

## **DYNAMICS OF THE ATMOSPHERE AND THE OCEAN**

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### **Theoretical exam – questions**

- 1) List and explain forces acting 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 approximation.
- 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 circulation.
- 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 Bjerknes circulation theorem.
- 20) Which component of vorticity vector is the most important in geophysical fluid dynamics? Why?
- 21) Explain potential vorticity.
- 22) How 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.