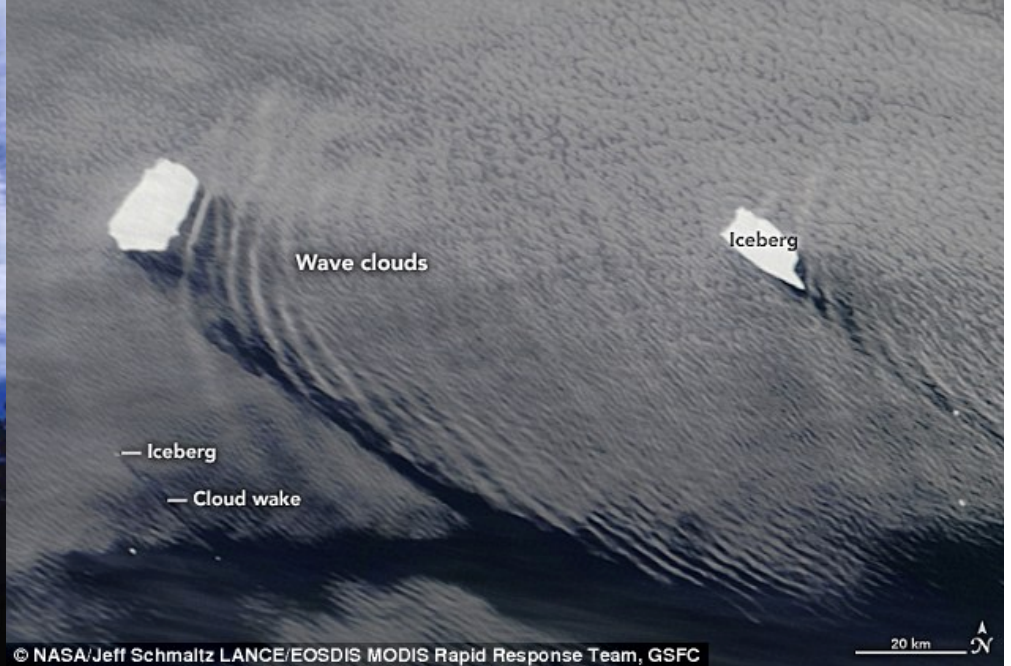
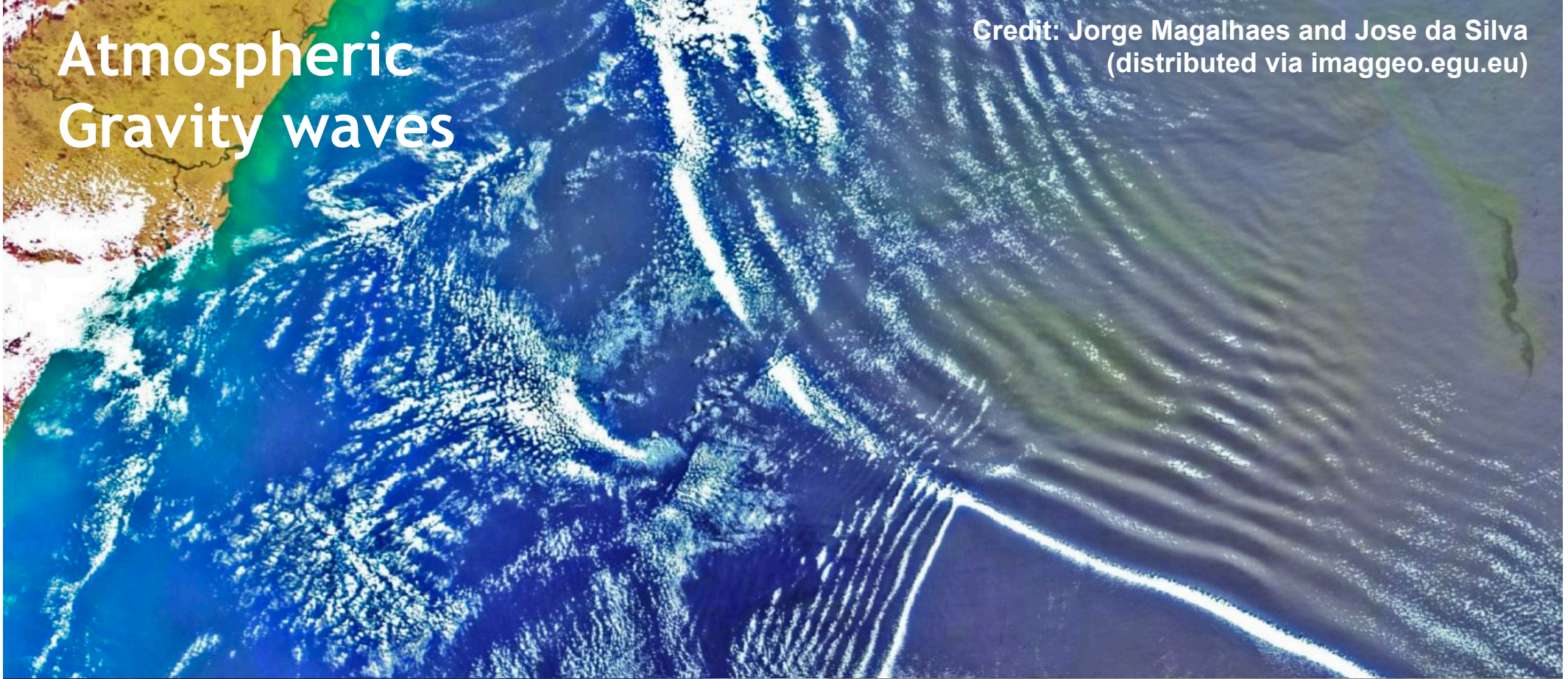


