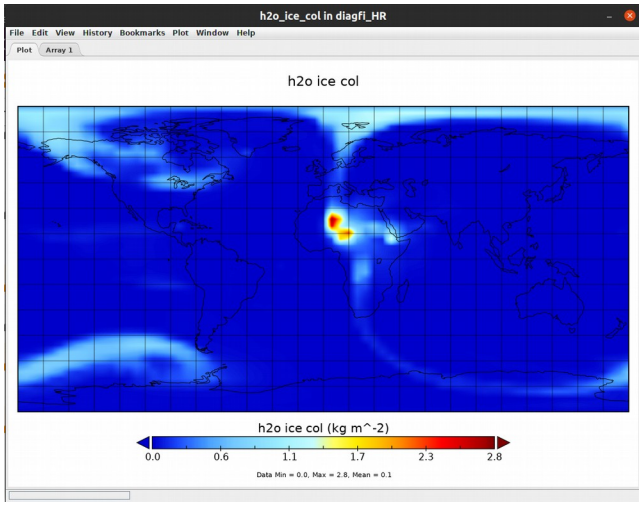
Observations of exoplanets spectra **(JWST)**

Retrieval → atmos.composition **(TAUREX)**

! Refine cloud modelization **(LMDz)**







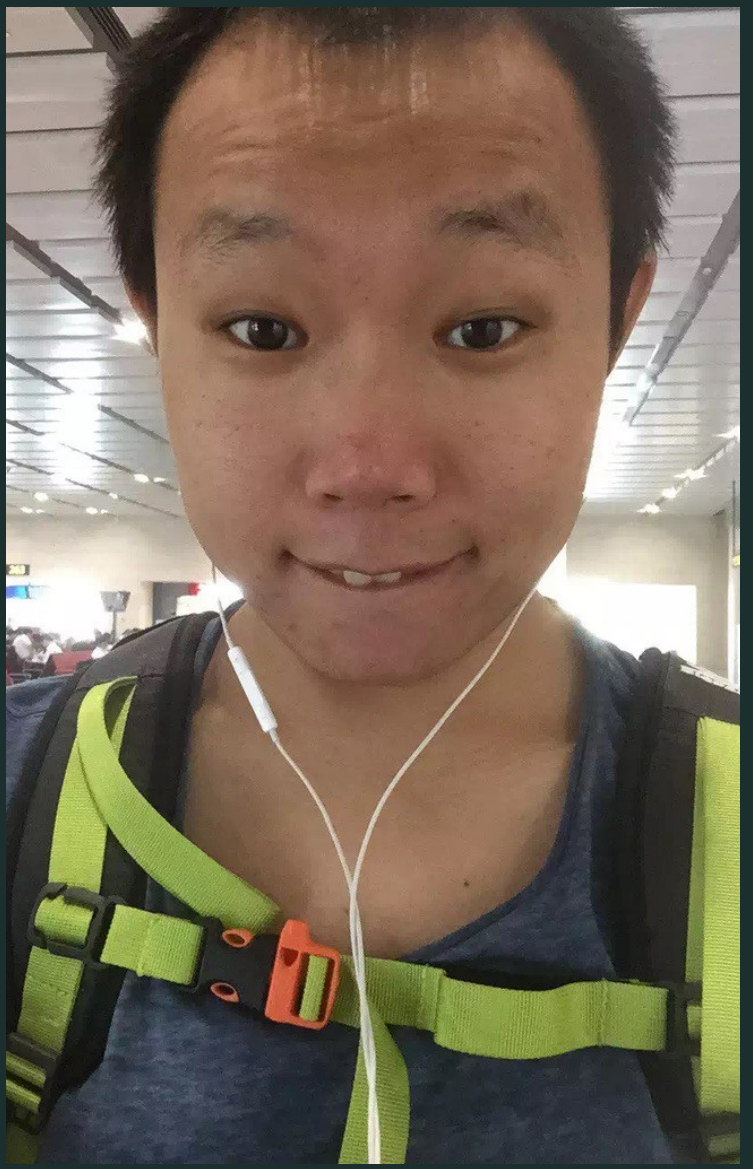
LMDz : generic PCM → simulations of the behavior of clouds on rocky exoplanets

Wang Zhiyuan: Visiting scholar at LMD

Working on: Historical global monsoon climate; detection and attribution of the anthropogenic signal in regional climate change under global warming.

