



Lecture 0: Course Introduction

Prof. Claudio Cassardo (Univ. of Torino)

Prof. Seon K. Park (Ewha Womans Univ.)



General Information

- **Course characteristics**

- Basic course for the curriculum "physics of the meteoclimatic system"

- **Teaching period:**

- This year: 1st (on 3) period (mid September to mid November)
- Next year: 1st semester (October to January)

- **Attendance:**

- It is not mandatory, but strongly suggested, as this course is preparatory for other courses

- **Time table:**

- Three 2-hours lectures per week
- Check exact timetable and classroom on Campusnet

- **Language:**

- For this year, part in English and part in Italian

General Information

- **In class lectures**

- For this year, there will NOT be lectures in class

- **Online lectures**

- Lectures **of my part** will be performed using the institutional Webex platform, by connecting at my room:
<https://unito.webex.com/meet/claudio.cassardo>
- Time table for Webex lectures is the official one: please connect to the above address and wait for my appearance

- **Recorded lectures**

- Recorded lectures, separated for argument and/or hours, will be made available on Moodle platform. To connect, please click on the Moodle box at the bottom of the Campusnet page of this course. Actually you can find just the last recorded lectures of one year ago.

General Information

- **Educational objectives**

- The course is aimed to give the physical-mathematical bases that regulate the behavior of the terrestrial atmosphere, pointing out on the phenomena connected to the stability (also by the point of view of the pollution), on the thermodynamic transformations, on the hygrometric variables and on the dynamics, pointing out on the different contribution of the forces involved in the dynamics of the atmosphere. A special section introduces the dimensional analysis and the similarity theory.

- **Expected learning outcomes**

- The student will be able to understand the physical processes which regulate the statics, the dynamics and the thermodynamics of the atmosphere, and to manage the main equations on which such disciplines are based. The student will also possess the necessary physical-mathematical background indispensable to successfully face arguments like the meteorology or the study of the boundary layer turbulence.

General Information

- **Supporting activities**

- Eventual visits to laboratories or other experimental locations (only if compatible with the pandemic emergence):
 - The meteorological station located on the roof of the building
 - The TURLAB laboratory equipped with a rotating tank and a linear channel
- Close look of some meteorological instruments
- Participation to some conferences available during the course
- Other eventual events related to the course will be advertised during and after the lectures

General Information

• Exams

- Nominally, the methods for learning verification will be carried out by means of WRITTEN tests with three open questions, to be answered in class in three hours.
- Due to the health emergency of Coronavirus, it may be decided to temporarily switch to an ORAL exam in ONLINE connection or IN CLASS; in this case, the questions will be the same as the nominal written tests, but diversified by student.
- The three questions will be drawn from a list of questions that will be made available on Campusnet at the end of the course, before the exam, and will be valid for the whole year.
- On Campusnet you can find the list of questions for the past year exam.

Program of the Course (1)

- **Characteristics of the atmosphere (composition, evolution, formation, regions)**
- **Variables and instruments**
- **Atmospheric optics**
- **Forces in static atmosphere: hydrostatic equilibrium**
- **State equation for dry and moist air: virtual temperature**
- **Potential energy and geopotential; barometric formulae; pressure coordinates**
- **Thermodynamics for dry air (introduction, first law, potential temperature, dry atmosphere stability)**
- **Thermodynamics for moist air (introduction, first law, Clapeyron equation, pseudoadiabatic processes, moist air stability)**

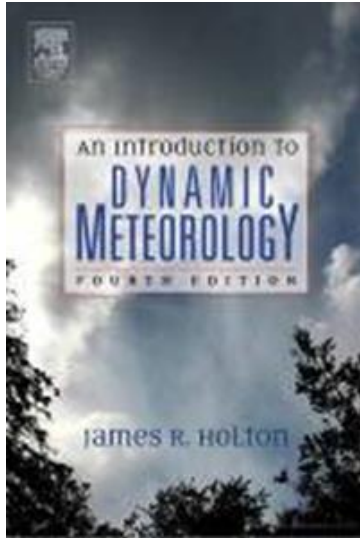
Program of the Course (2)

