Introduction to Atmospheric Physics and Climate

Teacher: dr. Paolina Bongioannini Cerlini (PhD)
Date: January 28-February 20, Tuesday-Thursday
Time: 3:00 pm - 6:00 pm
Venue: Class Room 1st foor, CIRIAF, Via G. Duranti 67, Perugia
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Syllabus:

Introduction: The atmosphere continuum, atmospheric composition and phenomena, scale analysis, vertical structure of the atmosphere.

Governing equations. Atmospheric equations of motion on spherical cords. Synoptic scale motions. Lorenz system: deterministic chaos. Thermodynamic charts. Hydrostatic equation. Geopotential. Climatic feedbacks and global warming. An Introduction to the Energetics of Moving Air.

Thermodynamics (dry and moist): Kinetic theory, First and Second principle of Thermodynamics, Enthalpy, Hydrostatic balance, Buoyancy, Moisture variables: Tephigrams and SkewT-LogP diagrams. Potential Temperature. Virtual Temperature. Stability and soundings. Introduction to Convection. Moist Adiabatic Lapse Rate.
Radiation: Planck function. EM spectrum. Irradiance and flux density. Inverse square law. Stefan-Boltzmann law. Black body spectra, Wien displacement law. Radiation and climate change: Elements of Thermal Balance: Solar and terrestrial radiation. Earth's budget: Radiative equilibrium, RCE (Radiative Convective Equilibrium), Climate Change. Energy Balance Models. Greenhouse effect: simple model.

Numerical Weather prediction modeling (NWP): Mesoscale motions: numerical modeling with WRF/ARPS.
Data: Copernicus and the ERA5 Reanalysis (European Centre for Medium-Range Weather Forecasts, Reading, U.K.)