LMDZ Training December 2024

Who are you ?

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

Vivien BAUER - PhD

A Last Glacial Maximum constraint on future warming: optimising the comparison and integration of sea surface temperature estimates from proxies and climate models

*At **LSCE** in **CLIM** team*

Director : Masa KAGEYAMA (CLIM)
William GRAY (PALEOCEAN)

01/01/2025 – 01/01/2028

Formation LMDZ hiver 2024

Justine Charrel

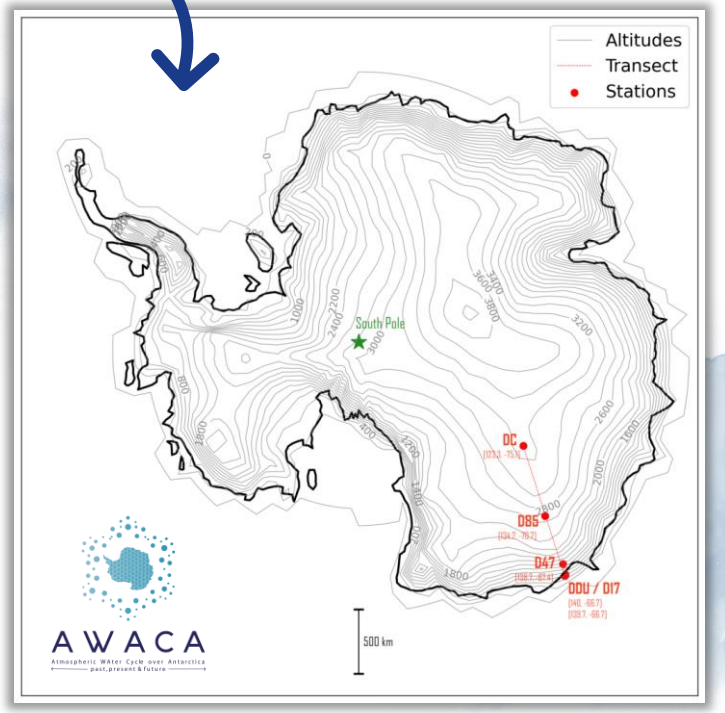
Doctorante en 1ère année au LMD Jussieu (équipe EMC3) depuis 12/2024

Encadrants : Jean-Baptiste Madeleine, Christophe Genthon, Thomas Dubos

Ma thèse

L'eau atmosphérique antarctique : observation, processus et modélisation dans le cadre du projet AWACA[1]

- Comparaison des observations in-situ et satellite avec des simulations LMDZ (météo de surface : nuages, précipitations, etc.)



Intérêts pour LMDZ

- Prise en main du modèle
- Mise en place d'une config. ICO-LMDZ-LAM Antarctique
- Lancer des simulations

Étudier la variabilité passée et future du cycle de l'eau atmosphérique en Antarctique via les observations et la modélisation

[1]Atmospheric WAter Cycle over Antarctica

Constanza VERA

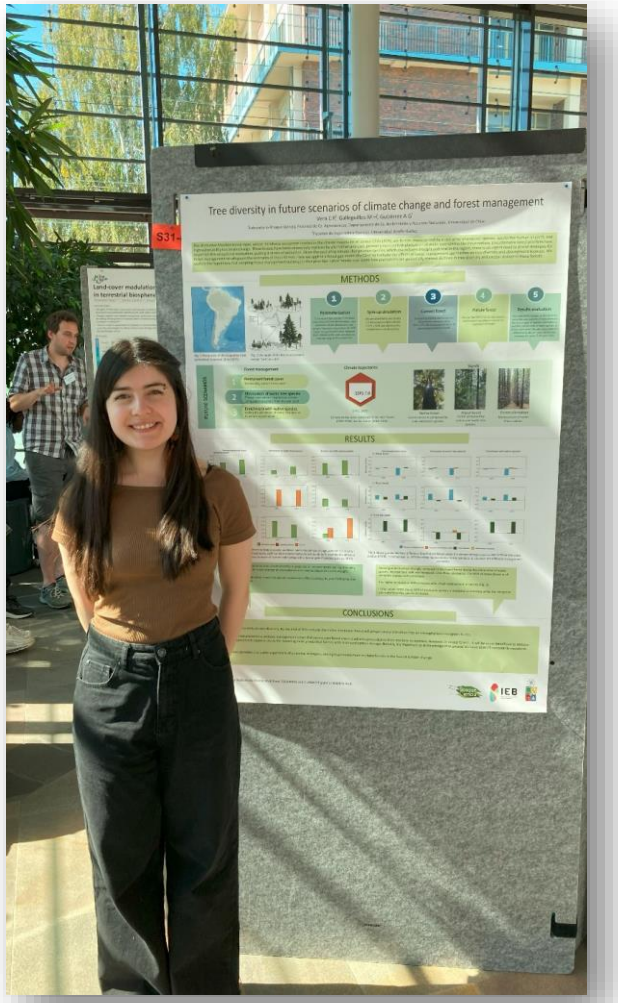
BACKGROUND – Engineer in Nat. Res.