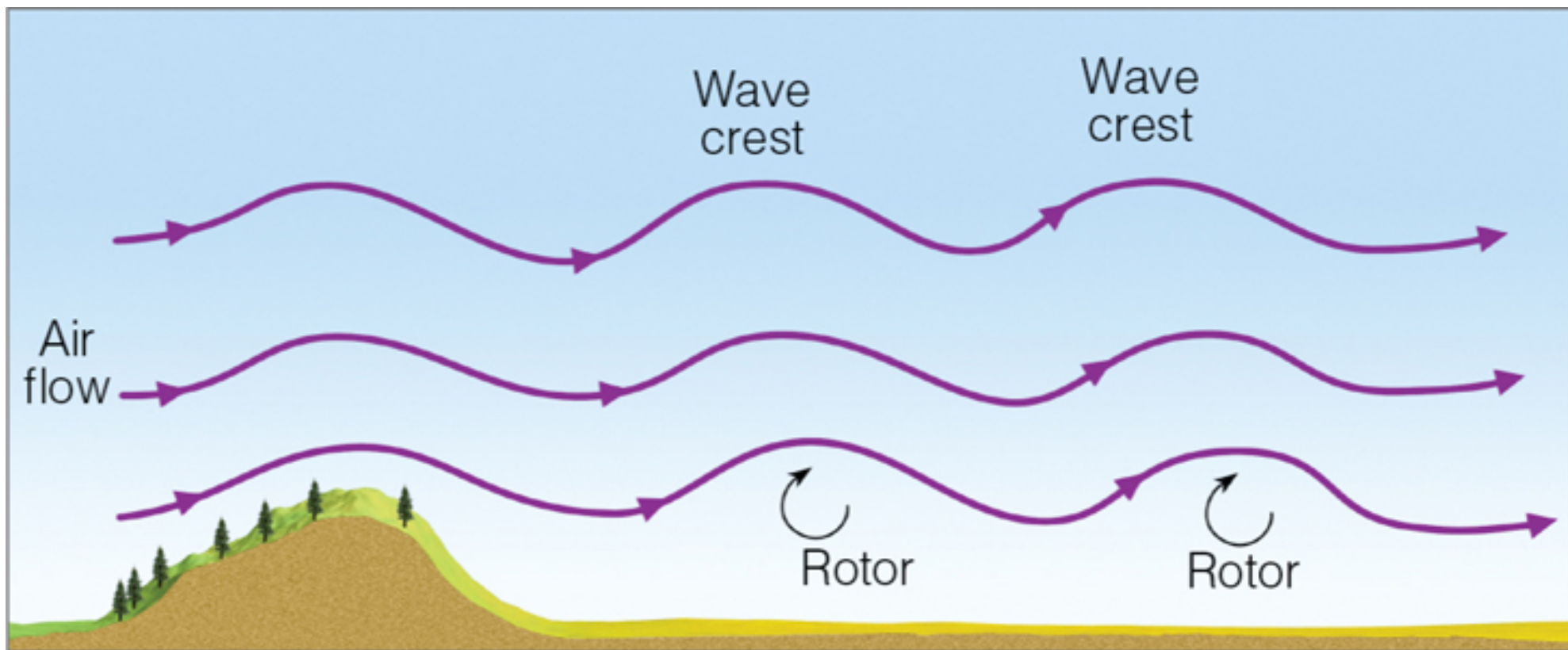
Atmospheric Gravity waves

Credit: Jorge Magalhaes and Jose da Silva
(distributed via imagegeo.egu.eu)

