

## ATMOSPHERIC MODELING

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Introduction: weather, climate and air pollution, atmospheric processes, scales of motion, differences between weather prediction models and climate models; Atmosphere: pressure, density and composition, equations of state, changes pressure and temperature with altitude, water in atmosphere, first law of thermodynamics ; Continuity and Energy Equation: Derivation of generalized continuity equation for compressible fluid (air) and constituents (gas, particle) suspended in a compressible fluid, examples of wind driven circulation, thermodynamic energy equation; Momentum equation: Coordinate systems and grids: brief descriptions of Cartesian, spherical, UTM, Mercator projection, stereographic projection, Lambert Conformal projection; brief review of Cartesian to spherical Co-ordinate transformation; Generalized derivation of the momentum equation in an inertial frame of reference: local acceleration, coriolis force, gravitational force, pressure gradient force, viscous force, turbulent-flux divergence, Ekman number, Rossby number and Froude number; Applications: Geostrophic wind, Surface-layer winds, Gradient winds and atmospheric waves; Vertical coordinate conversions, introduction to numerical solution of the equations, brief introduction to parameterization of the atmospheric processes.