LMD project: Regional dynamic downscaling simulations for the future climate change in eastern China.

Want to learn: How to use LMDZ on basic climate change simulations and modify the surface processes in the LMDZ to discover the coupled climate evolutions?



Alexis Mariaccia

PhD au LATMOS (3ème année)

Evolution de la température de la stratosphère aux hautes latitudes de l'hémisphère nord; Mécanismes d'initialisation des échauffements

Formation:

1. Licence de Physique à l'Université Lyon 1

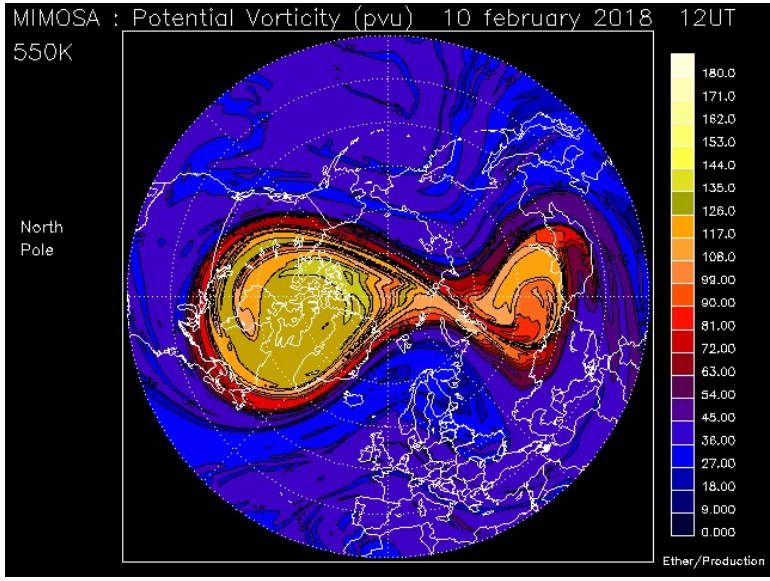
2. Master Sciences de l'Océan, de l'Atmosphère et du Climat (SOAC) à l'Université Lyon 1

3. Doctorat au sein de l'équipe STRATO au LATMOS sous la direction de Philippe Keckhut et Alain Hauchecorne

Motivation pour LMDZ:

- Appréhender et utiliser un modèle de circulation Générale
- Modéliser et prédire les phénomènes SSWs
- Utile pour modéliser les inversions mésosphériques (travail future)

SSW on Feb 10th, 2018



From MIMOSA

Formation LMDZ : présentation du participant Mohammad EL AABARIBAOUNE

Nom et prénom : Mohammad EL AABARIBAOUNE

Organisme : Université Mohamed 6 Polytechnique (UM6P) de Benguerir (Maroc)

Poste : Ingénieur de recherche

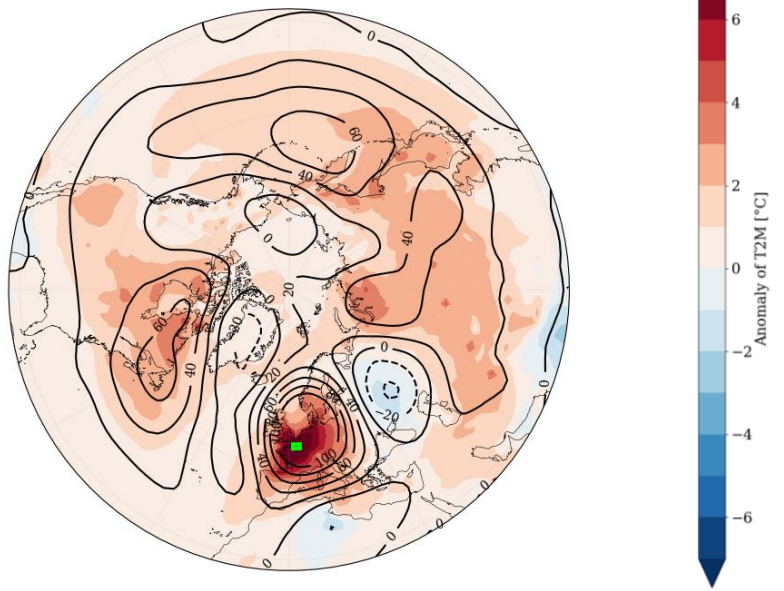
Attentes de la formation : Je travaille sur le portage de LMDZ sur le calculateur de l'UM6P avec M. Idelkadi Abderrahmane. Cette formation me pertmettra du coup de découvrir LMDZ dans sa composante scientifique (la phisique et la dynamique) mais ausi dans la partie code. Venant d'un environement d'assimilation de données, cette formation me servira aussi comme une introduction à la modélisation du climat.