- **Conventional temperatures: dew point, wet bulb, equivalent**
- **Atmospheric stability: the slice method**
- **Atmospheric radiative balance**
- **The forces in the moving atmosphere (vectorial equation, N-S equations in Polar and Cartesian coordinates, continuity equation in Lagrangian and Eulerian forms, thermodynamic energy equation)**
- **Scale analysis of momentum equation: geostrophic and quasi-geostrophic approximation; hydrostatic approximation**
- **Other equations (continuity, thermodynamic energy) in Cartesian and isobaric coordinates, and scale analysis**
- **Natural coordinates: geostrophic, inertial, cyclostrophic and gradient flow**
- **Barocline and barotropic atmosphere: thermal wind**
- **Vorticity and circulation, and the vorticity equation**

Program of the Course (3)

- **Natural coordinates: geostrophic, inertial, cyclostrophic and gradient flow**
- **Barocline and barotropic atmosphere: thermal wind**
- **Vorticity and circulation, and the vorticity equation**
- **General atmospheric circulation**
- **A sketch on general oceanic circulation**

Suggested Textbooks/References



James R. Holton (2004)

**"An Introduction to Dynamic Meteorology" Elsevier Inc.
Available in library**

- **A copy of a pdf book (never published) of previous professor of this course will be made available on Campusnet. The book title is:**

Arnaldo Longhetto (2009)

"Corso di Fisica dell'atmosfera, dell'ambiente e del clima terrestre" (in Italian)

Personal Information

Claudio Cassardo

- **Contacts:**

- Phone: 011-670-7407; personal: 333-3991128 (also whatsapp)
- E-mail: claudio.cassardo@unito.it
- Course web: see on Campusnet
- Personal web: <https://claudiocassardo.wordpress.com/claudio-cassardo/>
- Personal blog: <https://claudiocassardo.wordpress.com/>

- **Available for students:**

- By appointment (through email)

- **My office:**

- room **A3** (1st floor new building, institute of Physics)

Personal Information

Claudio Cassardo – Who I am?

- **Education**

- Graduated in Physics at UniTo
- Ph. D. in Geophysics at the Univ. of Genoa

- **Position**

- Professor (settore FIS/06: Fisica per il sistema terra e per il mezzo circumterrestre)
- Invited Professor at Ewha Womans University, Seoul, Korea (2013-now)
- Meteorologist at the Italian Meteorological Service, Milano, Italy (1988).

- **Teaching activity**

- Climate Physics, Meteorology, Physics of the Atmosphere, Earth climate and Climate change, Physics of the Environment, Micrometeorology, Hydrometeorology, Atmospheric Turbulence, Land Atmosphere Interactions.

Personal Information

Claudio Cassardo – What are my research interests?

- **study of processes at the interface between the atmosphere and the Earth's surface;**
- **land surface modeling (author of the model UTOPIA);**
- **climatic variations of surface parameters;**
- **microclimate of specific environments (i.e. vineyards);**
- **surface layer modeling;**
- **experimental activity (scientific responsible of the meteorological station and regional forecasts of the Dept of Physics, University of Torino)**
 - Web site: <http://www.meteo.dfg.unito.it/previsioni> (in Italian)

Personal Information

Claudio Cassardo – Other interests

- **very involved in scientific dissemination to the public**
 - through the main social networks (Facebook, Linkedin, Instagram, Research Gate, Academia Edu)
 - Involved in the scientific committee of Italian blog climalteranti (www.climalteranti.it)
 - Personal blogs:
 - <https://claudiocassardo.wordpress.com/>
 - https://www.agi.it/blog-italia/autore/claudio_cassardo/
 - You tube channel:
<https://www.youtube.com/playlist?list=PLkJapKbSzqvGXBIDYd6xTHTCizi92m3Y5>
 - Author of several public conferences/debates
 - List for 2019-2020: <https://claudiocassardo.wordpress.com/le-conferenze-di-claudio-2019-2020/>

Student presentation

- **During this introductory lecture, it would be nice if each student could give a short presentation of himself/herself**
- **Despite I may know well some of you (but not everyone), the other professor do not know you at all**
- **During your short autopresentation (in English, please), you can specify also your interests, why you have chosen this course and curriculum, and mention if you will attend the lectures LIVE or just the recorded ones**
- **During your autopresentation you can show also your face - this part of video will not be put on Moodle, since otherwise too much bureaucracy is required**

Prof. Park Presentation

- **Finally, the terminal part of this introductory lecture will be dedicated to the presentation of the other teacher, Prof. Seon Ki PARK, from Ewha Womans University (Seoul, Korea).**

Personal Information

Seon Ki PARK – Course

- **Online lectures**

- Lectures of my part will be performed using the Zoom platform, by connecting at the class room: <https://ewha.zoom.us/j/94431338014>
- Please connect to the above address and wait for my appearance.
- All lectures will be done fully in English.