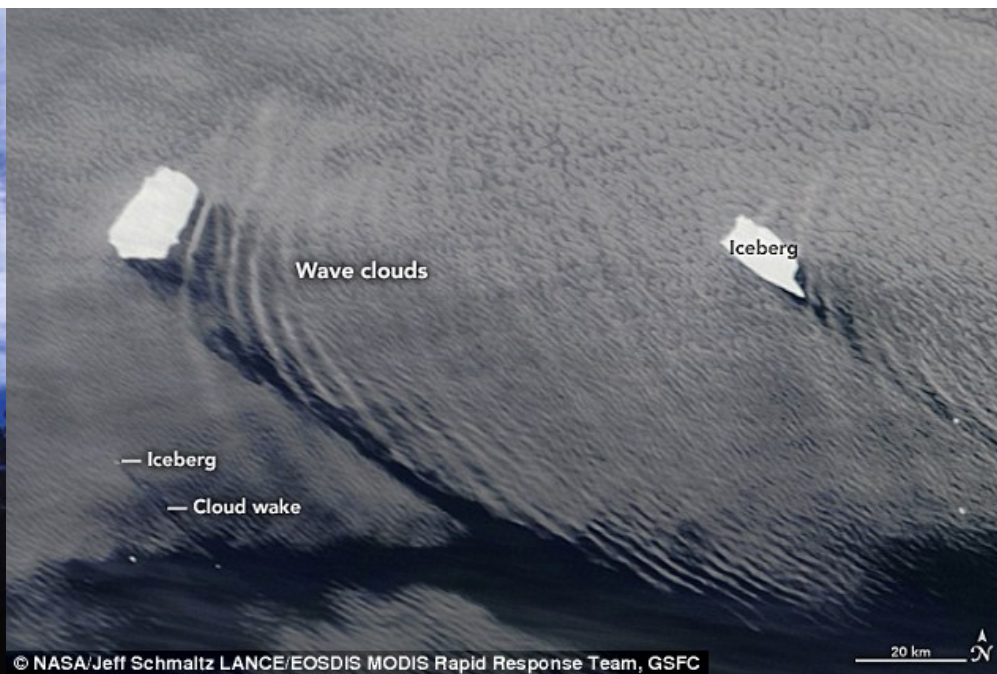


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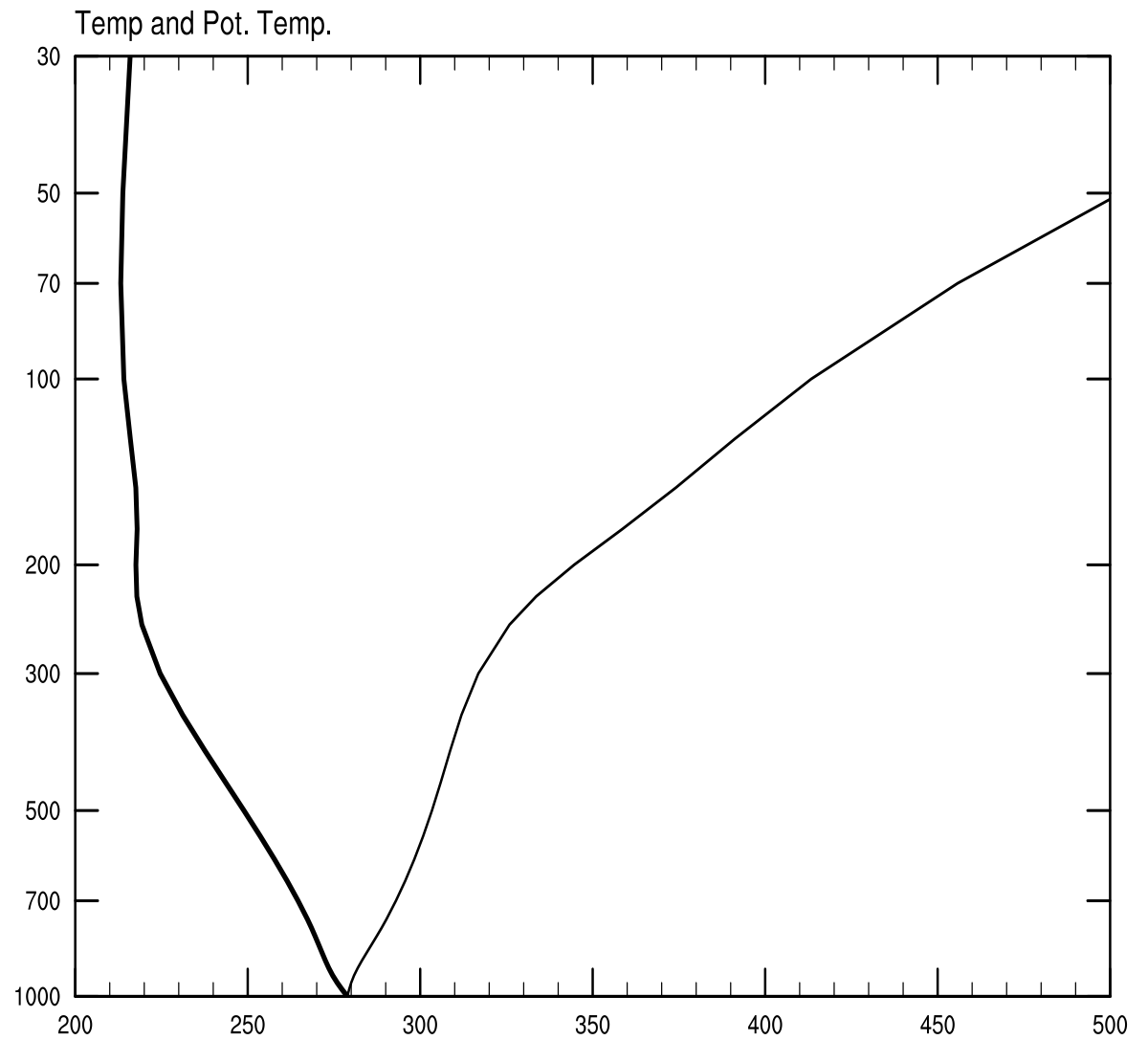
Buoyancy oscillation