Robin Noyelle – PhD student

Who I am ?

- PhD student at **Laboratoire des Sciences du Climat et de l'Environnement** (LSCE) – 2nd year
- Supervised by Pascal Yiou and Davide Faranda
- **My work:** focuses on the **dynamics (especially in the atmosphere) leading to extreme temperatures in Western Europe** and how this dynamics can change with climate change
- **Methods:** I am and will be using **ensemble methods** to simulate more extreme events

- **Interests in LMDZ:** I will be using the LMDZOR configuration to simulate extremes
- **Objectives for the training:**
  - Understand which physical mechanisms are and are not in the model
  - Getting familiar with the technicalities to launch a simulation with the model
  - Ensemble simulation (?)



Marine LANET

INSTITUT d'OPTIQUE GRADUATE SCHOOL ParisTech / Imperial College London	2013 – 2018	Education : • Classes Préparatoires • SupOptique • Imperial College London
nomadéis	2018 – 2021	Consulting in Sustainability and Environment
LMD	Dec. 2021 - 2024	PhD at LMD in Sorbonne Université with Hervé LE TREUT and Laurent LI

PhD :

- Characterize and interpret local climate evolution during the last decades in Nouvelle-Aquitaine, in terms of trends, change in the seasonal cycle and extreme events and analyze projections
- Develop a conceptual ditch drainage model and quantify the drought and flood risk reduction potential using storylines based on plausible short and long term climate conditions in Nouvelle-Aquitaine

Interest in LMDz :

- Running LMDz zoomed in Nouvelle-Aquitaine, nudging, coupling with ORCHIDEE

Last centuries Antarctic climate: reconstructions from shallow cores with a model-data approach

Niels Dutrievoz, phD student (first year)
Supervisor: Cécile Agosta & Didier Roche
Laboratory: LSCE

Research topic:
Reconstructing the Antarctic climate of the last few centuries by trying to understand how the snow isotope signal is influenced by local processes and by large-scale circulation

Tools:
- MAR-iso & LMDZ-iso models
- Isotopic observations between Dumont d'Urville and Dôme C in :
  - water vapour & precipitation,
  - surface snow & snow cores

Interest in LMDZ :
- Setting up LMDZ-iso simulations
- Forcing MAR-iso with LMDZ-iso
- Intercomparison of models

Pablo Fernández — 24 year-old 2nd year PhD student from Madrid (Spain)

BsC in Physics, Universidad Complutense de Madrid (2016-2020):

- **BsC Project:** Impact of ENSO on the West African Monsoon.

MsC in Meteorology and Geophysics, Universidad Complutense de Madrid (2020-2021):

- **Master thesis:** Equatorial energy transport and the West African Monsoon.
- **Internship I:** Monitoring and evolution of snow cover in the Sistema Central (Madrid and Castilla y León, Spain).
- **Intership II:** Large-scale air-sea interactions in the Northern Hemisphere (annular modes).

PhD ED129 S. de l'Environnement (2021 – ongoing):

- **Current interests:** Small-scale air-sea interactions, tropical ocean dynamics, air-sea fluxes, mesoscale eddies, submesoscale filaments and fronts.
- **Next steps of my thesis:** use of high-resolution regional models to obtain better estimates of air-sea fluxes → need of numerical modelling notions.