- **Recorded lectures**

- Recorded lectures, in mp4 format, will be uploaded to the Moodle platform with help from Prof. Cassardo.

Personal Information

Seon Ki PARK – Contact

Seon
WhatsApp 연락처



• Contacts:

- Phone: +82 10-3951-3331
- E-mail: spark@ewha.ac.kr; hydromet.ewu@gmail.com
- Course web: see on Campusnet
- Personal web: <http://spark-ewha.yolasite.com/>
- Lab web: <https://hydrometewha.weebly.com/>

• Available for students:

- By e-mail (for course-related questions, hydromet.ewu@gmail.com)
- WhatsApp
- Zoom (with appointment)

• My office:

- I wish I were in Torino, but ...

Personal Information

Seon K. Park – Who am I?

- **Affiliation**

- Ewha Womans University (EWU), Seoul, Korea

- **Education**

- B.S. in Meteorology, Seoul National University, Korea
- M.S. in Atmospheric Sciences, Seoul National University, Korea
- Ph. D. in Meteorology, Univ. of Oklahoma, U.S.A.

- **Positions**

- Professor, Dept. of Environmental Sci. & Eng., EWU (2001 – Present)
- Professor, Dept. of Climate & Energy Systems Eng., EWU (2017 – Present)
- Founding Director, Severe Storm Research Center (SSRC), EWU (2007 – 2015)
- Founding Director, Center for Climate/Environment Change Prediction Research (CCCPR), EWU (2009 – 2016)
- Research Scientist at OU, UMD, NASA/GSFC in US (1996 – 2001)
- Weather Forecasting Officer, Republic of Korea Air Forces (1987 – 1990)

- **Teaching activity**

- <http://spark-ewha.yolasite.com/courses.php>

Personal Information

Seon K. Park – What are my research interests?

- Numerical modeling and prediction of high-impact weather and climate
- Data assimilation of mesoscale and storm-scale weather systems
- Inverse modeling of environmental and regional climate problems
- Sensitivity and predictability study of convective storms
- Nonlinear dynamics and predictability in weather/climate systems
- Energy and water cycles in climate system
- Interactions among environmental systems and feedback mechanisms in regional climate change
- Coupled modeling of land surface-soil-atmosphere-ecosystem processes (RECIPE: Regional Environment/Climate Integrated Prediction system of EWU)
- Application of computational differentiation to sensitivity analysis and data assimilation

Personal Information

Seon K. Park – Other interests

- **Outreach to the public**

- Through the main social networks (Facebook, LinkedIn, Research Gate)
- News Commentator at KBS (Korea Broadcasting System):
 - Climate Crisis: <http://mn.kbs.co.kr/mobile/news/view.do?ncd=4534326>
 - Super-typhoon: <http://mn.kbs.co.kr/mobile/news/view.do?ncd=4277939>

- **Book publications**

- Park, S.K., and L. Xu, Eds., 2017: [*Data Assimilation for Atmospheric, Oceanic and Hydrologic Applications \(Vol. III\)*](#). Springer, 553 pp. [homepage][cover][front matter]
- Park, S.K., and L. Xu, Eds., 2013: [*Data Assimilation for Atmospheric, Oceanic and Hydrologic Applications \(Vol. II\)*](#). Springer, 730 pp. [homepage][cover][front matter]
- Park, S.K., and L. Xu, Eds., 2009: [*Data Assimilation for Atmospheric, Oceanic and Hydrologic Applications. Springer*](#), 455 pp.

Personal Information

Seon K. Park – International Collaborations

- **University of Torino, Italy (Prof. Claudio Cassardo)**
 - From 2004 when Prof. Cassardo gave a seminar at SNU.
 - ASEM-DUO Fellowship (2005): Exchange program — since then I visited UNITO several times.
 - Prof. Cassardo was invited to EWU several times as an Invited Professor to teach courses.
- **Chapman University, USA (Prof. Menas Kafatos)**
 - Sabbatical leave (2009) to Center of Excellence in Earth Systems Modeling & Observations (CEESMO)
- **Griffith University, Australia (Prof. Brendan Mackey)**
 - Invited Talk in 2018 at the Griffith Climate Change Response Program (GCCRP)