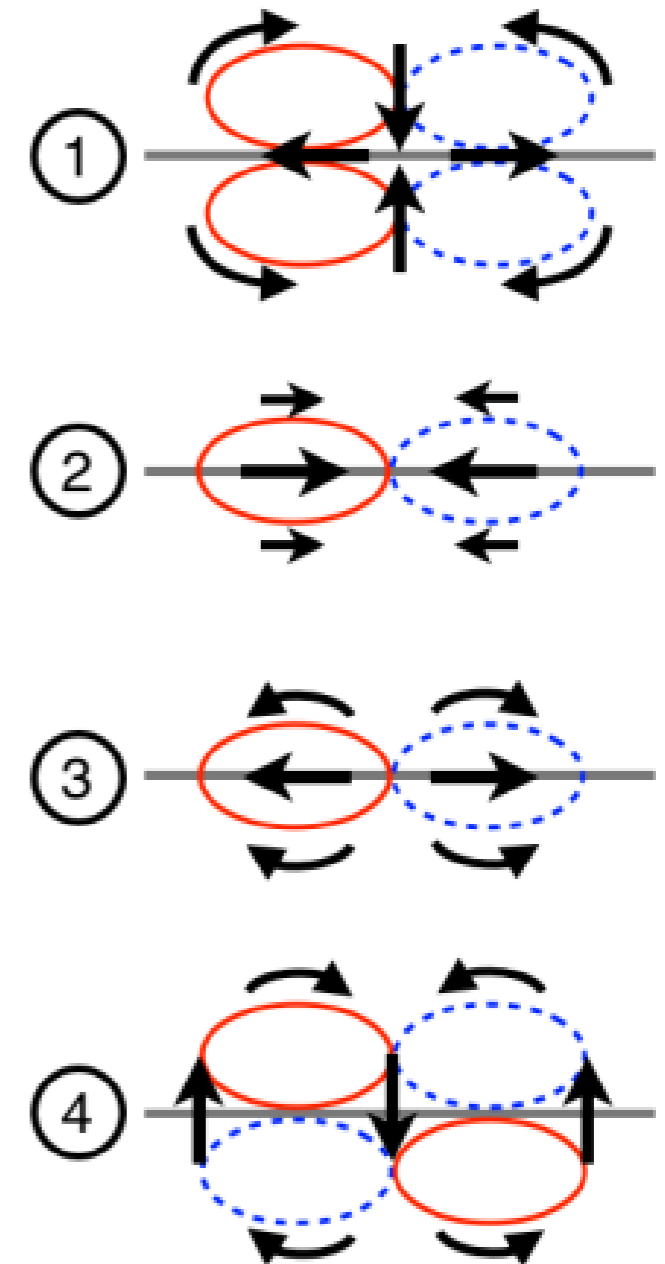
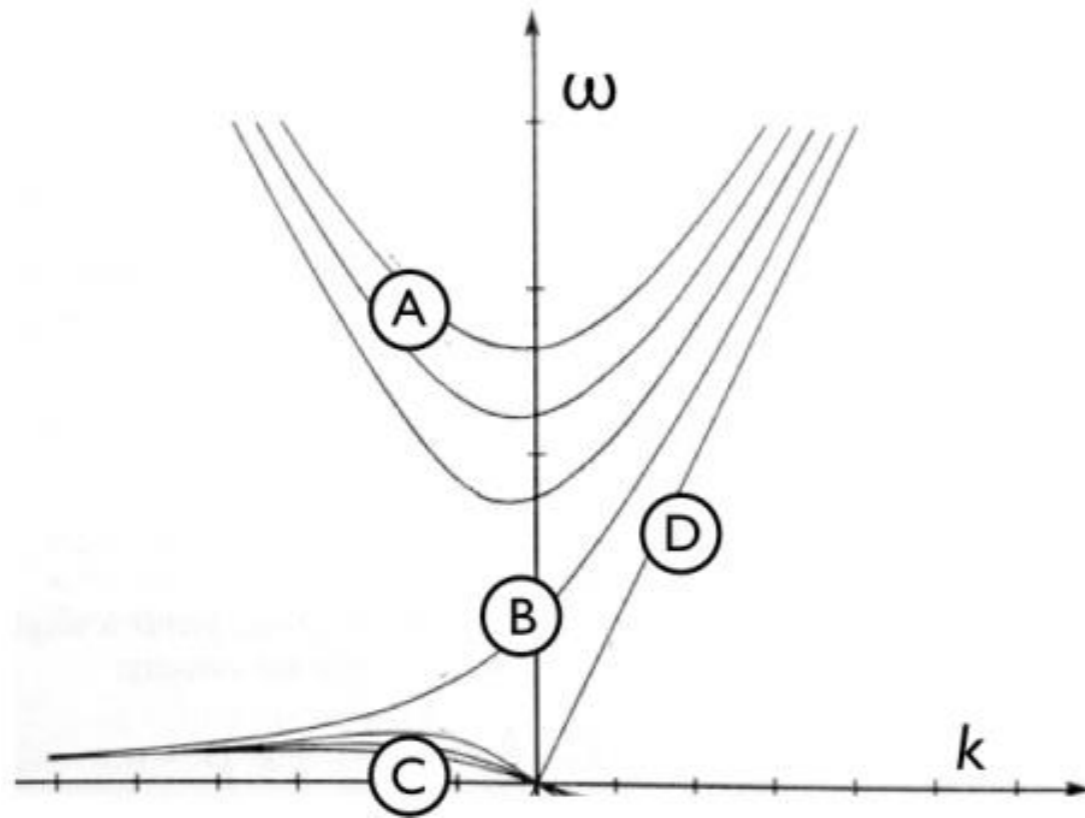