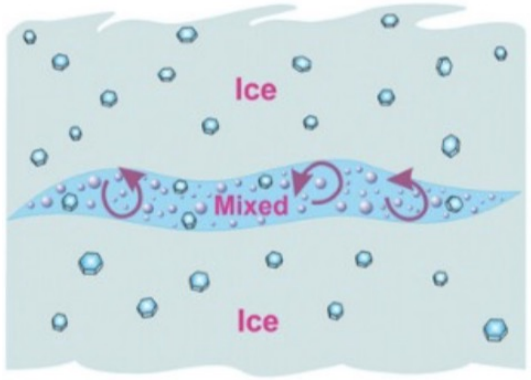
Hobbies / other interests:

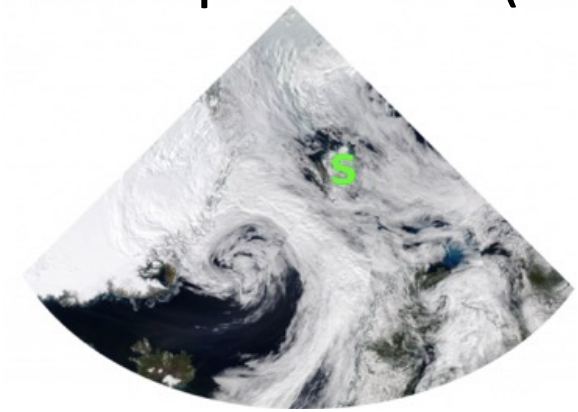
- Running (training for Paris marathon 2023).
- Literature.
- Piano playing.

Lea Raillard - Thèse (1ère année) au LMD

Encadrement : Etienne Vignon, Jean-Baptiste Madeleine, Gwendal Rivière

Sujet : Développement d'une nouvelle paramétrisation des nuages de phase mixte dans LMDZ, impact sur les dépressions (arctiques)





Intérêts pour LMDZ :

- Mise en place de simulation zoomée
- Travailler en 1D (colonne)
- Comprendre le schéma de nuages

Miguel Garrido

Ph.D. (ongoing)

Univ. of Copenhagen, Denmark

UNIVERSITY OF COPENHAGEN

Who am I: *A PhD student at the Niels Bohr Institute, Copenhagen, Denmark*

Working on: *Microbial influence on atmospheric dynamics and viceversa.*

Want to learn: *How clouds and transport processes are parameterised.*

Yi XI

Post-doctoral researcher (working with Philippe Ciais at LSCE)

Email: yi.xi@lsce.ipsl.fr

Education:

Ph.D. Sep 2017 – Jul 2022	Physical Geography, College of Urban and Environmental Sci Peking University, Beijing, China.

Post-doc work: improve permafrost processes in ORCHIDEE-MICT

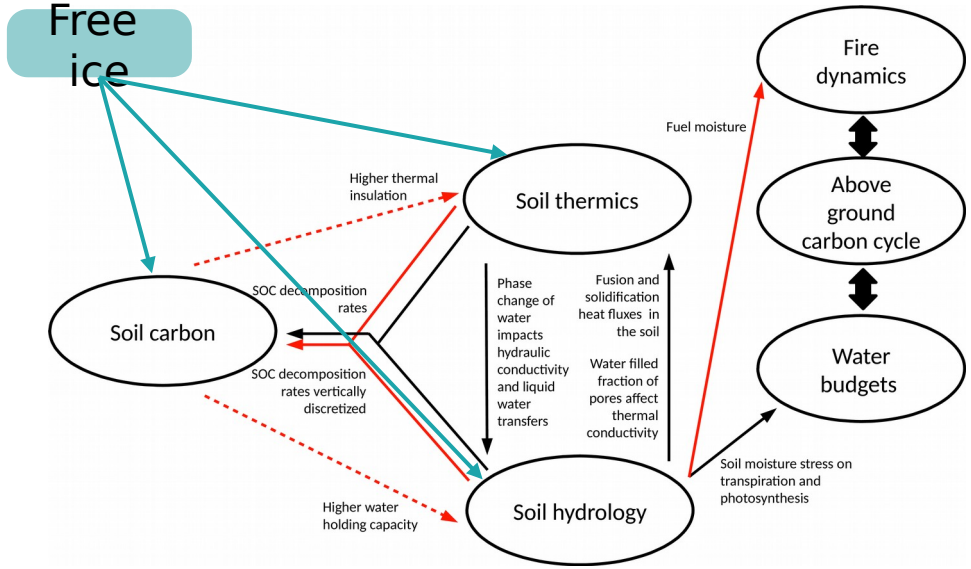
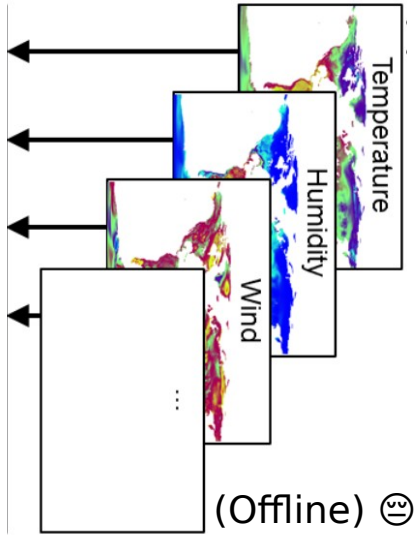
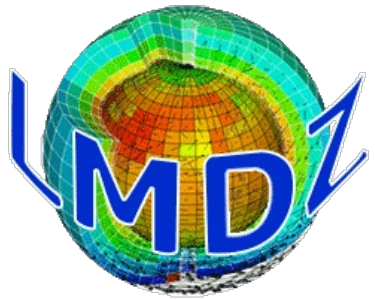


