

ENV-400

Air pollution and climate change

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Cursus	Sem.	Type
Civil & Environmental Engineering		Opt.
Energy Management and Sustainability	MA2, MA4	Opt.
Energy Science and Technology	MA2, MA4	Opt.
Energy minor	E	Opt.
Environmental Sciences and Engineering	MA2, MA4	Opt.
Mineur STAS Russie	E	Opt.
Minor in Integrated Design, Architecture and Sustainability	E	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	3 weekly
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

A survey course describing the origins of air pollution and climate change

Content

- Atmospheric pollutants and their effects on the environment
- Emissions related to air pollution and climate change
- Measurements of air pollutants, greenhouse gases and meteorological conditions
- Air quality models
- Environmental regulations and abatement strategies related to air pollution and climate change

Keywords

Atmospheric chemistry, air quality, climate change, air pollution, meteorology, aerosols

Learning Prerequisites**Recommended courses**

Physics and Chemistry of the Atmosphere (ENV-320)

Important concepts to start the course

- Differential, integral, and vector calculus
- Linear algebra
- Chemistry (reaction rates, chemical thermodynamics)
- Basic programming concepts

Learning Outcomes

By the end of the course, the student must be able to:

- 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 pollution/climate change phenomena.

- Explain the dependence of air quality on emissions, meteorology, and atmospheric chemistry.
- Assess / Evaluate the impacts of human activity on air pollution and climate change.
- Describe potential mitigation strategies as possible solutions to air pollution/climate change problems.
- Interpret atmospheric observations

Transversal skills

- Access and evaluate appropriate sources of information.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.

Teaching methods

Lectures and exercises (quantitative and programming)

Expected student activities

Lecture attendance, exercise assignments

Assessment methods

50% exercise assignments, 50% final exam

Resources

Bibliography

- Atkins, Peter, and Julio de Paula. *Physical Chemistry*. W. H. Freeman, 2006.
- Cooper, C. David, and F. C. Alley. *Air Pollution Control: A Design Approach*. Waveland Press, Inc, 2011.
- Denbigh, Kenneth George. *The Principles of Chemical Equilibrium: With Applications in Chemistry and Chemical Engineering*. Cambridge University Press, 1981.
- Finlayson-Pitts, Barbara J., and James N. Pitts Jr. *Chemistry of the Upper and Lower Atmosphere: Theory, Experiments, and Applications*. Academic Press, 1999.
- Flagan, R. C and Seinfeld, J. H. *Fundamentals of Air Pollution Engineering*, Prentice Hall, Inc., New Jersey, 1988. <http://authors.library.caltech.edu/25069/>
- Friedlander, Sheldon Kay. *Smoke, Dust, and Haze: Fundamentals of Aerosol Dynamics*. Oxford University Press, 2000.
- Hinds, William C. *Aerosol Technology: Properties, Behavior, and Measurement of Airborne Particles*. Wiley, 1999.
- Jacob, Daniel. *Introduction to Atmospheric Chemistry*. Princeton University Press, 1999. <http://acmg.seas.harvard.edu/people/faculty/djj/book/>
- Kulkarni, Pramod, Paul A. Baron, and Klaus Willeke. *Aerosol Measurement: Principles, Techniques, and Applications*. John Wiley & Sons, 2011.
- Prausnitz, John M., Rudiger N. Lichtenthaler, and Edmundo Gomes de Azevedo. *Molecular Thermodynamics of Fluid-Phase Equilibria*. Pearson Education, 1998.
- Seinfeld, J. H. & Pandis, S. N. *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change*. John Wiley & Sons, New York, 2006.
- Wark, Kenneth, Cecil Francis Warner, and Wayne T. Davis. *Air Pollution: Its Origin and Control*. Addison-Wesley, 3rd ed., 1998.

Ressources en bibliothèque

- [Molecular Thermodynamics of Fluid-Phase Equilibria / Prausnitz](#)
- [Atmospheric Chemistry and Physics / Seinfeld](#)
- [Air Pollution Control / Cooper](#)
- [The Principles of Chemical Equilibrium / Denbigh](#)
- [Fundamentals of Air Pollution Engineering / Flagan](#)

- Physical Chemistry / Atkins
- Aerosol Technology / Hinds
- Air Pollution / Wark
- Chemistry of the Upper and Lower Atmosphere / Finlayson-Pitts
- Introduction to Atmospheric Chemistry / Jacob
- Smoke, Dust, and Haze / Friedlander
- Aerosol Measurement / Kulkarni