*Consider local process
without diffusion*

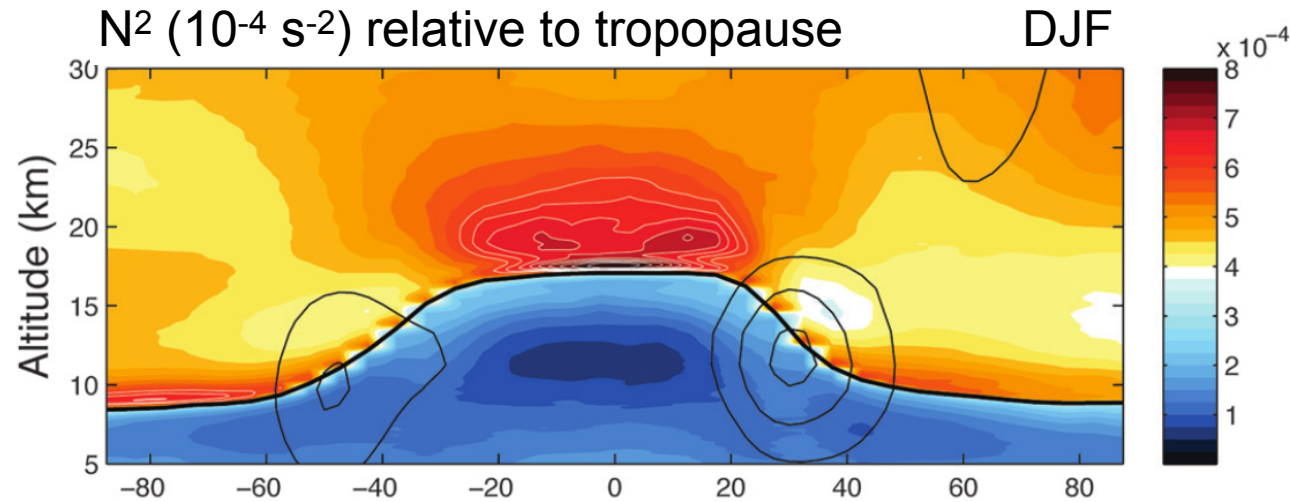
$$\rho \frac{Dw}{Dt} = -\frac{\partial p}{\partial z} - \rho g$$

$$\rho \frac{Dw}{Dt} = -\frac{\partial p}{\partial z} - (\rho_0 + \rho')g$$