Fig. Temperature, water, carbon interactions in current ORCHIDEE-MICT.





Feedbacks of permafrost on future

Mathieu Ratynski

Doctorant au LATMOS en 3ème année

Etude des caractéristiques globales des ondes de gravité atmosphérique à l'aide des mesures de vent du satellite de l'ESA Aeolus.

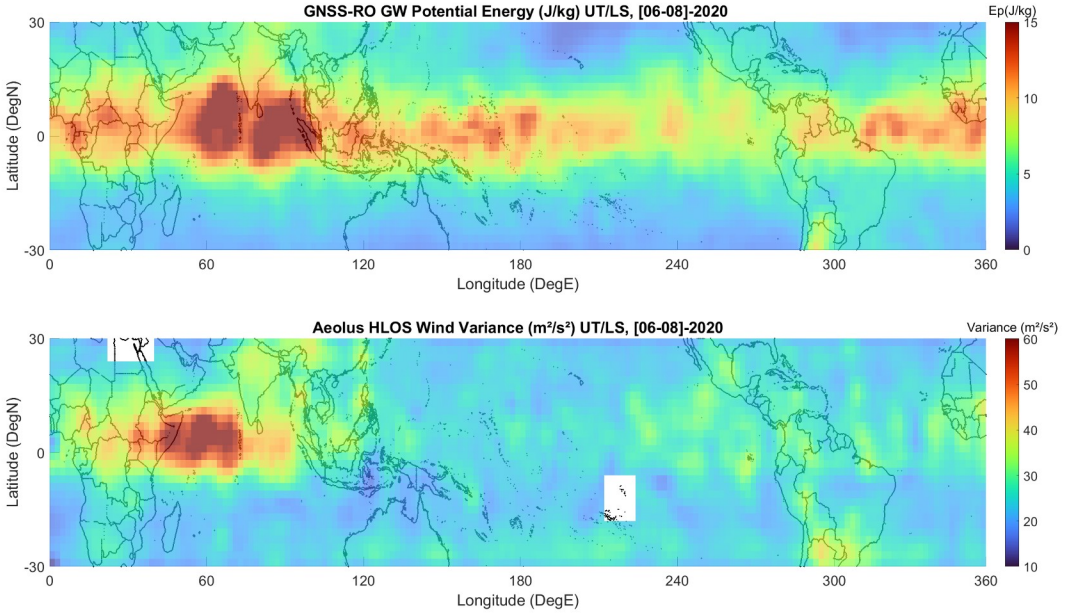
Formation

- Diplôme d'ingénieur Aérospatial ESTACA/SUPAERO
- Magistère de Physique Fondamentale (L3) – Paris Diderot
- Doctorat au LATMOS au sein de l'équipe STRATO sous la direction de Sergey Khaykin

Motivation pour LMDZ

- Obtenir un nouvel outil de référence pour vérifier mes résultats
- Acquérir des compétences et un recul critique sur les modèles
- Utiliser le modèle pour prolonger mon analyse et prospecter des évènements intéressants