# Equatorial wave structures

## Question 4

Match the dispersion relations on the left to the wave structures on the right for  $n < 2$ .



- 1) What is the name for each type of wave ?
- 2) Is it symmetric or antisymmetric in zonal velocity ?
- 3) Is it predominantly divergent or rotational in nature ?
- 4) Is it close to non-dispersive for long waves ?
- 5) Is it close to non-dispersive for short waves ?
- 6) Is it associated with cross-equatorial flow?

# Equatorial Kelvin wave ( $n=-1$ ) structures

## Wave type **(D)** Equatorial Kelvin waves

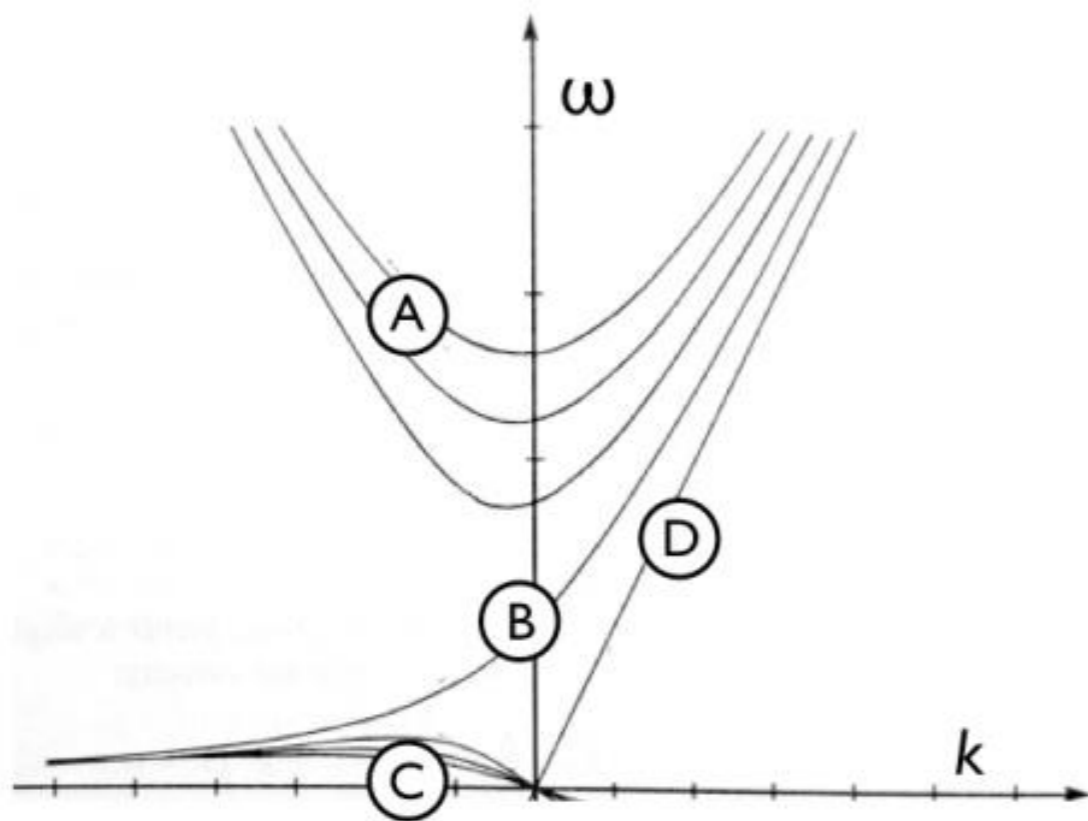
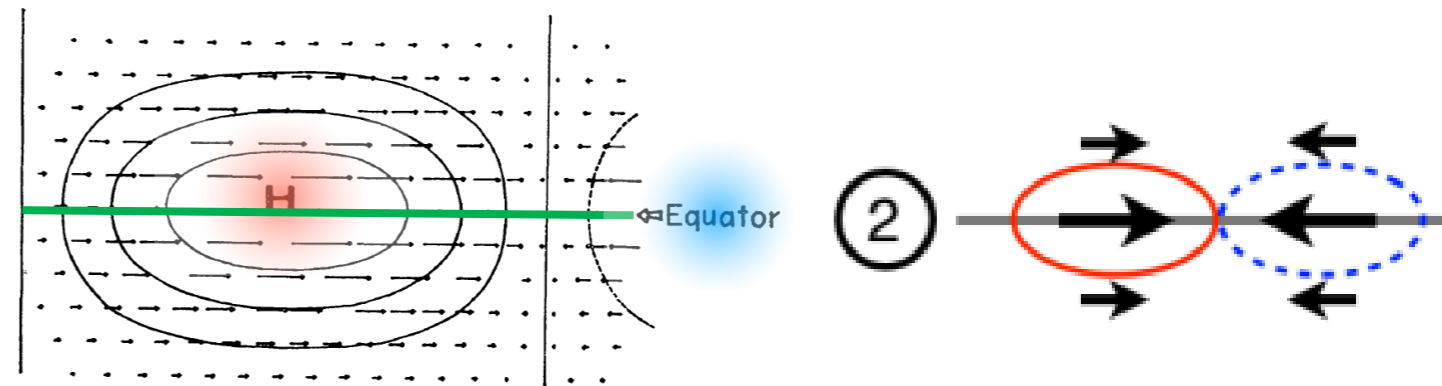


