

1. Introduction

1.1 Fundamental Laws

➤ Fundamental laws of geophysical fluid dynamics (GFD) and thermodynamics are applied to describe the

(a) atmospheric motions, (u, v, w)

[Mechanics]

(b) states of the atmosphere, (ρ, p, T)

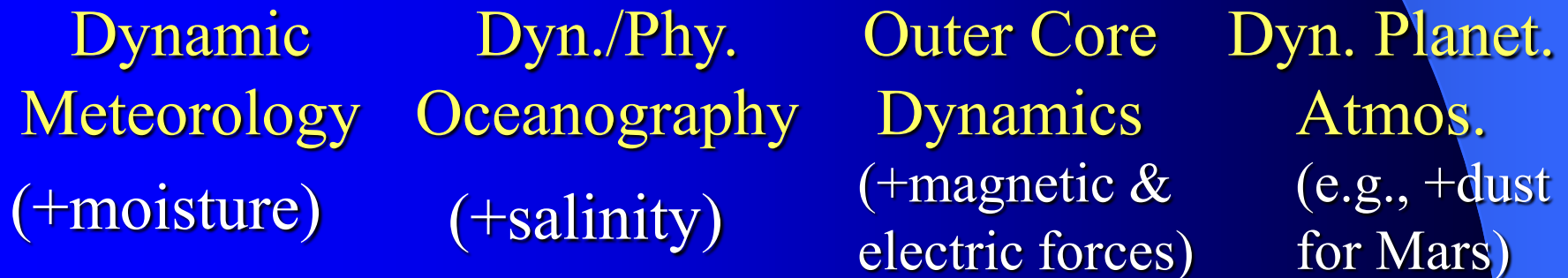
[Thermodynamics]

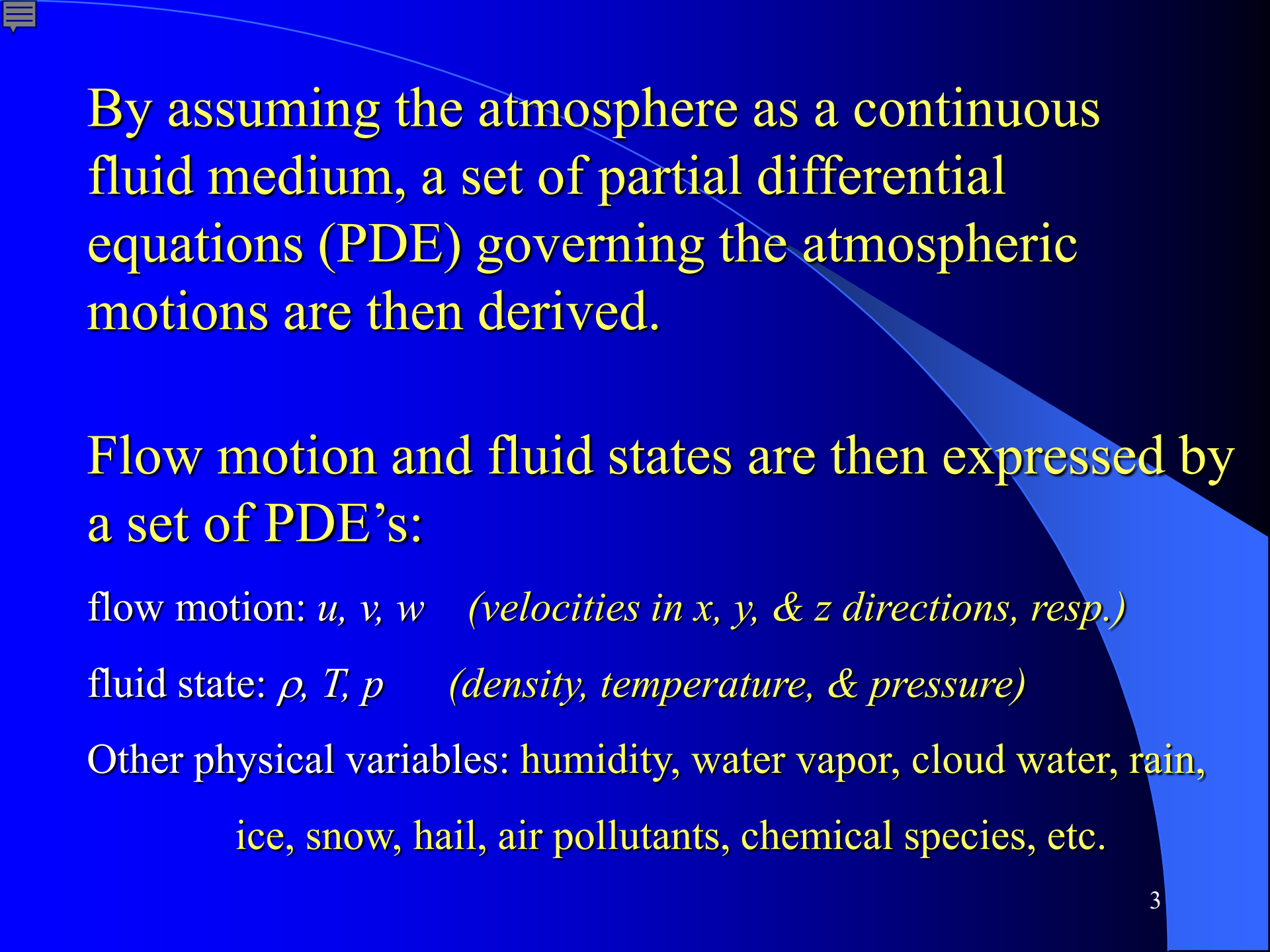
The relationship among different branches of Fluid Dynamics

Fluid Dynamics

+stratification ↓ +rotation

GFD





By assuming the atmosphere as a continuous fluid medium, a set of partial differential equations (PDE) governing the atmospheric motions are then derived.

Flow motion and fluid states are then expressed by a set of PDE's:

flow motion: u, v, w (*velocities in x, y , & z directions, resp.*)

fluid state: ρ, T, p (*density, temperature, & pressure*)

Other physical variables: humidity, water vapor, cloud water, rain, ice, snow, hail, air pollutants, chemical species, etc.

➤ Objectives: to understand the mechanisms for atmospheric motions and processes and to help predict the weather.

➤ Various approaches have been adopted to solve this set of PDE equations.

➤ Solve PDEs analytically by making approx. ➡

Dynamic Meteorology

➤ Solve PDEs approximately by computers ➡

Numerical Weather Prediction

➤ Combination of the above approaches ➡

Synoptic-Dynamic Meteorology

The relationship among different branches of Atmospheric Sciences and Meteorology