2023 MSc. Territorial Management of Natural Resources
Universidad de Chile

2020 BSc. Renewable Natural Resources Sciences
Universidad de Chile

2024 PhD thesis: Tree growth allocation from days to centuries

Objective:
Reconstruct growth allocation and improve its representation in the **ORCHIDEE** model



2023 European Conference on Ecological Modelling.
Leipzig, Germany.

- Who am I ?

- Ke Yu
- third-year PhD in environmental science in LSCE

- **Hobbies & Interests**
  - reading books
  - sports, hiking, mountain and sea

- **Scientific topic**
  - the Biophysical impact of agriculture on climate (ORCHIDEE)

- **Why use LMDZ?**
  - understand the climate feedback induced by agriculture

LSCE
Laboratoire des sciences du climat & de l'environnement

UVSQ université PARIS-SACLAY

cnrs

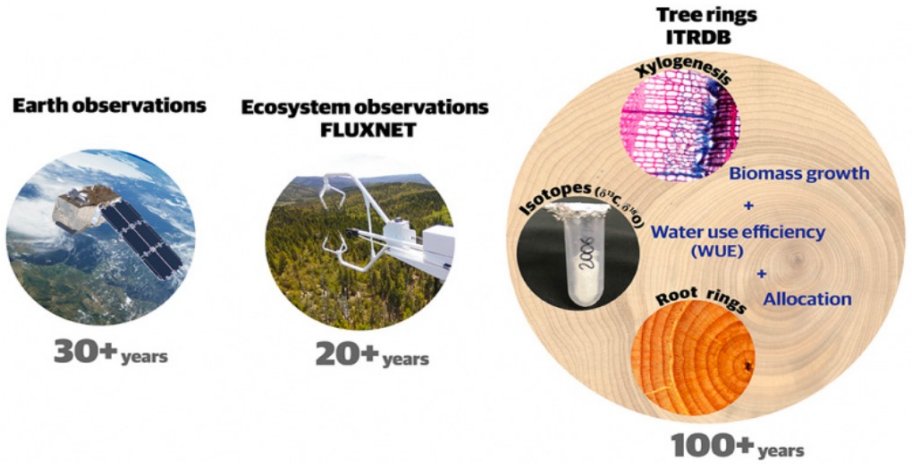
cea

ClieNFarms
Climate Neutral Farms

Cland

université PARIS-SACLAY

Jonathan BARICHIVICH
Directeur de Recherche
CNRS-LSCE
https://jbarichivich.github.io/



Research field
Global climate and ecology (Section 30, CNRS)

Bio
I **integrate measurements and models** to reconstruct and predict the interactions between terrestrial ecosystems and the climate system from days to centuries.

Tools
Tree rings, eddy covariance, remote sensing, ORCHIDEE model

Research project
PI of ERC CATES
Long-term consequences of altered tree growth and physiology in the Earth System

Dr. Sasa Kostic
Postdoc

Constanza Vera
Phd student

Lucien Ricome
Engineer

Dr. Isabel Dorado
Visiting researcher

Application of LMDZ
Coupled simulations using an improved version of ORCHIDEE in the IPSL-CM6 Earth system model

Lekshmi Mudra B

Post-doctoral Researcher

Research Interest

- Last Glacial Maximum stratospheric oxygen chemistry
- Stratosphere-Troposphere Exchange

LMDZ Application

The stratospheric photochemical reactions during the past glacial climate will be quantified using coupled models **LMDZ-REPROBUS** or **LMDZ-INCA**.