Fig. 8. Pressure and velocity distributions of eigensolution for  $n=-1$  and  $k=0.5$ . This wave behaves like as the Kelvin wave.

from Matsuno (1966)



	<b>(D)</b>
Name	Equatorial Kelvin wave
Symmetric in $u$ ?	✓ ( $n = -1$ )
Predominantly divergent or rotational?	Divergent
Long-waves non-dispersive?	✓
Short-waves non-dispersive?	✓
Cross-equatorial flow	✗

# Mixed Rossby-gravity wave ( $n=0$ ) structures

## Wave type **(B)** Mixed Rossby-gravity waves

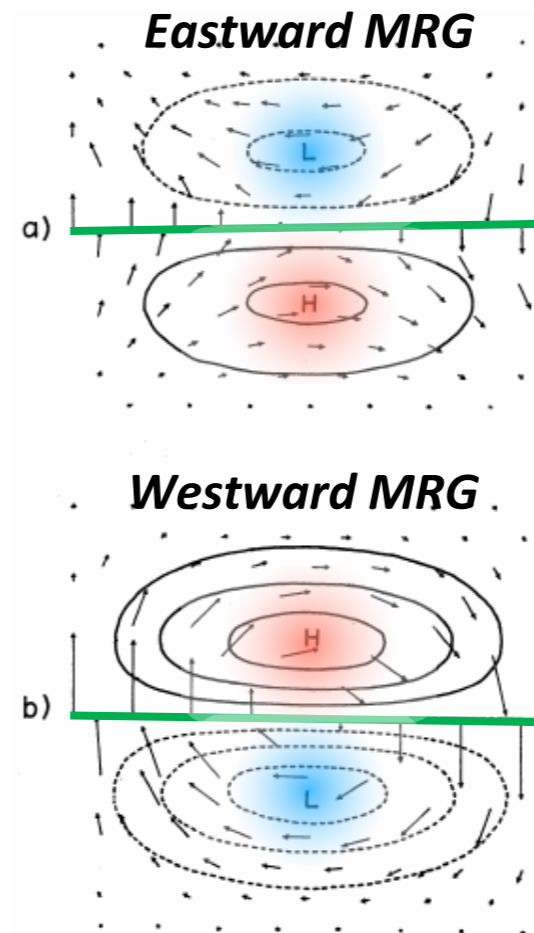
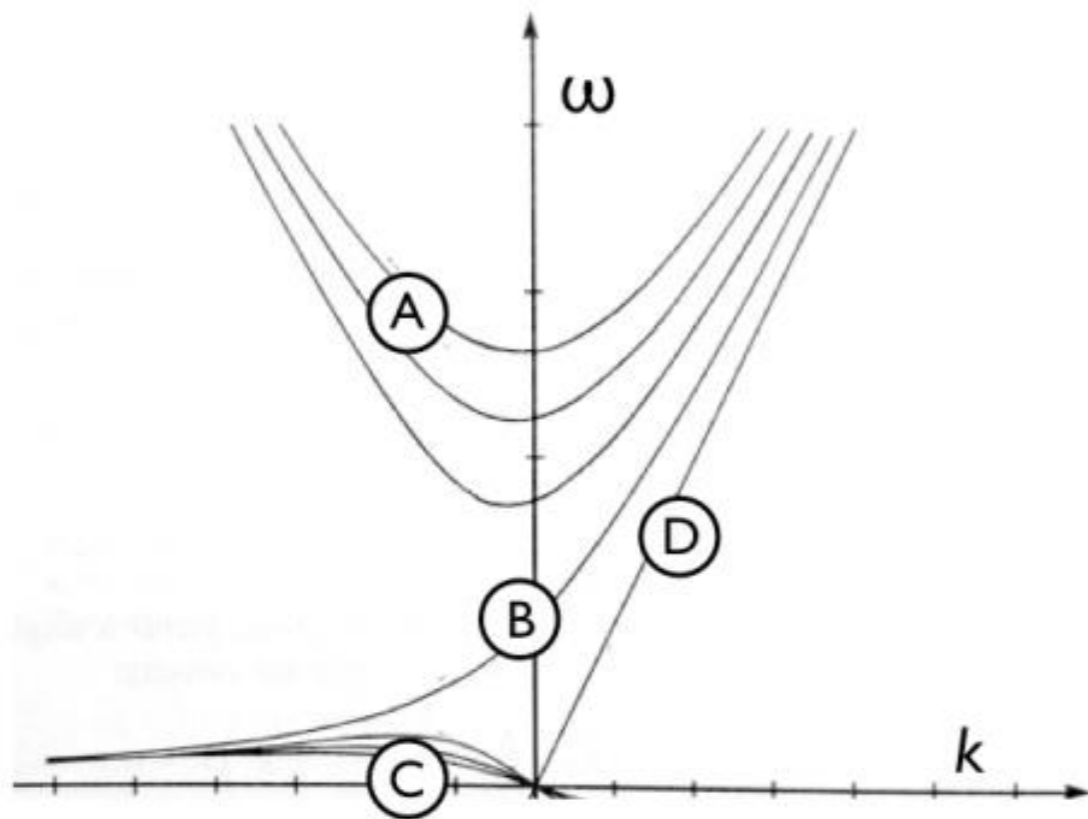
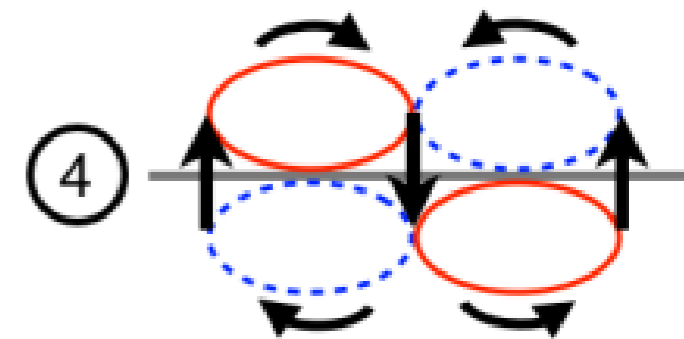


Fig. 6. Pressure and velocity distributions of eigenfunctions for  $n=0$  and  $k=0.5$   
 a: Eastward moving inertio-gravity wave  
 b: Westward moving inertio-gravity wave.

from Matsuno (1966)



	<b>(B)</b>
Name	Mixed Rossby-gravity (Yanai) wave
Symmetric in $u$ ?	<b>x</b> ( $n = 0$ )
Predominantly divergent or rotational?	<b>R-West D-East</b>
Long-waves non-dispersive?	<b>x</b>
Short-waves non-dispersive?	<b>✓</b> For eastward-propagating MRG
Cross-equatorial flow	<b>✓</b>

# $n \geq 1$ Equatorial wave structures

Fig. 4. Pressure and velocity distributions of eigensolutions for  $n=1$   
 a: Eastward propagating inertio-gravity wave  
 b: Westward propagating inertio-gravity wave  
 c: Rossby wave.  
 from Matsuno (1966)