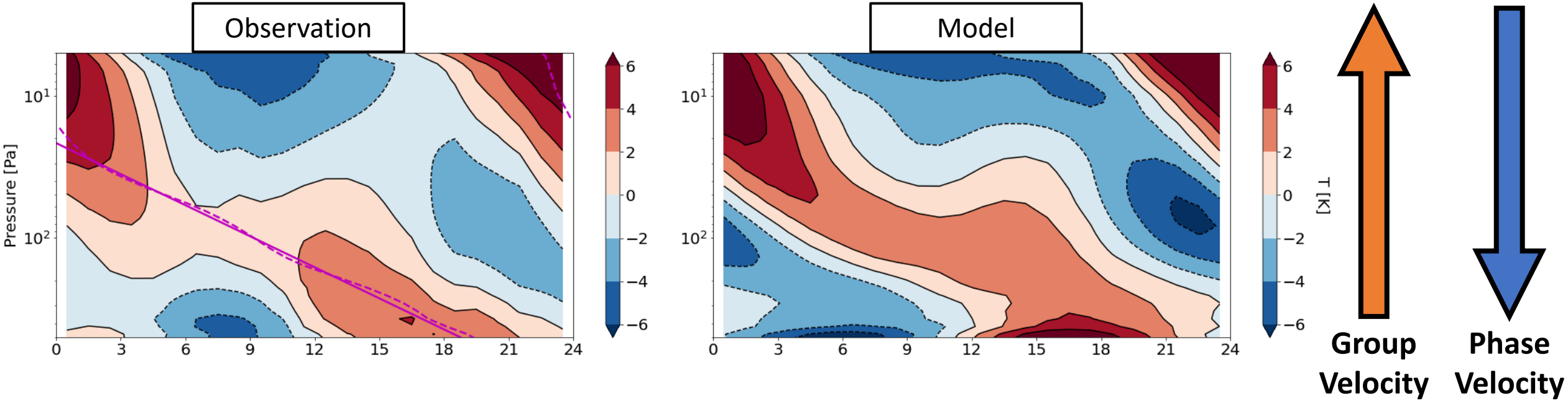
Etude des Ek/Ep des IGW



Siteng FAN: Postdoc at LMD

- Research: Thermal tides in the Martian atmosphere
- Observation: Diurnal temperature variation on Mars observed by infrared spectrometers on Mars orbiters
- Model: The Mars version of LMDZ (LMD Mars Planetary Climate Model)

www.lmd.jussieu.fr/~sfan



Shengjie WANG

Associate professor
College of Geography and Environmental Science,
Northwest Normal University, China

Visiting scholar
LMD, Paris

Research interests:
Stable water isotopes (^{18}O and ^{2}H) in arid central Asia: climatology and hydrology

LMDZ projects:
Stable isotopes in precipitation and water vapor using isotope-enabled LMDZ

Nicolas Février

Climaviation
Action de recherche sur Aviation et Climat

- 1st year PhD at Climaviation project with Nicolas Bellouin and Didier Hauglustaine

- LMDZ-INCA → chemistry-transport:
  - Aviation NO_x, ozone and H_2O
  - Aviation BC, SO_4

Pierre Tiengou
25 years old
Engineering school background (Mines Paris)
1st year PhD student at METIS laboratory (IPSL) under the supervision of Agnès Ducharne

