Eight essentials of Chaps. 1 - 3

- Climate: Atmosphere + hydrosphere (ocean, lake, river, …) + earth

- Physics: Three conservative quantities: mass, momentum, energy

  + their statistical quantities: density, pressure, temperature

Force (momentum input) balance

- Vertical hydrostatic: Pressure gradient ≈ Gravity

- Horizontal geostrophic: Pressure gradient ≈ Coriolis   (mainly extratropical)

- Imbalance: Acceleration − friction → Waves, convections (Chaps 5 – 6)

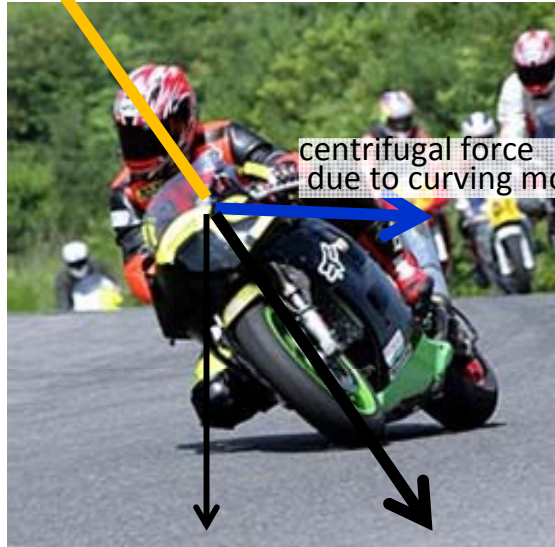**Energy balance**

- Radiative energy : Insolation − "parasol" ≈ infrared − "greenhouse"

- Convection adjusting imbalance → Troposphere + stratosphere

- Condensation alleviation → − 10 / − 5 K/km outside/inside of cloud

Force balance over the rotating earth

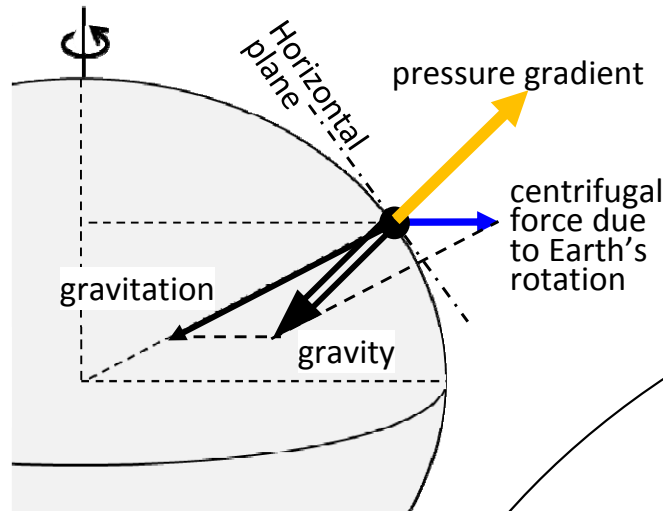normal force
From road surface

Motorcycle on curving road
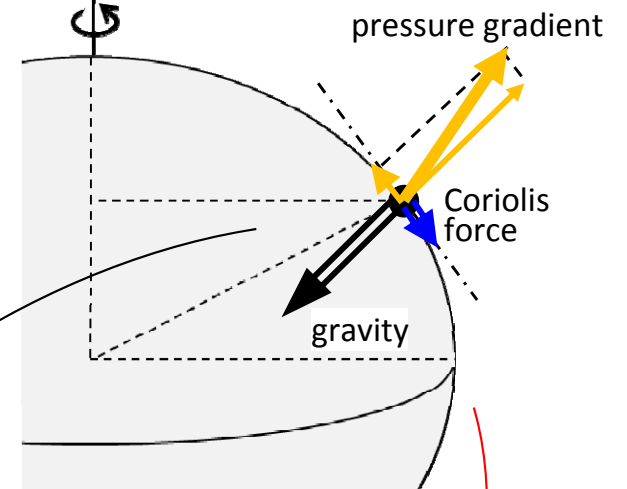
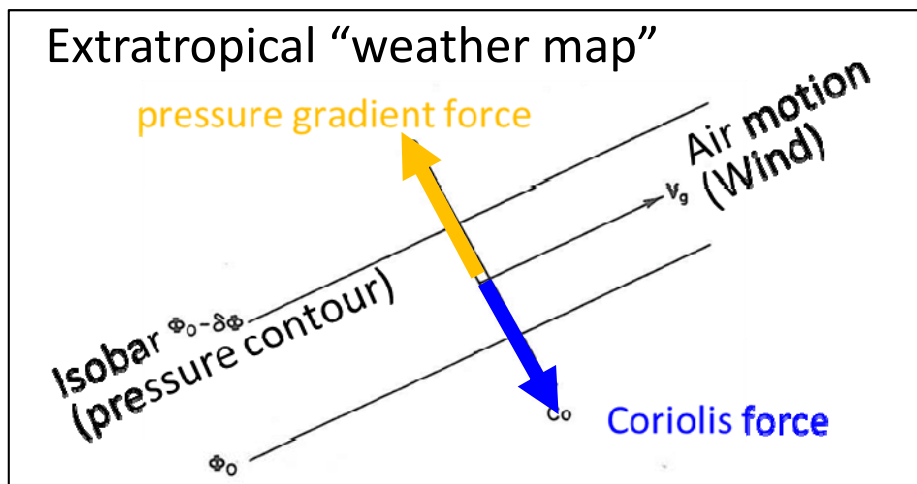centrifugal force due to curving motion

gravity

Air at rest on Earth

Horizontal plane

pressure gradient

centrifugal force due to Earth's rotation

gravitation

gravity

Air moving with geostrophic westerly

pressure gradient

Coriolis force

gravity

Extratropical "weather map"

pressure gradient force

Air motion (Wind)

v_g (Wind)

Isobar $\Phi_0 - \delta\Phi$ (pressure contour)

Coriolis force

c_0

Φ_0

Near the equator
free from Coriolis force
air moves following
force imbalance
(vertical buoyancy and
horizontal pressure gradient)

Energy balance and vertical temperature profile