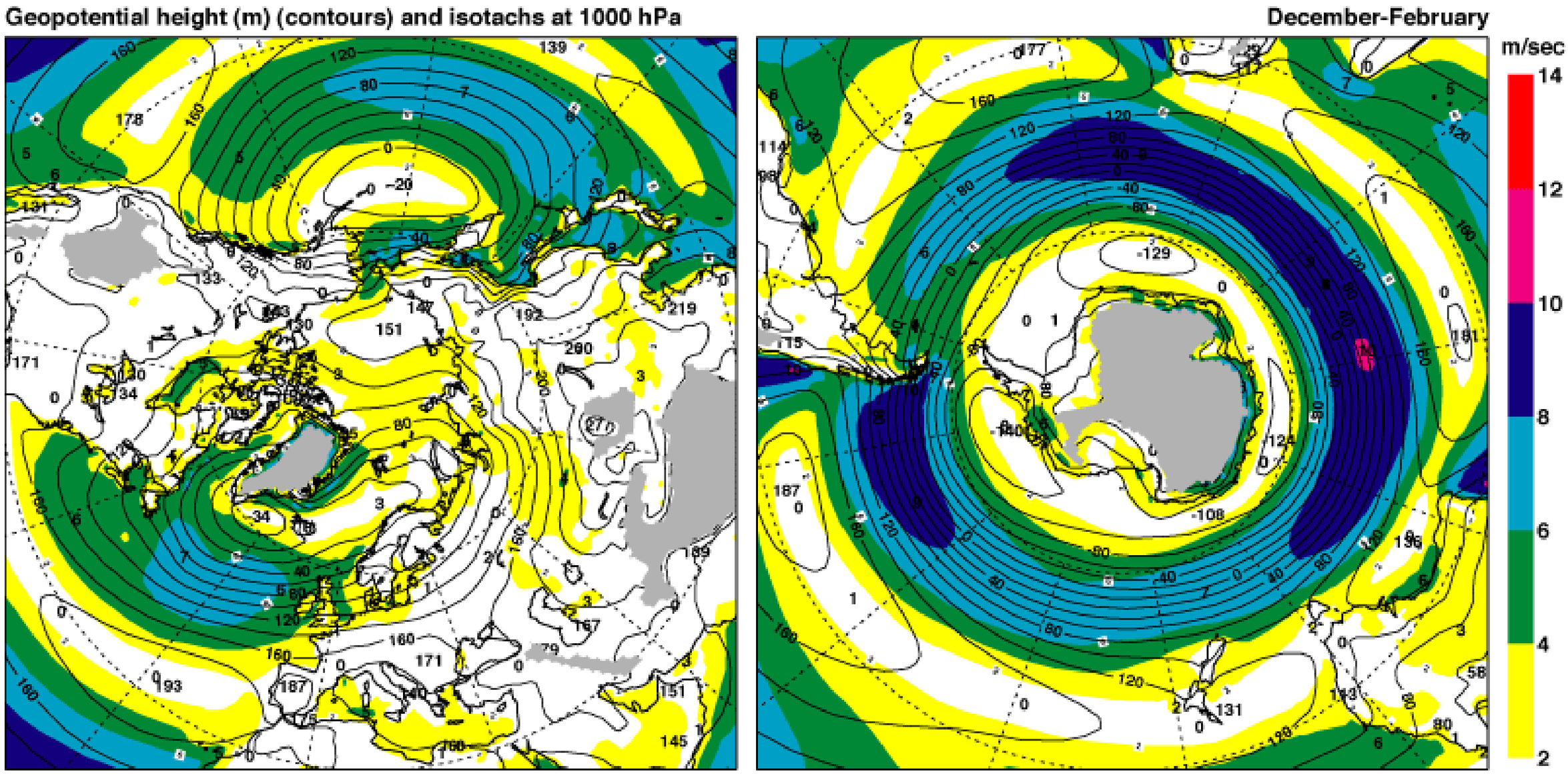
The stationary waves

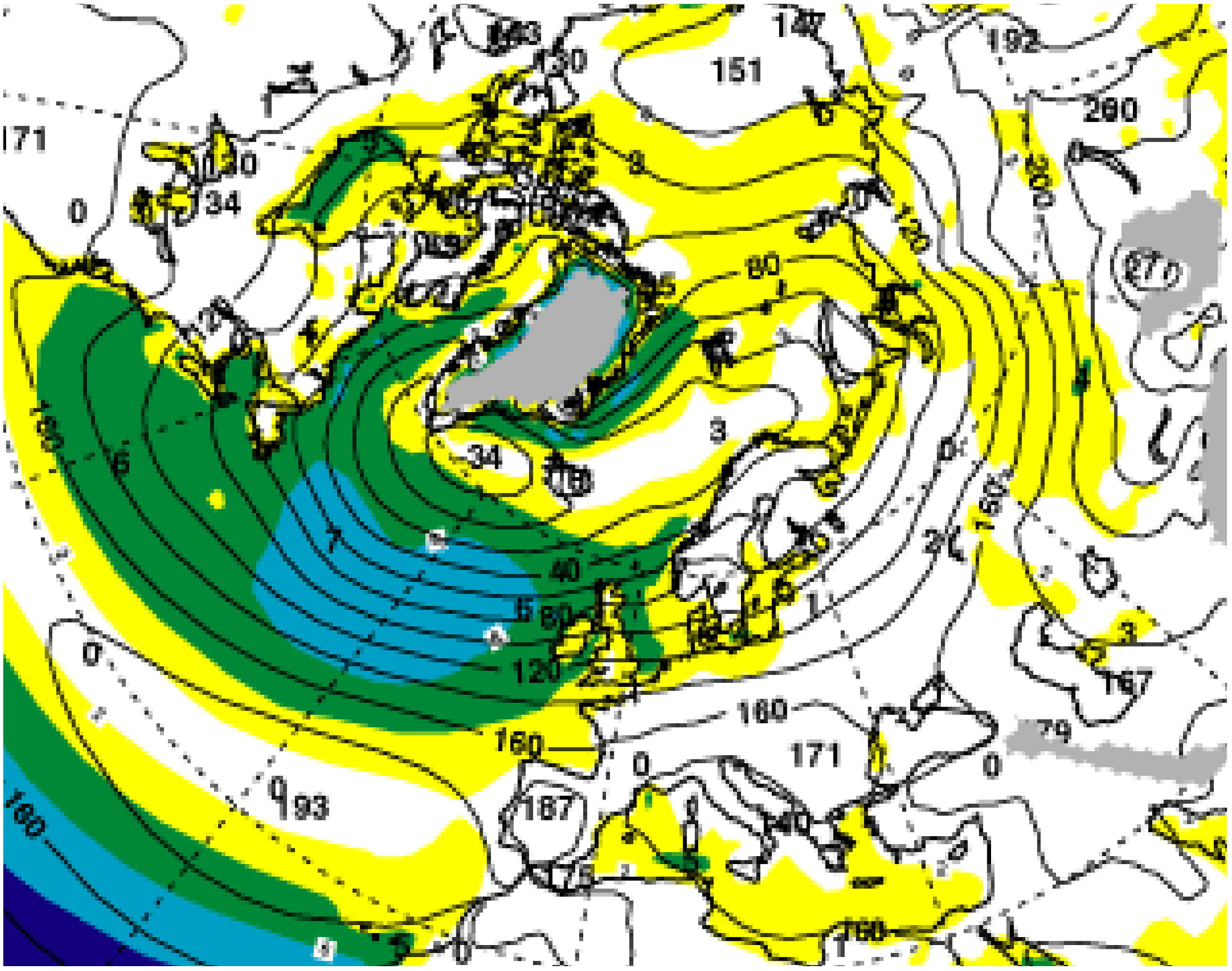
description

- stationary; zero frequency
- zonal wavenumbers 1-3
- span full range of latitudes; separate equatorial waves
- different in different hemispheres
- seasonally dependent
- winter waves extend into stratosphere