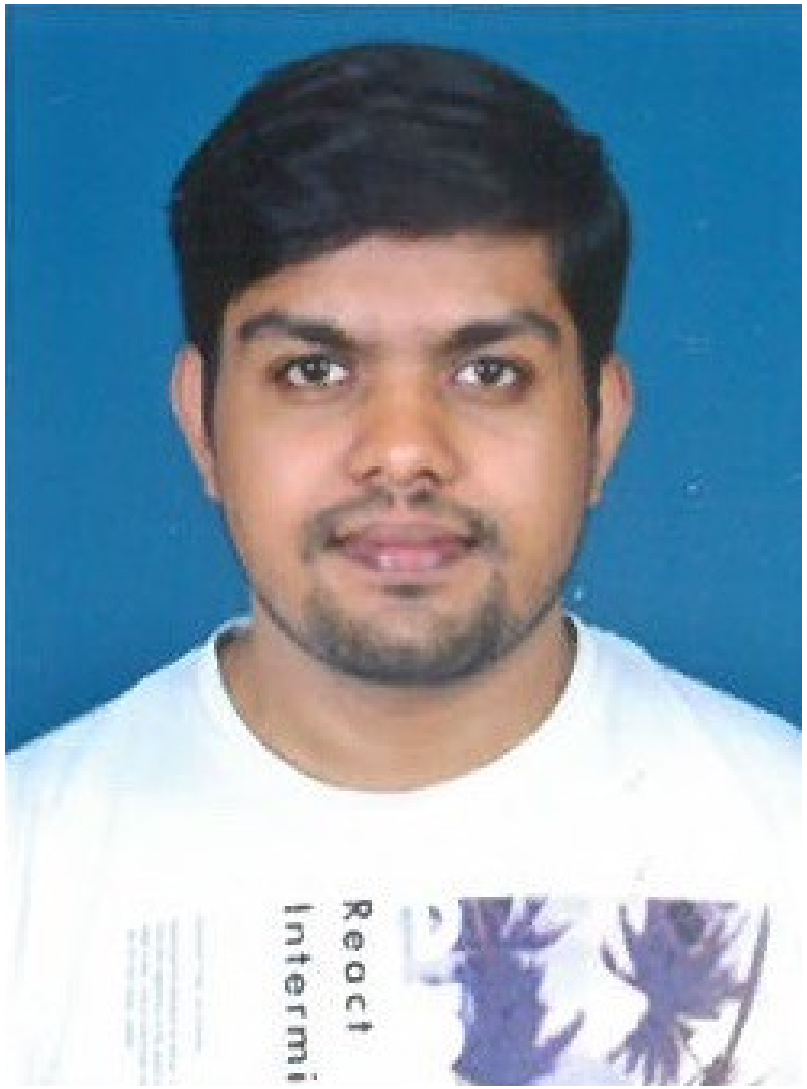
Working on the impacts of irrigation on land-atmosphere couplings.

Interest in LMDz :

- Understanding the current model and how it interfaces with ORCHIDEE (LSM).
- Eventually running coupled regional and global simulations with ORCHIDEE to study impacts of soil moisture on atmospheric boundary layer.

Sujith Krishnakumar

- Postdoctoral Researcher at University of Milano-Bicocca, Italy
- Mentor: Prof. Samuel Albani
- Research: Incorporation of impurities (such as dust, black carbon and organic matters) in snow over land in ORCHIDEE to achieve better simulation of global snow and its variability. The light absorbing impurities in snow reduce the reflectivity of snow causing variability not only in snow but also to the whole climate system which will be quantified with coupled LMDZ-OR-INCA simulations.



Xavier Faïn
Chargé de Recherche (CNRS), depuis 2011
Institut des Géosciences de l'Environnement (IGE, Grenoble)

Parcours scientifique :

<u>2011-2020 :</u> paléoclimatologue

- ✓ composition passé de l'atmosphère, carottes de glace et archives glaciaires
- ✓ instrumentaliste, utilisation de python pour traitement de données