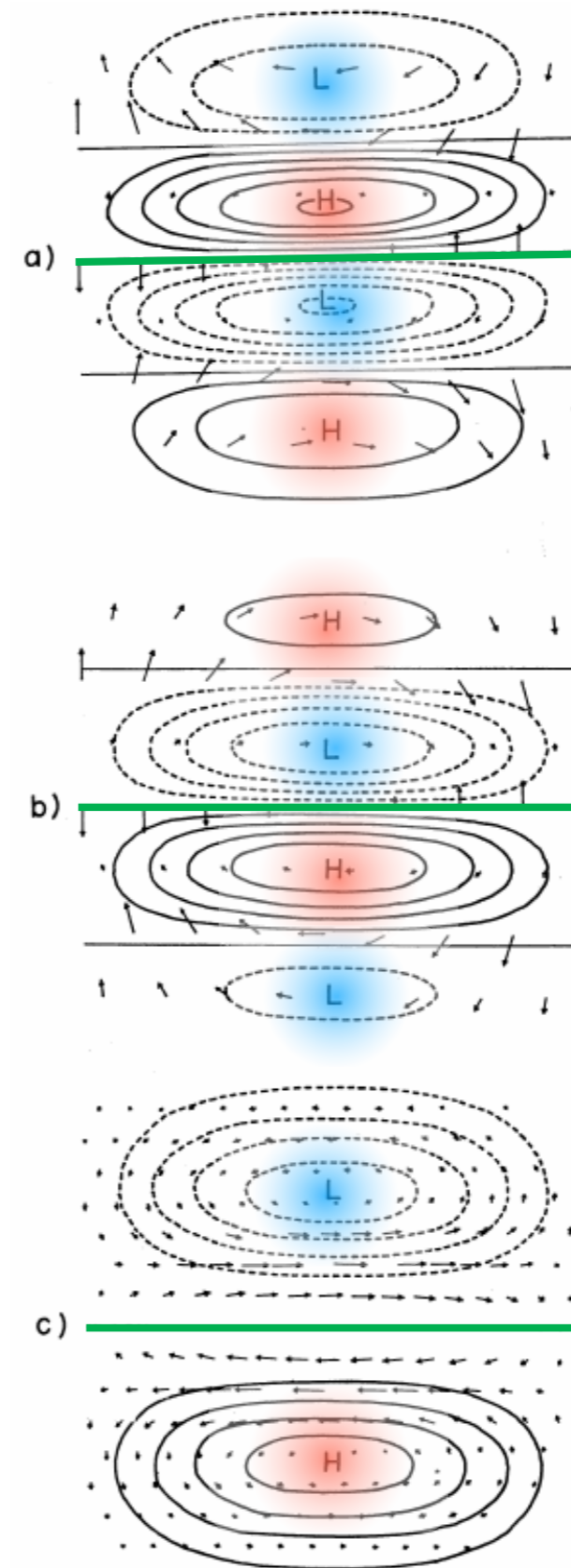
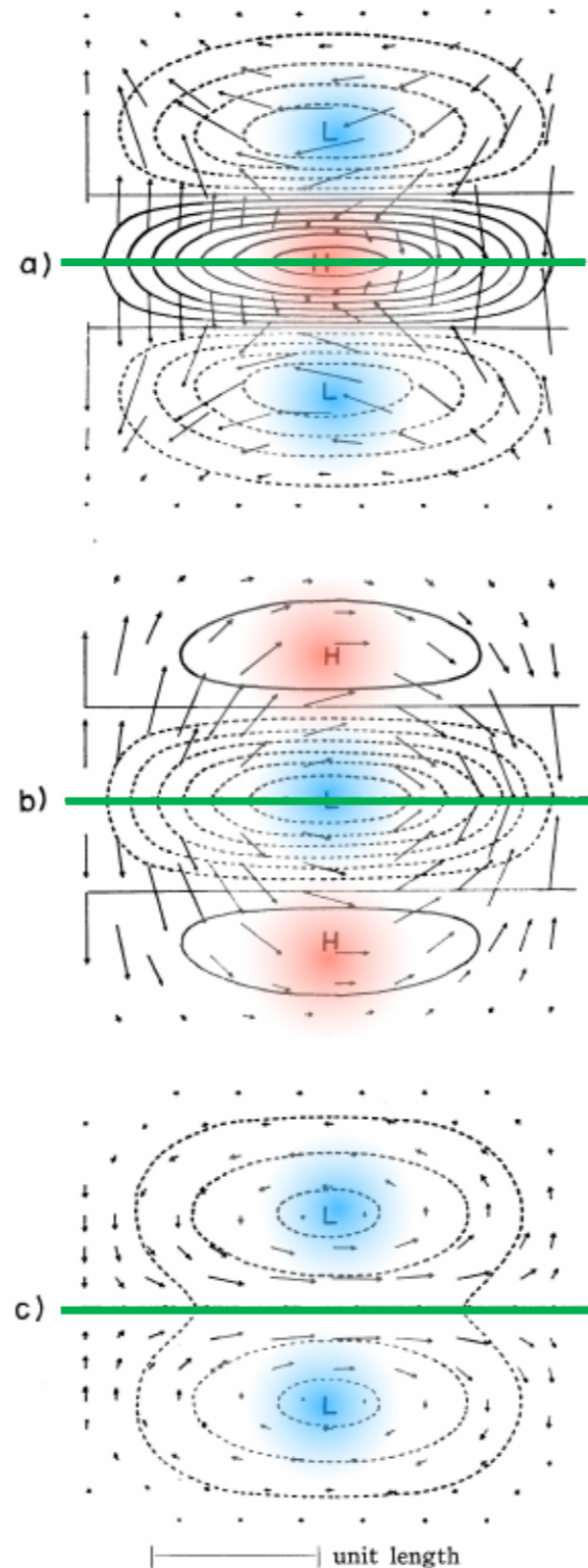