Institut des Géosciences de l'Environnement

Aude Champouillon

1st-year PhD student at IGE
Working with Juliette Blanchet and Gerhard Krinner

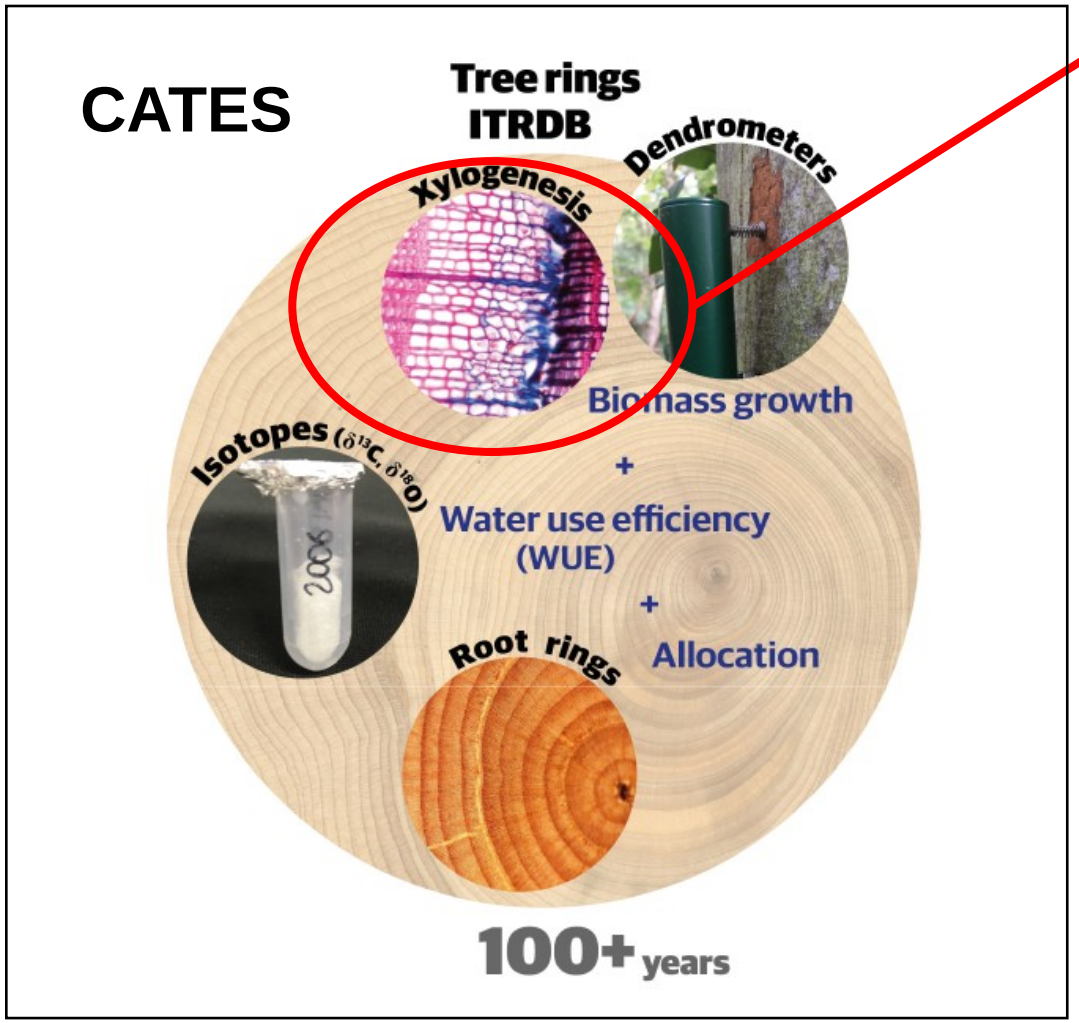
My PhD thesis' subject:

Modeling the hydroclimatic future of the Alps :
Contribution of a run-time bias-correction

→ using LMDZ

At the moment: running LMDZ with nudging and bias-correction terms, investigating the effect of nudging on the model's physics, trying 1D simulations for sensitivity tests…

Lucien Ricome,
Ingénieur d'étude ,
LSCE, CATES project



Xylogenesis (wood formation) model in ORCHIDEE

⇩

Sink of carbon in ORCHIDEE

⇩

Final aim : **be able to simulate coupled LMDZ and ORCHIDEE including sink of carbon.**

The Atmospheric Dynamics of a Super Venus

Stephen Kane (P.I.) & **Emma Miles** (Student)