DJF Sea-level pressure ERA 40

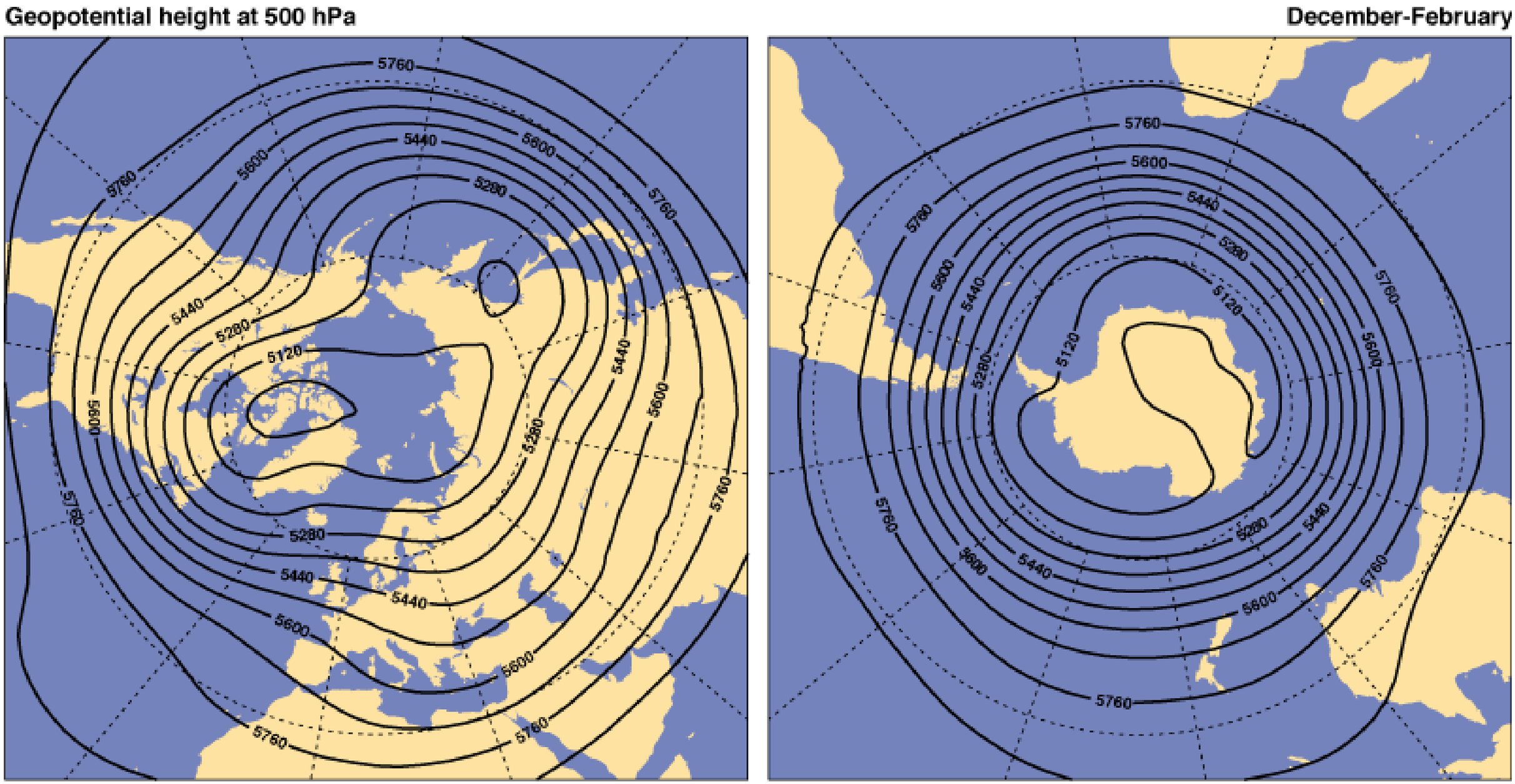


Note strong land-sea contrasts: Low pressure over warm oceans; high pressure over continents and sea ice, an indication of thermally forced features

