ENV-409 Air Pollution

First day overview

Diversity – Your responsibilities

The honor code at EPFL stipulates that everyone at EPFL should

- Be aware of the rules and regulations
- Respect everyone in the community
- Have integrity in their work and strive for high quality
- Have a positive attitude towards teaching and learning
- Respect the infrastructure
- Use EPFL's resources for appropriate uses

In case you become aware of behavior you suspect is inappropriate you can report it to the Ombudspersons who are an independent and external resource:

- For scientific misconduct : Prof. Winship Herr (Prof. Emeritus from UNIL)
- For inappropriate behavior: Isabelle Salomé Daïna, (Salomé Preile Associées)

Additional information:

- Respect unit
- Honor code
- Compliance guide
- Disciplinary rules and regulations (students)
- Directive on Whistleblowing at EPFL

https://www.epfl.ch/schools/enac/about/diversity-office/diversity-responsibility/

Teachers

Air pollution principles and data analysis

Satoshi Takahama

Pollutants and source analysis

Kalliopi Violaki

Air pollution measurement and trends

Empa
Materials Science and Technology

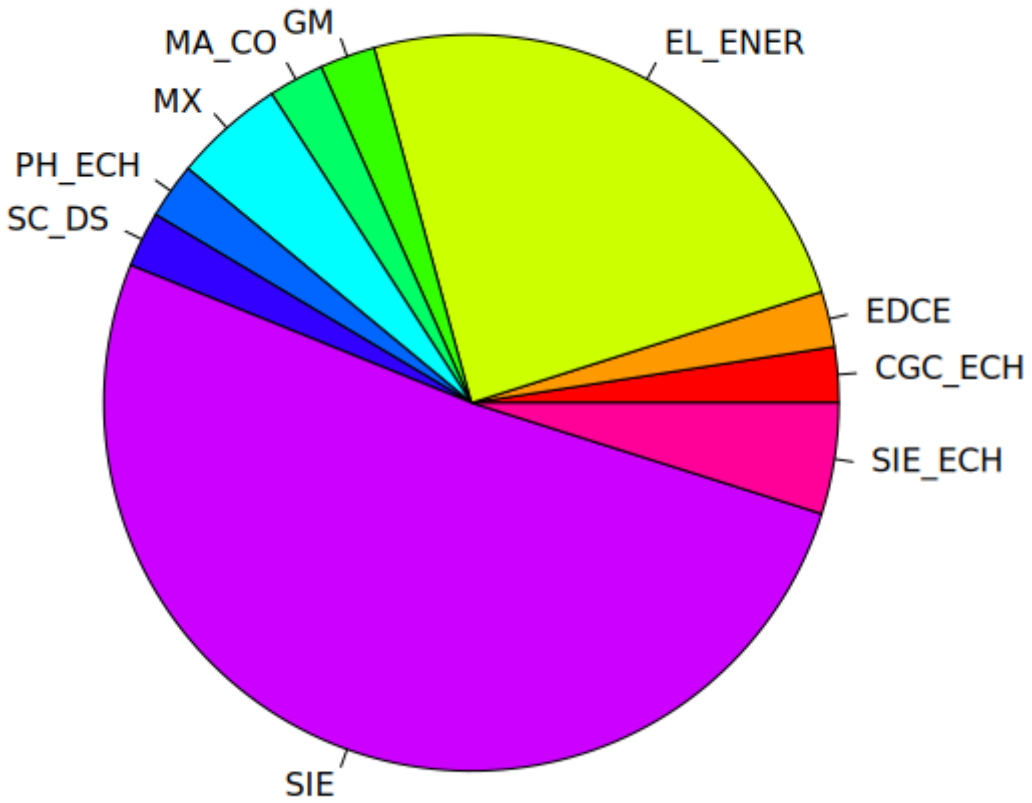
Stefan Reimann

Teaching Assistants

Virginia Tadei

Ernest Abboud

Students



41 registered

Course structure

ENV-409 is structured as a **survey course**:

“a course treating briefly the chief topics of a broad field of knowledge”

- Organized to provide exposure to many different topics
- Not intended to build toward competency or mastery in a specific domain as with preparatory classes
- Implications:
  - All lectures and exercises are related to air pollution but not necessarily sequentially connected
  - Concepts will vary in complexity/difficulty (not progressively build on one after another as with preparatory classes)

Course expectations

- Learn what you can in each topic
- Pursue a topic in more detail if interested (ask me for more resources)
- Learning outcomes:

•Identify compounds recognized as pollutants and regulated in various countries

•Categorize emission or production sources and removal mechanisms of various pollutants.