$$\frac{Dw}{Dt} = -\frac{\rho'}{\rho}g$$



Buoyancy frequency (N^2)



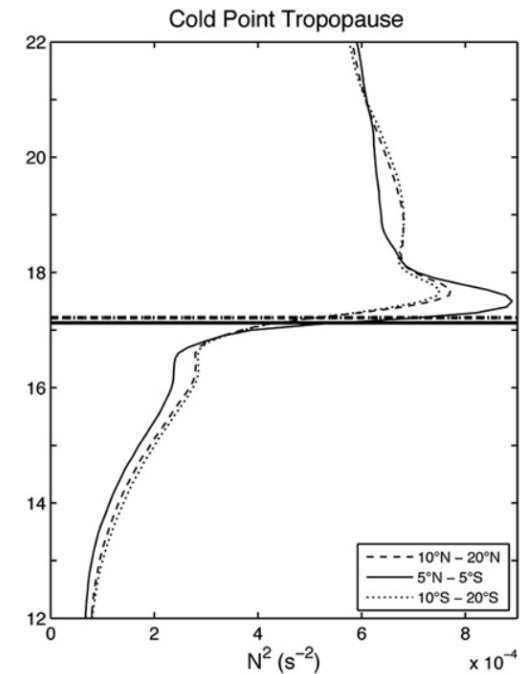
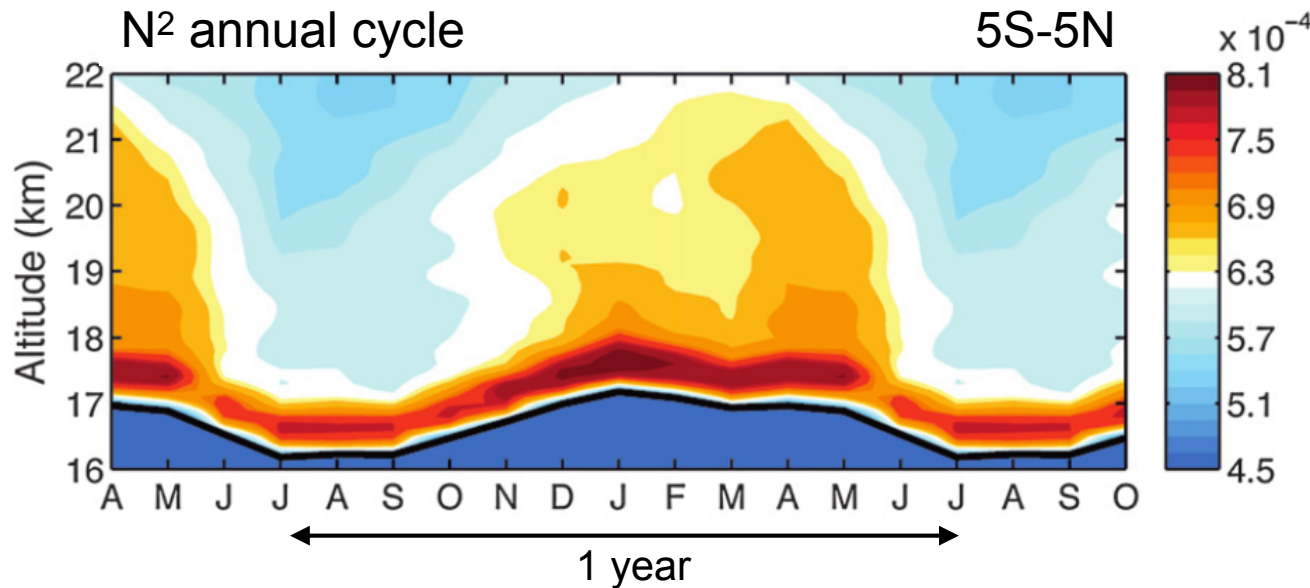
N acts as a “frequency” of this oscillation solution