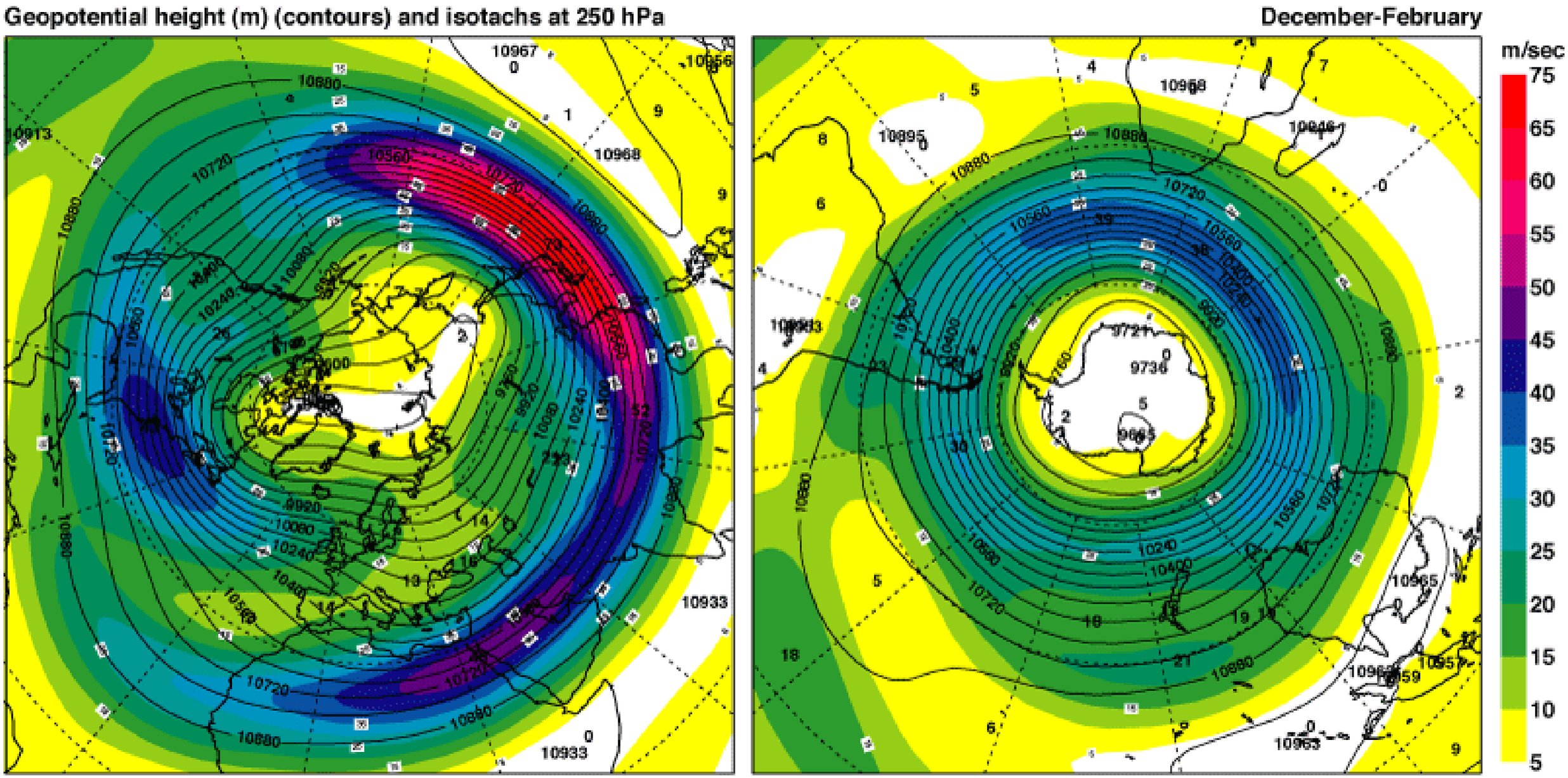


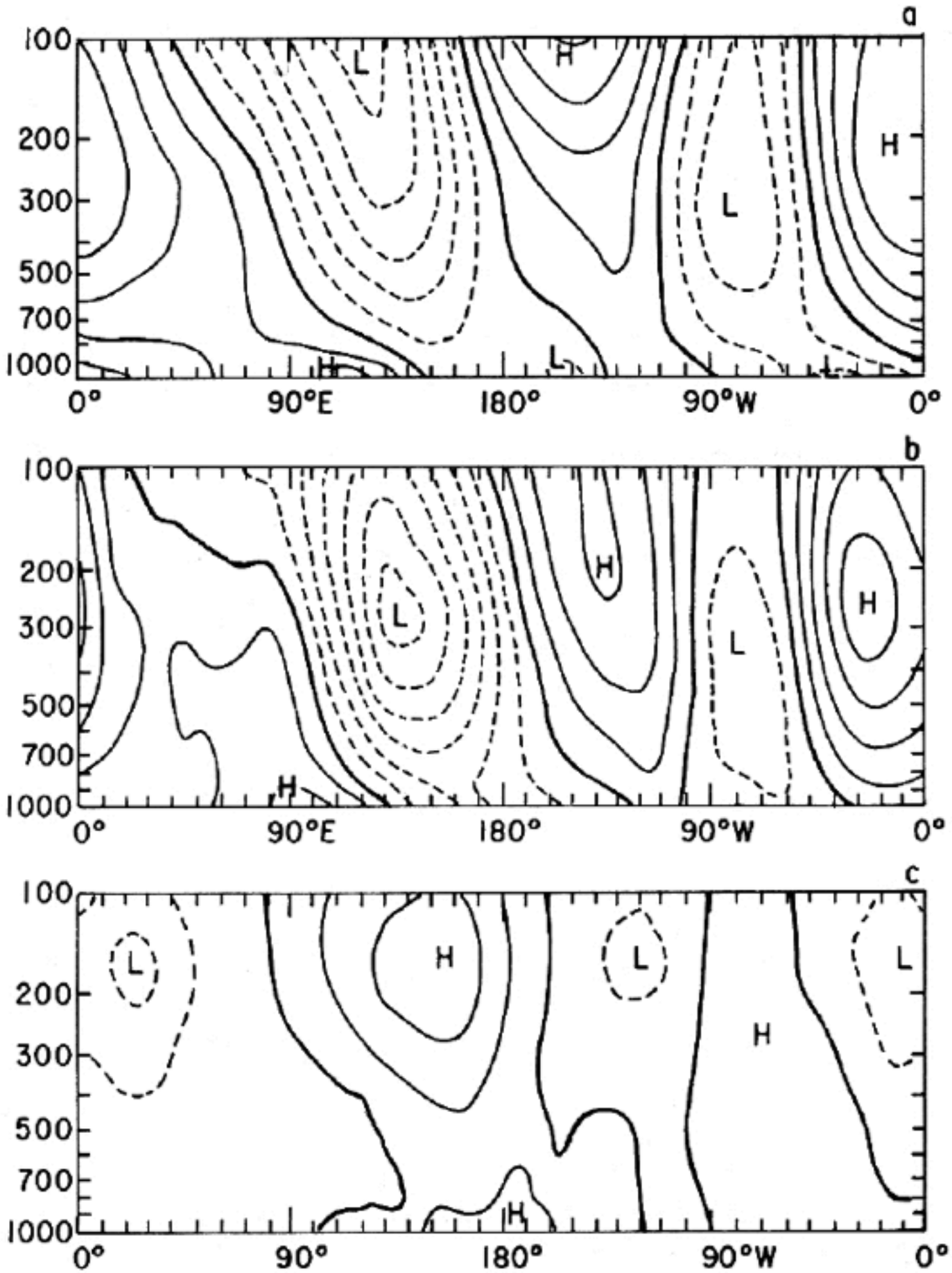
Close up of North Atlantic

DJF 500 hPa height ERA 40