•Compare methods and practical issues concerning measurement of gas, particles, and meteorological variables.

•Describe challenges in modeling atmospheric phenomena.

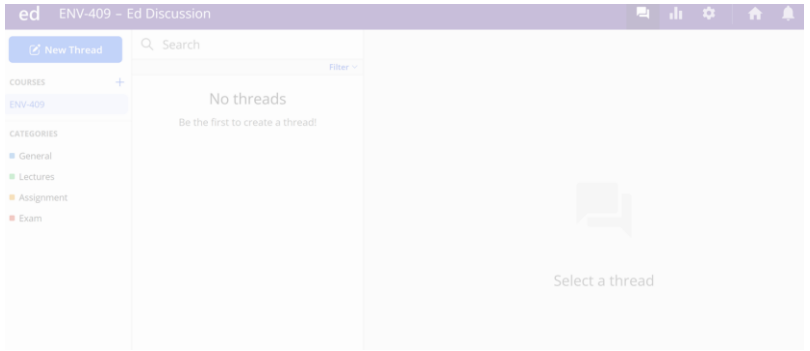
•Explain the dependence of air quality on emissions, meteorology, and atmospheric chemistry.

•Assess / Evaluate the impacts of human activity on air pollution.

•Describe potential mitigation strategies as possible solutions to air pollution problems.

•Interpret atmospheric observations

Modality



- *Lectures and assignment help*: Wednesdays 9h15-12h00 (room GCB330; GRB001 optional for exercises). Lectures live broadcasted via Zoom but not recorded.
  - Lectures on emissions, transport/meteorology, photochemistry
  - Assignment on data analysis modules (Takahama) and source analysis (Violaki)

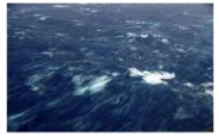
- *Field trip*: meet at the federal monitoring station at Lausanne Bibliomedia on 27.03.2025 (13h00-15h00; times to be assigned by group).

- *Online communication*: Ed Discussion forum (options: public, private, anonymous). General questions about the course, assignment, and exam should be directed to Satoshi Takahama via Ed Discussion (don’t email).

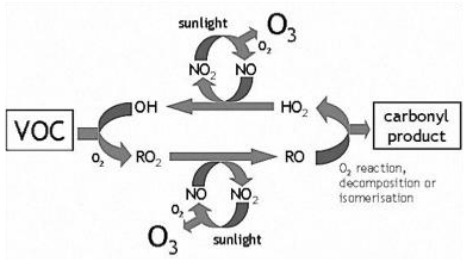
Overview of topics

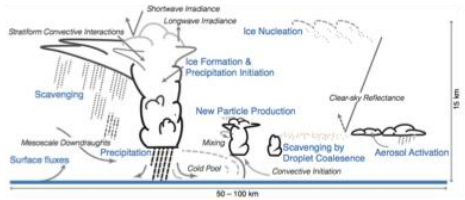
Emissions



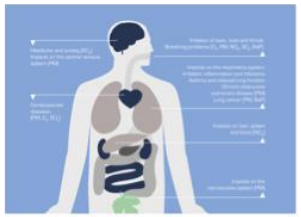
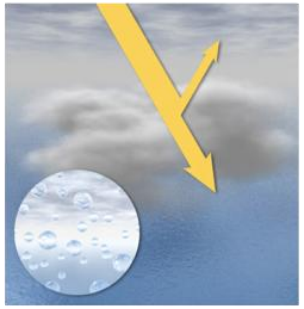
Atmospheric Processes