Fig. 5. Same as Fig. 4 but for  $n=2$ .  
 from Matsuno (1966)

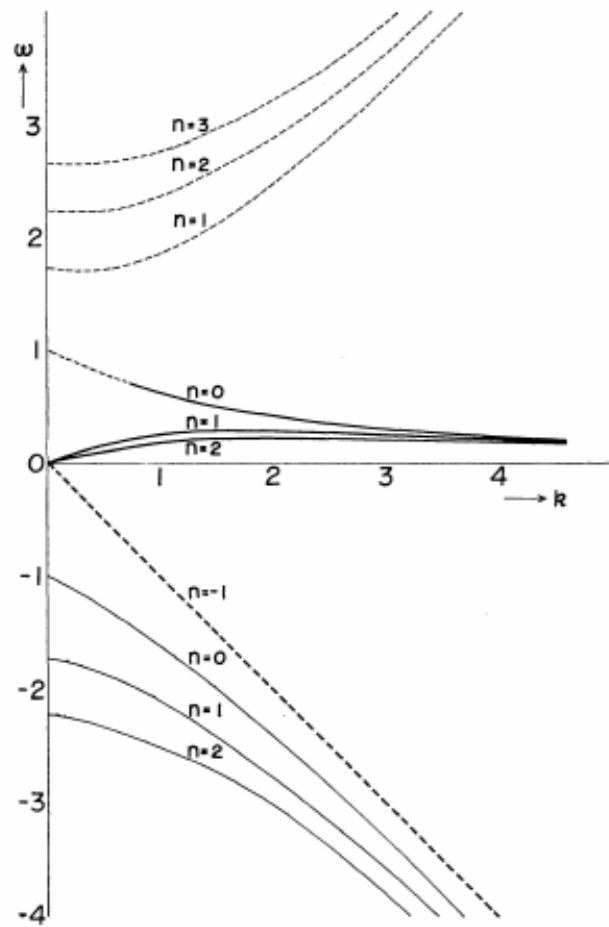