RESEARCH PLANS

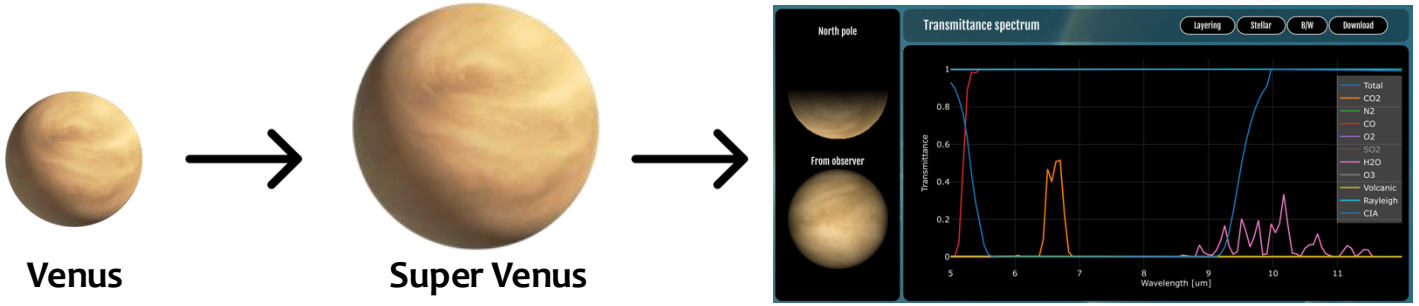
- ❑ Use Venus Zone catalog to find potential exo-Venus targets.
- ❑ Model Super Venus scenarios

RESEARCH QUESTION

- ❑ *How do terrestrial exoplanet atmospheres & surface conditions evolve in the high mass-radius regime?*
- ❑ *How can we differentiate a super Earth from a super Venus?*
- ❑ *Are there observable differences in super Earth and super Venus atmospheres?*

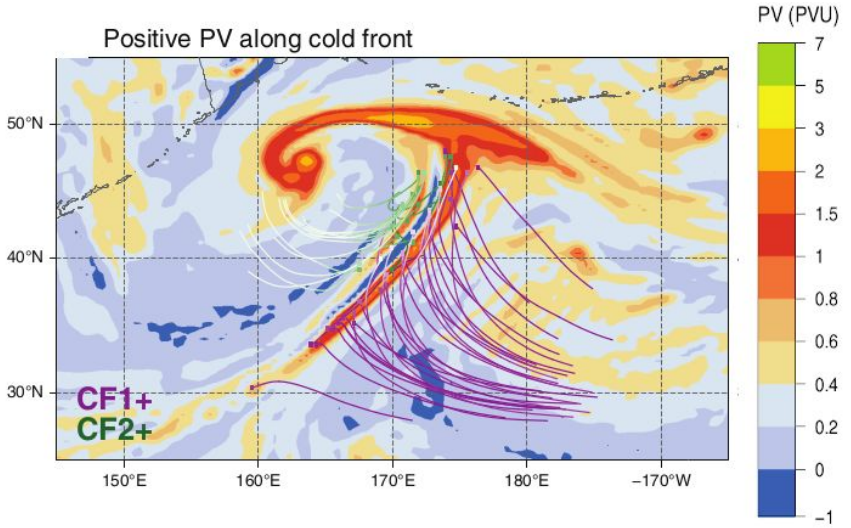
OUR PLANS FOR LMDZ

- ❑ Use LMDZ to scale-up Venus into the mass-radius regime of a super Venus:
  - 1.2 - 2 R_{Earth}
  - < 10 M_{Earth}
- ❑ Better understand:
  - Super Venus atmospheres as potential observables for future missions (HWO).
  - Opacities at high temperatures.
  - Super-rotation of Venus-like atmospheres as function of various parameters (i.e. insolation flux)



Rôle des processus diffusifs et diabatiques la dynamique des dépressions aux hautes latitudes

- Comparaison de sorties de ICOLMDZ en configuration LAM avec des données de la campagne de terrain RALI-THINICE
- Zones étudiées : Archipel de Svalbard (Arctique) et Terre Adélie (Antarctique)
- Calcul de trajectoires lagrangiennes à partir de zones de forte vorticité potentielle