DJF 250 hPa height and wind ERA 40





DJF stationary waves in eddy geopotential height Z^*

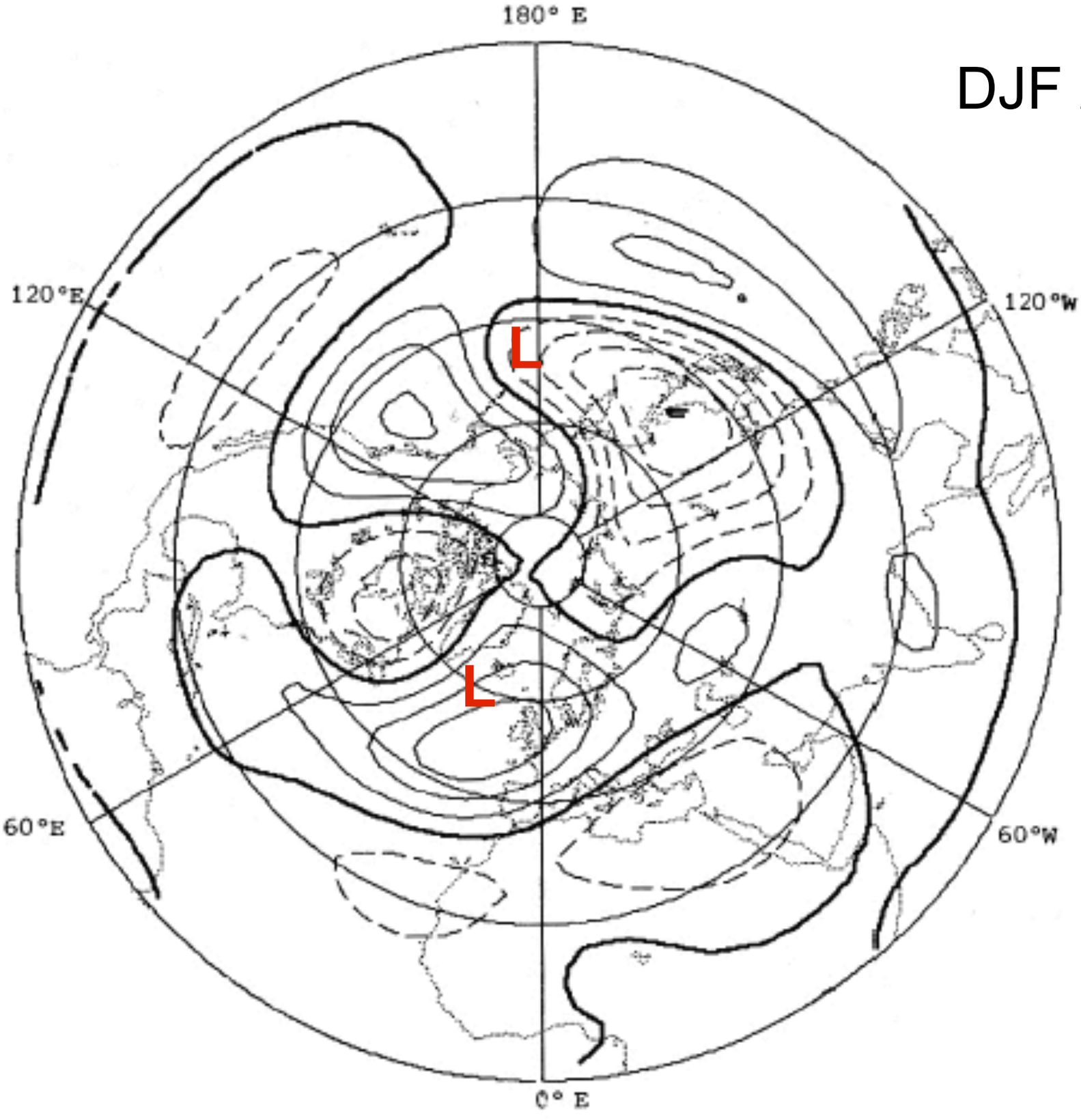
60°N

45°N

25°N

J.M. Wallace, Climatological-mean stationary waves. In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1098.