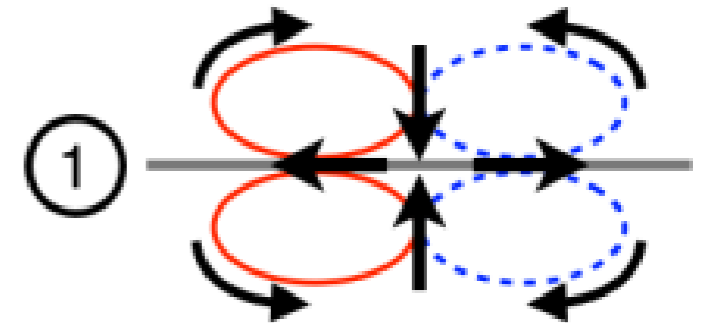
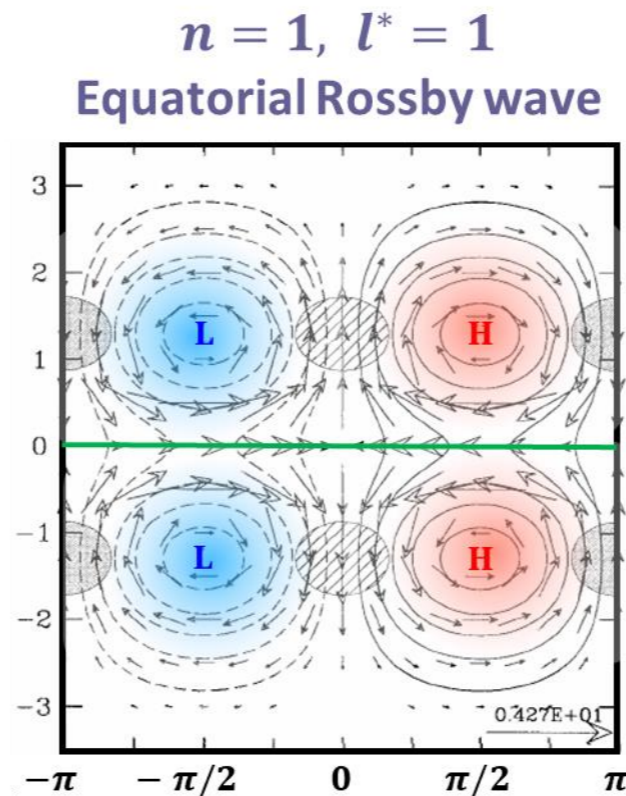
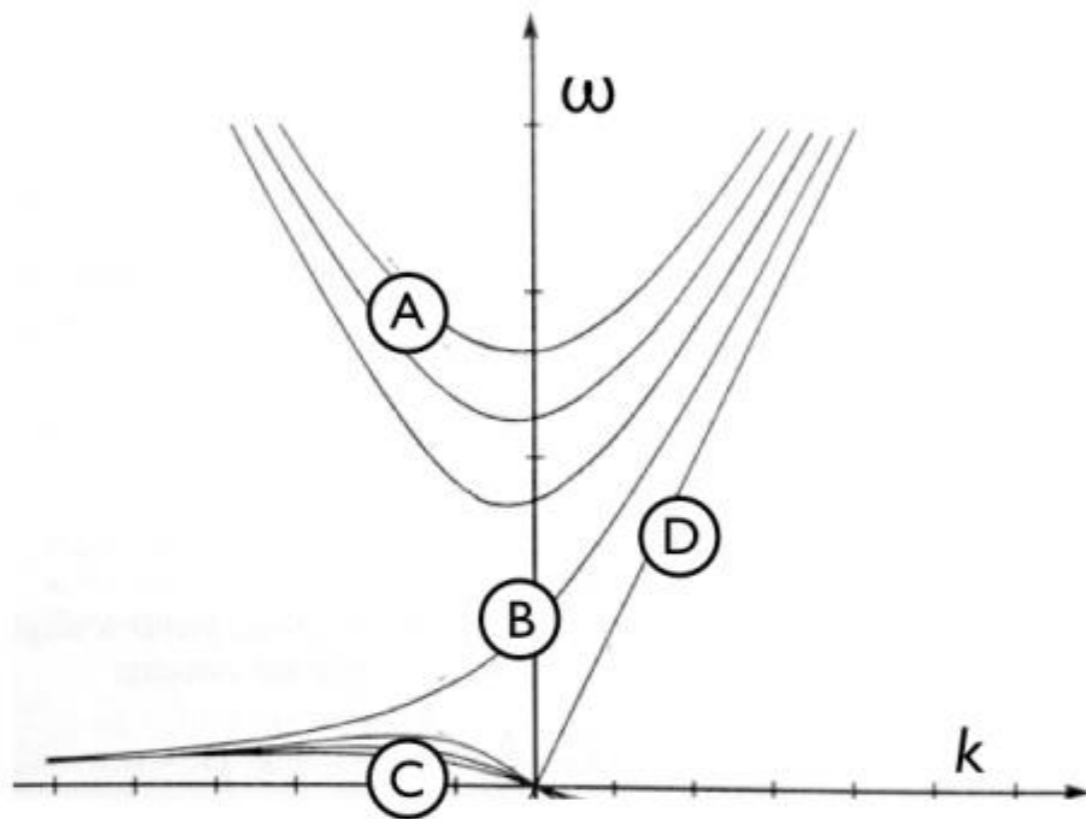