$$\frac{D^2 \delta z}{Dt^2} = -N^2 \delta z \quad (\text{solution } \delta z = c e^{iNt})$$

Buoyancy oscillation eq.

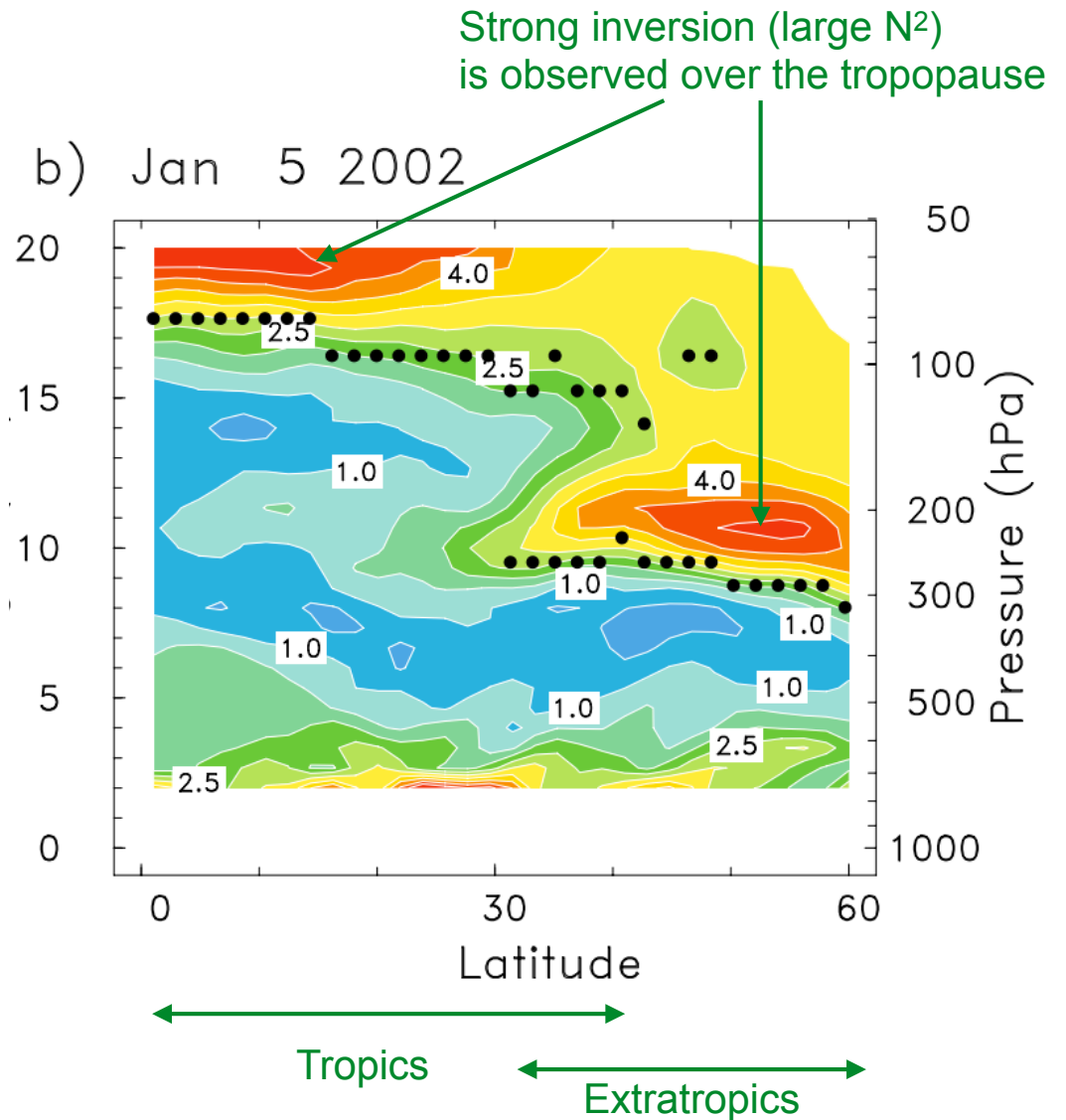
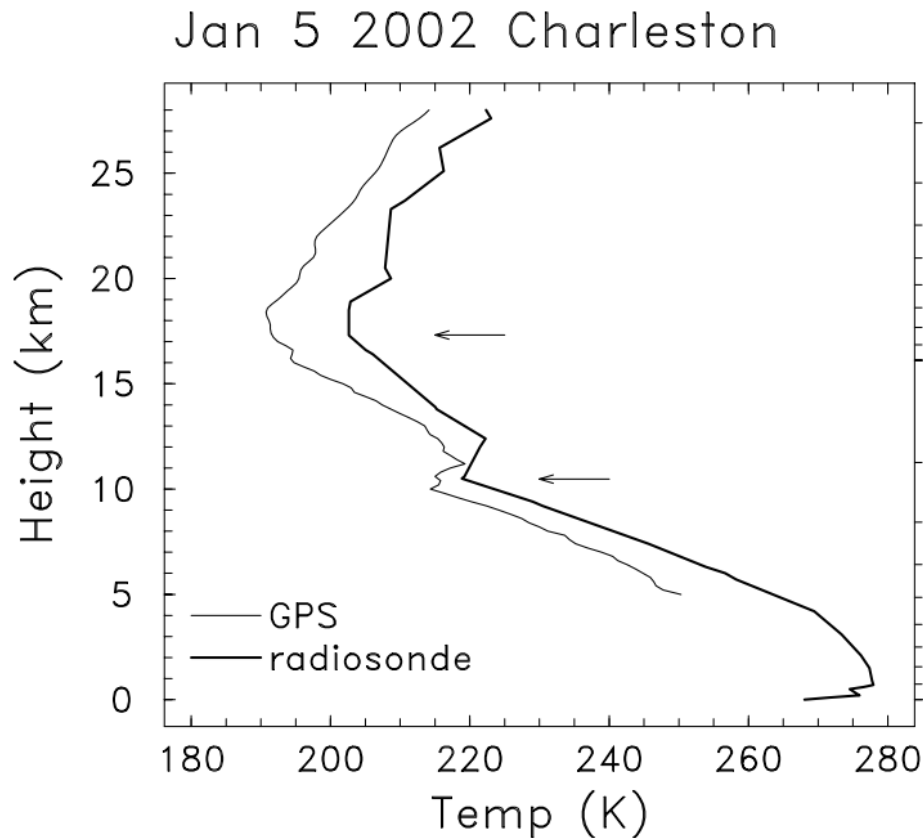
$$N^2 = \frac{g}{\theta_0} \frac{d\theta_0}{dz}, \quad \text{where } \theta_0 = \theta_0(z)$$

Potential temperature profile of background



Grise et al. (2010)

Double tropopause



- Clear division of tropospheric and stratospheric air
- “Tropical air” and “extratropical air” are well determined by altitude of the TIL (and tropopause)

Randel et al. (2007)