From Attinger et al. (2019) and adapted by Gwendal Rivière

Encadrement : Gwendal Rivière, Étienne Vignon

Laboratoire de Météorologie Dynamique (LMD), site ENS

Nicolas Chiabrando

Noé CLÉMENT

Postdoc at IPSL
CNRS/Sorbonne University

- Postdoc (2024-)

IPSL, within EU-funded *CleanCloud* project

Modeling and stuying Aerosol/Cloud interactions in Earth atmosphere, at global scale

-> analyzing CMIP6 simulations
-> using & developing LMDZ

- PhD (2021-2024)

LAB, University of Bordeaux

« Understanding the climate and storms on Uranus and Neptune »

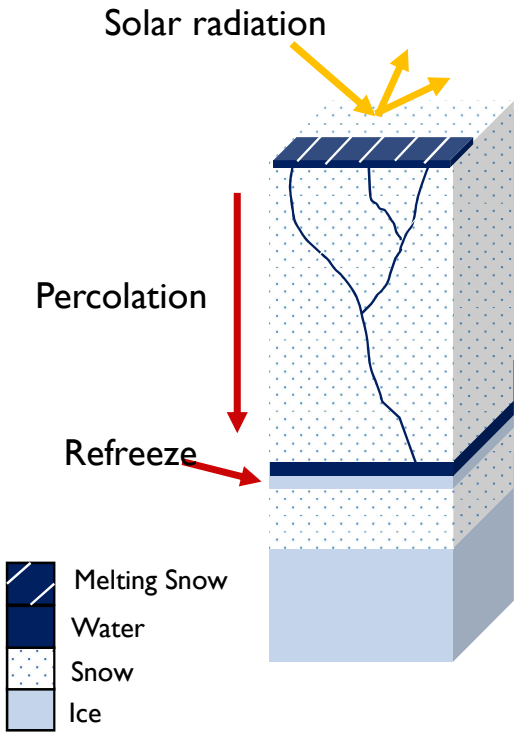
3D atmospheric modeling of Uranus & Neptune

-> used & developed the Generic PCM (LMDZ planeto) with the WRF dynamical core, for large-eddy simulations

Snow modelling over ice sheets in ORCHIDEE

Supervised by Sylvie Charbit and Cécile Agosta

- **New snow module over ice sheets in ORCHIDEE**



Main processes

- Albedo
- Percolation
- **Compaction**
- Heat conductivity
- Melt and Refreeze

- **Study the internal processes of the snowpack compared to observations in forced and coupled mode**

Hobbies & Interests

- Watching Movies
- City Walk
- Hiking

Who are you?

Haoran Xu

- First year Postdoc
- PhD in Environmental Geography
- Bachelor in Atmospheric Science

Personality Traits

- Realistic
- Outgoing
- Positive
- Curious

Why this image?

Concert after the Doctoral Graduation Ceremony at Peking University

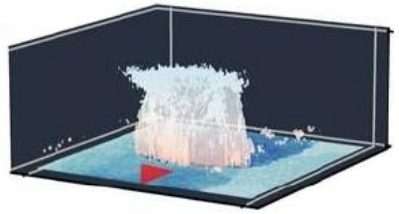
Why LMDZ ?

- Coupleing with ORCHIDEE —LMDZOR
- Capture the feedback of crop land change on climate change

