

Waves properties and barotropic instabilities

Question 5

True or False ?

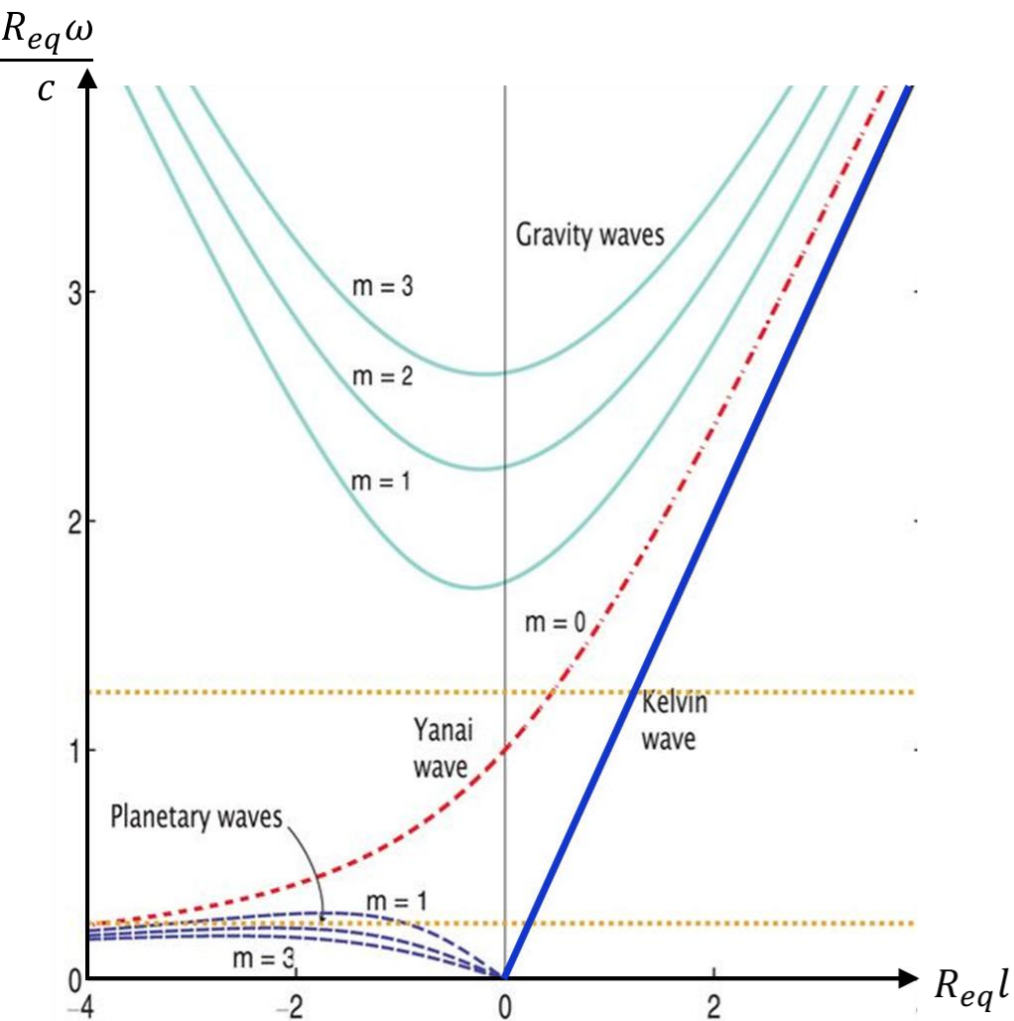
- a) Equatorial Kelvin waves propagate westwards.
- b) Equatorial wave structures that are symmetric in u are antisymmetric in v .
- c) Long equatorial Rossby waves propagate faster than equatorial Kelvin waves.
- d) Long equatorial Kelvin waves propagate faster than short equatorial Kelvin waves.
- e) Equatorial waves have wider meridional extent when the thermocline is deeper.

- f) Barotropic Rossby waves can grow exponentially if the background flow has a maximum in absolute vorticity.
- g) Barotropic Rossby waves can grow exponentially if the background flow has a minimum in absolute vorticity.
- h) Barotropic Rossby waves cannot grow exponentially if the zonal flow everywhere has the opposite sign to the meridional gradient of absolute vorticity.

Waves properties

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True or False ?



Equatorial wave general solution:

$$u = \tilde{u}(y)e^{i(kx - \omega t)}$$

$$v = \tilde{v}(y)e^{i(kx - \omega t + \pi/2)}$$

$$\eta = \tilde{\eta}(y)e^{i(kx - \omega t)}$$

$$K \sim e^{-\frac{\beta}{2\sqrt{g'H}}y^2}$$

- a) Equatorial Kelvin waves propagate westwards. ✘
- b) Equatorial wave structures that are symmetric in u are antisymmetric in v . ✔
- c) Long equatorial Rossby waves propagate faster than equatorial Kelvin waves. ✘
- d) Long equatorial Kelvin waves propagate faster than short equatorial Kelvin waves. ✘
- e) Equatorial waves have wider meridional extent when the thermocline is deeper. ✔

Barotropic instabilities

Question 5

True or False ?

$\beta - \bar{u}_{yy}$ must change sign somewhere in the domain between (0 and L).
↳ If the Rayleigh criterion is satisfied, we might have an instability.

$\forall u_0, (\bar{u} - u_0)(\beta - \bar{u}_{yy})$ must be positive somewhere in the domain.
↳ If the Fjørtoft criterion is satisfied, we might have an instability.

- f) Barotropic Rossby waves can grow exponentially if the background flow has a maximum in absolute vorticity. ✓
- g) Barotropic Rossby waves can grow exponentially if the background flow has a minimum in absolute vorticity. ✓
- h) Barotropic Rossby waves cannot grow exponentially if the zonal flow everywhere has the opposite sign to the meridional gradient of absolute vorticity. ✓