2020/2021

DYNAMICS OF THE ATMOSPHERE AND THE OCEAN

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Theroretical exam – questions

1) Which forces act on a parcel (elementary volume) of air?
2) Explain differences between equation of motion of atmospheric and oceanic flows.
3) Why do we perform scale analysis of the equations of motion?
4) Explain primitive equations.
5) Explain the geostrophic approximation.
6) Explain the balanced flow approximmation.
7) Explain horizontal motion in high and low pressure system
8) Explain the hydrostatic approximation.
9) Geopotential: what is it?
10) Explain advantages of pressure coordinates.
11) Why sometimes Boussinesq approximation is useful? In which problems?
12) Explain principle of the anelastic approximation.
13) Explain the shallow water approximation.
14) Explain thermal wind.
15) Explain planetary and relative cirulation.
16) Hydrostatic approximation results in vanishing of vertical accelerations in the momentum equations. Does this mean that the vertical velocities in hydrostatic atmosphere are constant? How we do estimate vertical velocities?
17) Explain atmospheric and oceanic Ekman layer.
18) Explain effects of surface friction on synoptic-scale circulations.
19) Write and explain Bjerkness circulation theorem.
20) Which component of vorticity vector is the most important in geophysical fluid dynamics? Why?
21) Explain potential vorticity.
22) Dow does zonal flow react on mountain range?
23) Using quasi geostrophic approximation one can derive omega and tendency equations. Explain their meaning.
24) Sketch and explain an idealized cross-section through the developing baroclinic wave.
25) List types of atmospheric waves. Which types are related to Earth rotation?
26) In which direction gravity waves transport energy?
27) Explain linearization of perturbed equations.
28) Explain derivation of dispersion relationship.
29) Explain Rossby Waves.
30) Explain the available potential energy.
31) Explain source of kinetic energy of atmospheric circulations.
32) Explain Lorenz energy cycle.