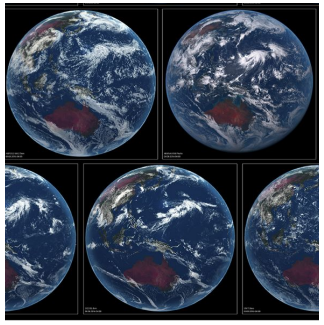
Malek SEGUENI

Organisation de la convection profonde en ligne de grain

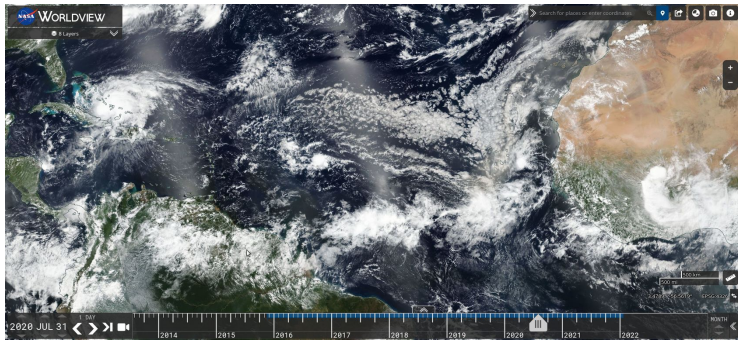
Simulation idéalisée résolution au km



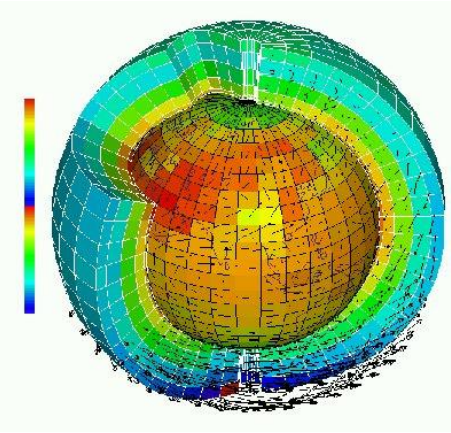
Simulation kilométrique globale (DYAMOND)



Comparaison avec observations satellites haute résolution



LMDz



Représentation des lignes de grain dans le LMDz

Contexte national

DEPHY - Collaboration avec le CNRM

Projet TRACCS (2024-2032)

“Décennie de la convection” - Prospective INSU 2023-2028

Contexte international

CMIP 7 (2028)

Missions spatiales d’observation

“Grand challenge” - WCRP (2022)

Isabel Dorado Liñán

Associate Professor in Climatology and Ecophysiology

Polytechnical University of Madrid

UNIVERSIDAD POLITÉCNICA DE MADRID

Isabel.dorado@upm.es

@DoradoLinan

Research lines

- Palaeoclimatology and climate dynamics
- Forest Ecology and Modelling
- Global Ecology

Interest in the LMDZ

- Understanding the LMDZ
  - -Atmospheric dynamics modeled in LMDZ

- Application to Coupled Models
  - -How LMDZ integrates with ORCHIDEE
  - -Gain technical knowledge for analysis of coupled model outputs

Sasa Kostic (postdoc)

PosDoc and ERC CATES project at LSCE.

Focus: incorporating wood growth dynamics and density in ORCHIDEE.

Background: Plant science, focus on tree ring and climate reconstruction from them.

Regional climate modeling and Water cycle diagnosys over France

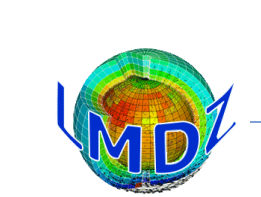
(Siméon Lang)

Commission européenne

NBRACER
Nature Based Solutions
for Atlantic Regional Climate Resilience

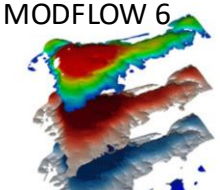
Nature Based Solutions to
Adapt to climate change