Fig. 3a. Frequencies as functions of wave number.  
 Thin solid line: eastward propagating inertio-gravity waves.  
 Thin dashed line: westward propagating inertio-gravity waves.  
 Thick solid line: Rossby (quasi-geostrophic) waves.  
 Thick dashed line: The Kelvin wave like wave.

# Equatorial Rossby wave structures

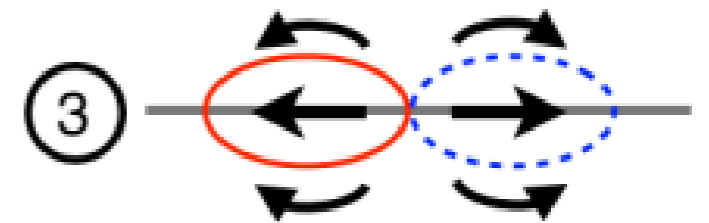
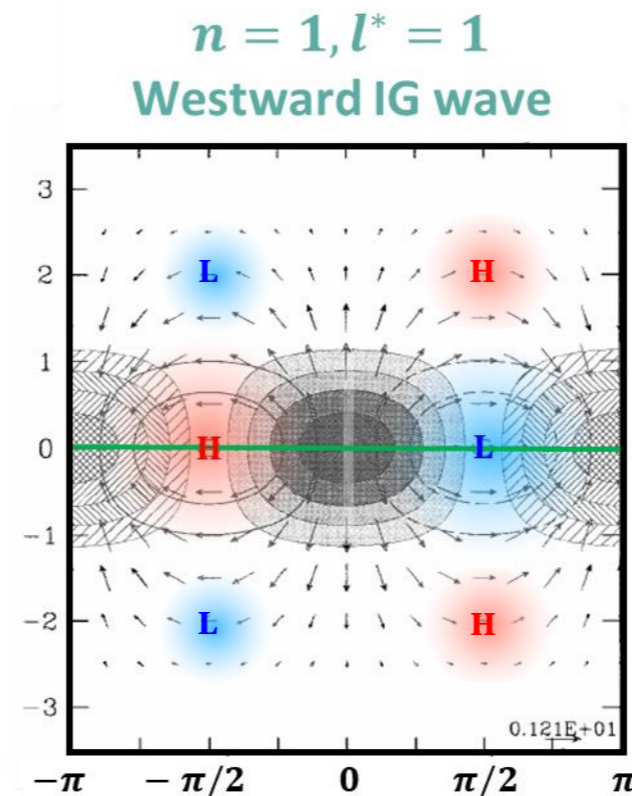
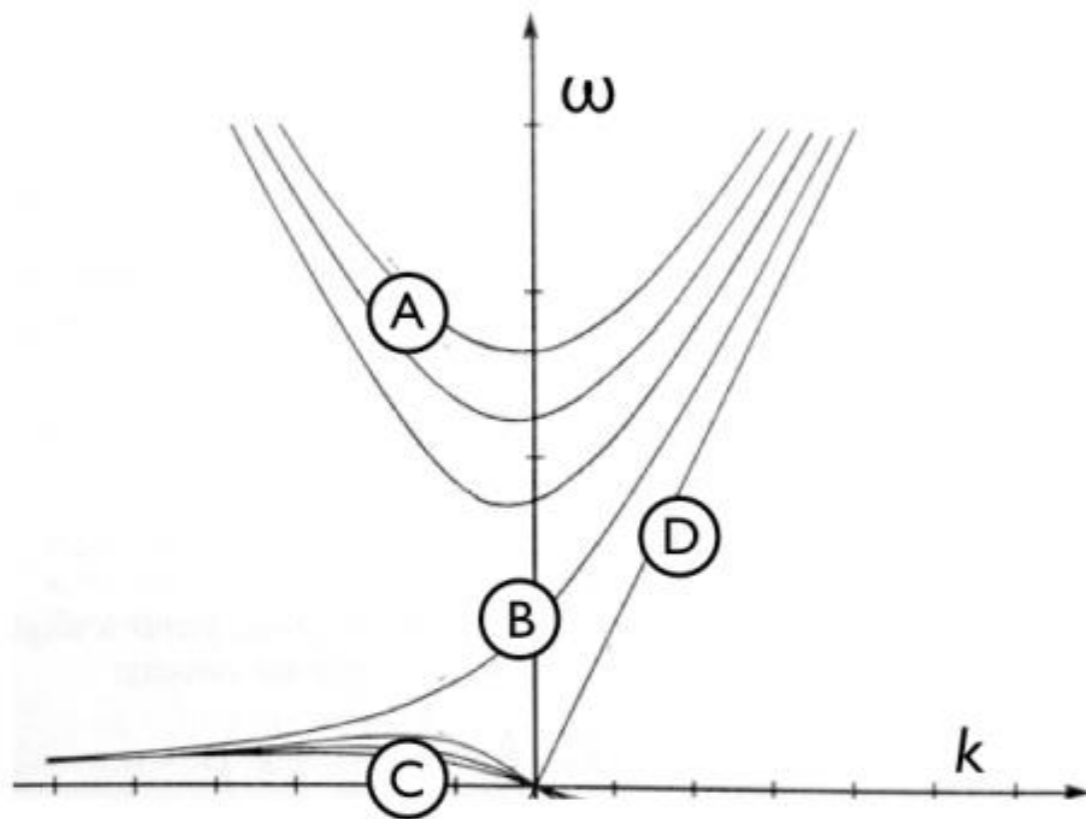
Wave type **(C)** Equatorial Rossby waves



	<b>(C)</b>
Name	Equatorial Rossby wave
Symmetric in $u$ ?	✓ for odd values of $n$
Predominantly divergent or rotational?	Rotational
Long-waves non-dispersive?	✓
Short-waves non-dispersive?	✗
Cross-equatorial flow	✗ for odd values of $n$

# Inertia-gravity wave structures

Wave type **(A)** Inertia-gravity waves



	<b>(A)</b>
Name	Inertia-gravity (Poincaré) wave
Symmetric in $u$ ?	✓ for odd values of $n$
Predominantly divergent or rotational?	Divergent
Long-waves non-dispersive?	✗
Short-waves non-dispersive?	✓
Cross-equatorial flow	✗ for odd values of $n$