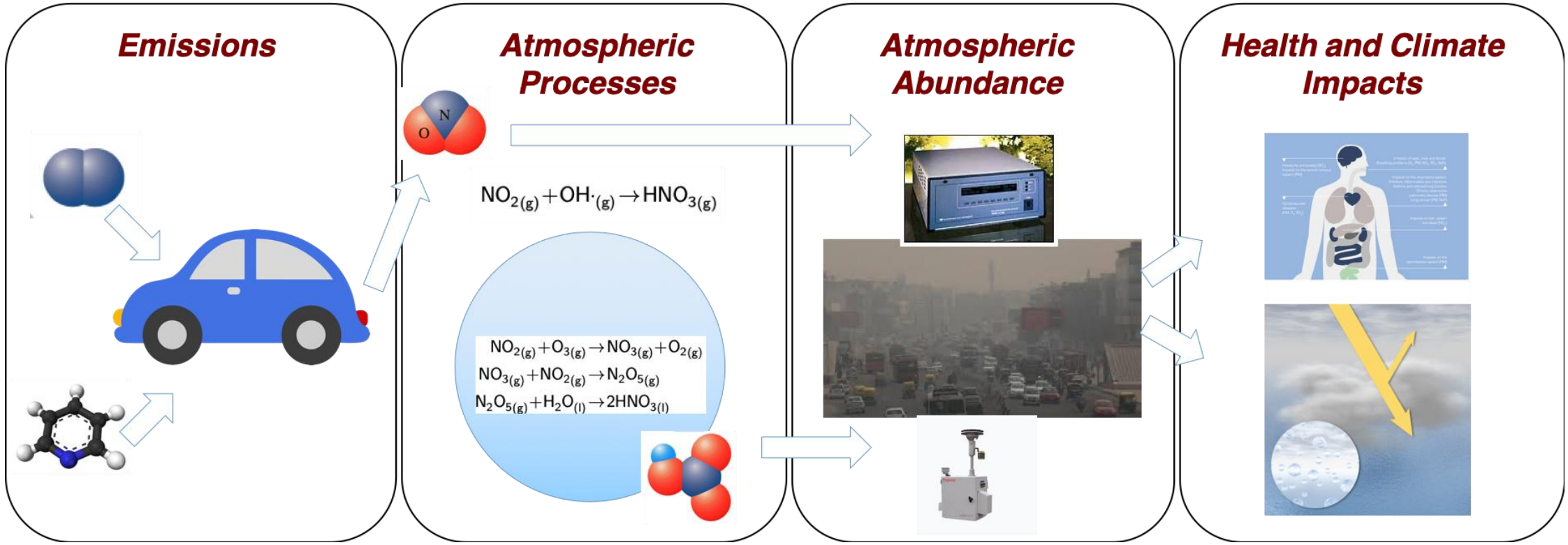


Atmospheric Abundance


Health and Climate Impacts

Example (NO_2)


Emissions
Atmospheric Processes
Atmospheric Abundance
Health and Climate Impacts
N
O
$NO_{2(g)} + OH\cdot_{(g)} \rightarrow HNO_{3(g)}$
$NO_{2(g)} + O_{3(g)} \rightarrow NO_{3(g)} + O_{2(g)}$
$NO_{3(g)} + NO_{2(g)} \rightarrow N_2O_{5(g)}$
$N_2O_{5(g)} + H_2O_{(l)} \rightarrow 2HNO_{3(l)}$

Assessment

40% **assignment**

- analyze air pollution data to understand importance of emissions, chemistry, and transport/meteorology due 09.05.2023 23h55
- source analysis due 30.05.2023 23h55

60% **final exam**

- basic concepts in air pollution (sources, analysis, mitigation)
- interpretation of atmospheric measurements
- simple calculations
- 2 sheets (front and back) of notes + calculator are allowed during the exam

Notable dates

- **27.03.2025** field trip to NABEL monitoring station (Lausanne Bibliomedia)
  Director Christoph Hueglin comes from Empa

- **09.05.2025** and **30.05.2025** due dates of data analysis assignment