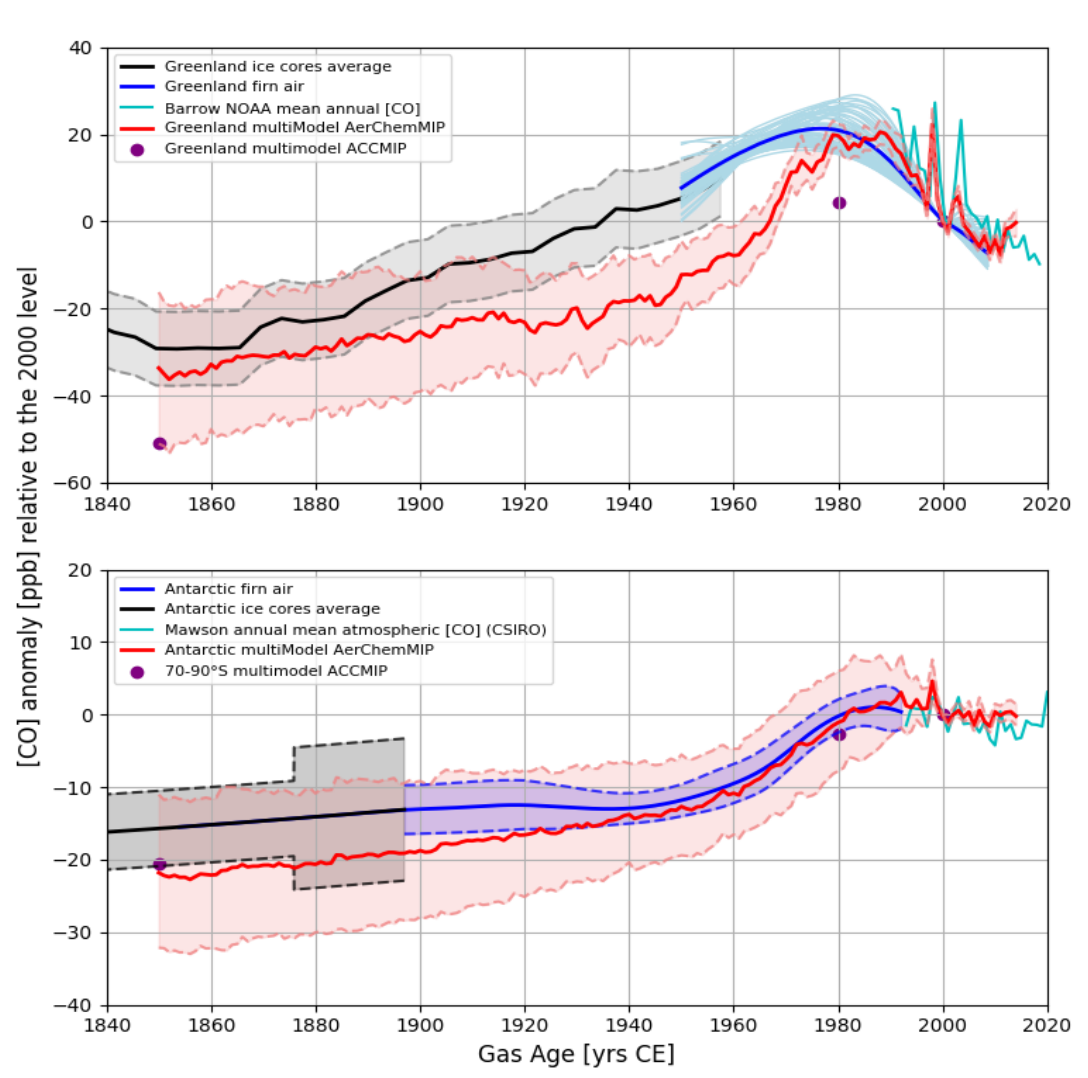
<u>2021-2022 :</u> année de césure hors CNRS

<u>2022 :</u> réintégration de l'IGE

- ✓ intérêt pour repositionner mon projet de recherche : évolutions futures du climat aux échelles régionales ?
- ✓ Utiliser LMDz ? Analyser des sorties de modèles ?
- ✓ rapprochement possible avec équipe C2H, IGE

Ma motivation pour cette formation :

- ✓ ressentir mes aptitudes/mon gout (en tant qu'instrumentaliste) à évoluer vers un usage de LMDZ?
- ✓ prendre contact avec cet outil et sa communauté.



Un résultat de recherché recent : reconstruction bipolaire du [CO] atmosphérique depuis 1850 à partir des archives glaciaires, et comparaison aux sorties de modèles AerChemMIP

- El Ouaraini Rachida
  PhD from INP Toulouse
- Gachon Guillaume
  CDD Ingénieur IPSL auprès de Julie Deshayes (LOCEAN). Poursuite en thèse en 2023. \nSujets de travail : Accélération du SpinUp océanique, et Développement de Métriques pour l'Évaluation des Modèles de Climat et le Tuning Automatique.
- Michalezyk Nicolas
  PhD student, Sorbonne Université. Working on reducing the Arctic temperature bias between observations and CMIP6 and particularly in the LMDZ part of the IPSL code at LOCEAN under the direction of Guillaume GASTINEAU. We want to use LMDZ with different configurations in order to better parametrize the physics of the sea ice and its associated feedbacks (albedo, lapse-rate, water vapor...) that are in the atmospheric part of the IPSL model.
- Han Peng
  LMD
- Sanogo Sidiki
  postdoc, IPSL
- Xu Siqing
  PhD student at LSCE. My research topic is Vegetation - Dust Cycle Feedback in the IPSL Earth System Model. I would like to simulate the interactions between vegetation, dust and precipitation in earth system by LMDZ.
- Yang Ji-Woong
  Enseignant-chercheur. To study the atmospheric chemistry changes during past climate evolution, using INCA or REPROBUS. Main purpose is to understand and quantify the changes in vertical circulation and photochemical reactions during glacial-interglacial climate changes.