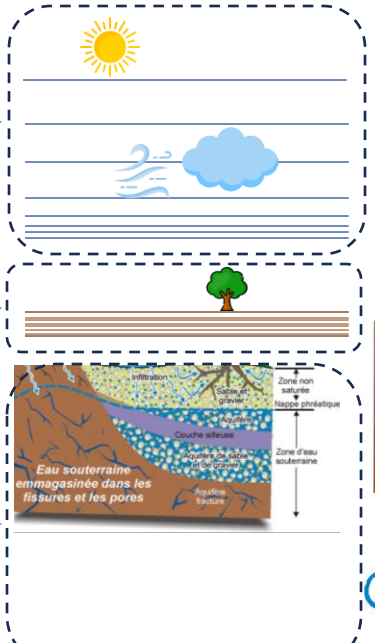
1 Coupled simulator

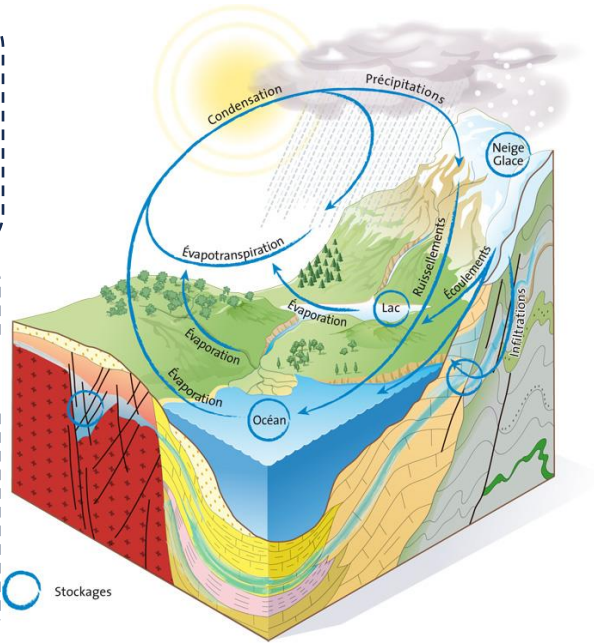


ORCHIDEE
LAND SURFACE MODEL

MODFLOW 6







2 Integrate analysis tools

Water particle labelling
Lagrangian retro-trajectory
Automated reports

3 Sensitivity studies

Wrt Nature Based Solutions
Wrt Climate Change

Sarah Silverman, MSc student (First year)

Background:

- BA in Astrophysics and Earth Science, Columbia University (2020-2024)
- Earth and Planetary Sciences MSc student, McGill University (2024-)

MSc Project:

- Simulating ice sheet formation and evolution on **non-synchronously rotating** Earth-like exoplanets around red dwarf stars
- Working closely with former McGill postdoc Thomas Navarro

Goals at LMDZ Training:

- Learn how to use LMDZ so I can couple it with 1D ice sheet model
  - will help with simulating the complex interplay between climate, ice sheets, and solid planet

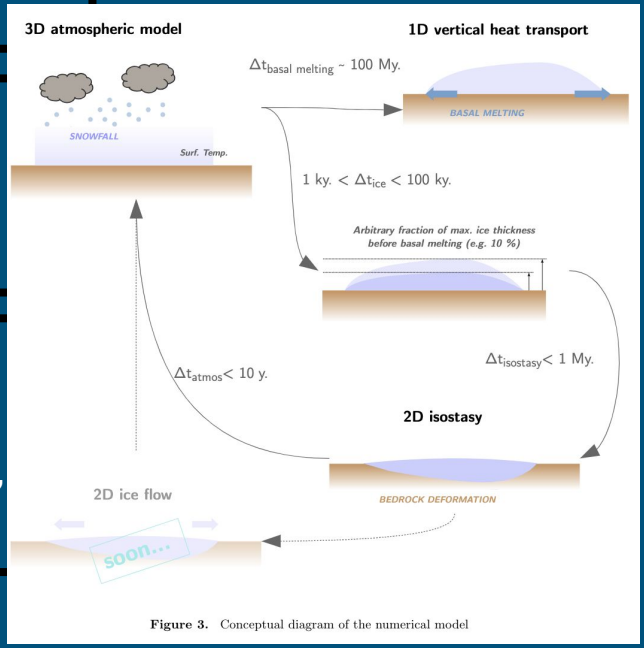


Figure 3. Conceptual diagram of the numerical model

Taken from Navarro et al. (in prep)

Supervisors: Dr. Nic Cowan, Dr. Natalya Gomez

- **Bardet Deborah,** *PostDoc, LMD,* Projet : vérifier l'effet (mais principalement sur la QBO) des valeurs de flux de quantité de mouvement des ondes de gravité observés par les ballons Stratéole 2 et des paramètres ondulatoires de ces ondes simulées à très haute résolution, dans le GCM, en changeant les valeurs d'entrée de la paramétrisation des ondes de gravité non-orographiques. Tests réalisés avec le coeur LMDZ et possiblement DYNAMICO

- **De Coetlogon Gaelle,** *MdC, LATMOS-IPSL,* I want to perform forced simulations with SST anomalies in the Northeastern Tropical Atlantic and analyze the precipitation response, particularly in West Africa.

- **Hernández Bernal Jorge,** *PostDoc, LMD,* I currently use GCM output for Mars. But I can see myself developing a bit in the future, and also using it for Earth.

- **Hindaoui Faten,** *PhD Student, LMD,*

- **Huan Xiaohe,** *PhD Student, LMD,*

- **Lancelin Amaury,** *PhD Student, LMD,* Deep Learning and rare event algorithms to study climate extremes impacting the power system.

- **Li Hui,** *PostDoc, LSCE,* Use LMDz to establish the relationship between atmospheric components's emissions and concentrations.

- **Sèze Geneviève,** *Researcher, LMD,* analyses of the water vapor flux over Sahel and Sahara and their origin.

- **Tianqi Shi,** *PostDoc, LSCE,* For EU N2O flux inversion