DJF 200 hPa height

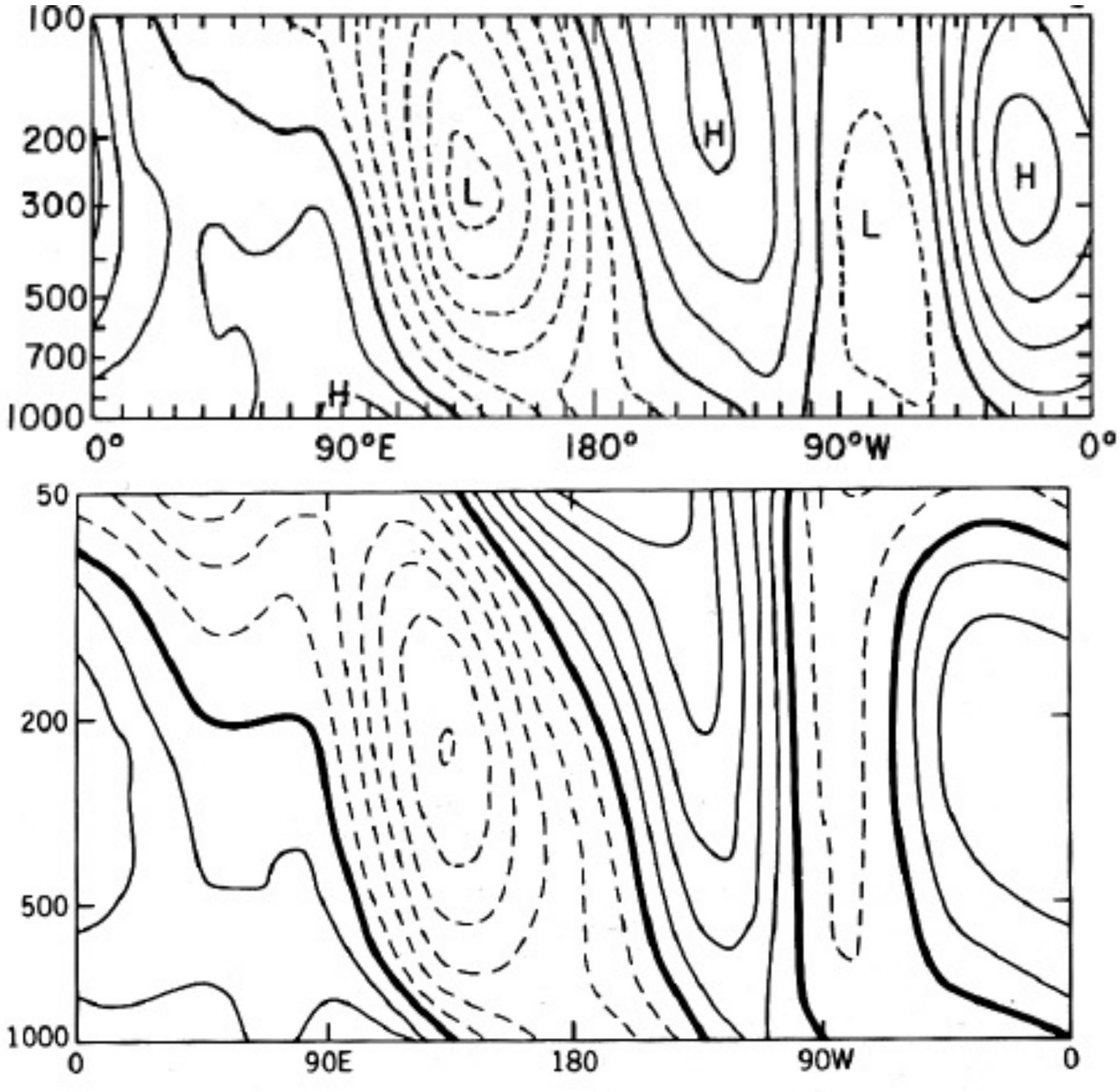


J.M. Wallace, Climatological-mean stationary waves. In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.

Z* along 45°N

Observations

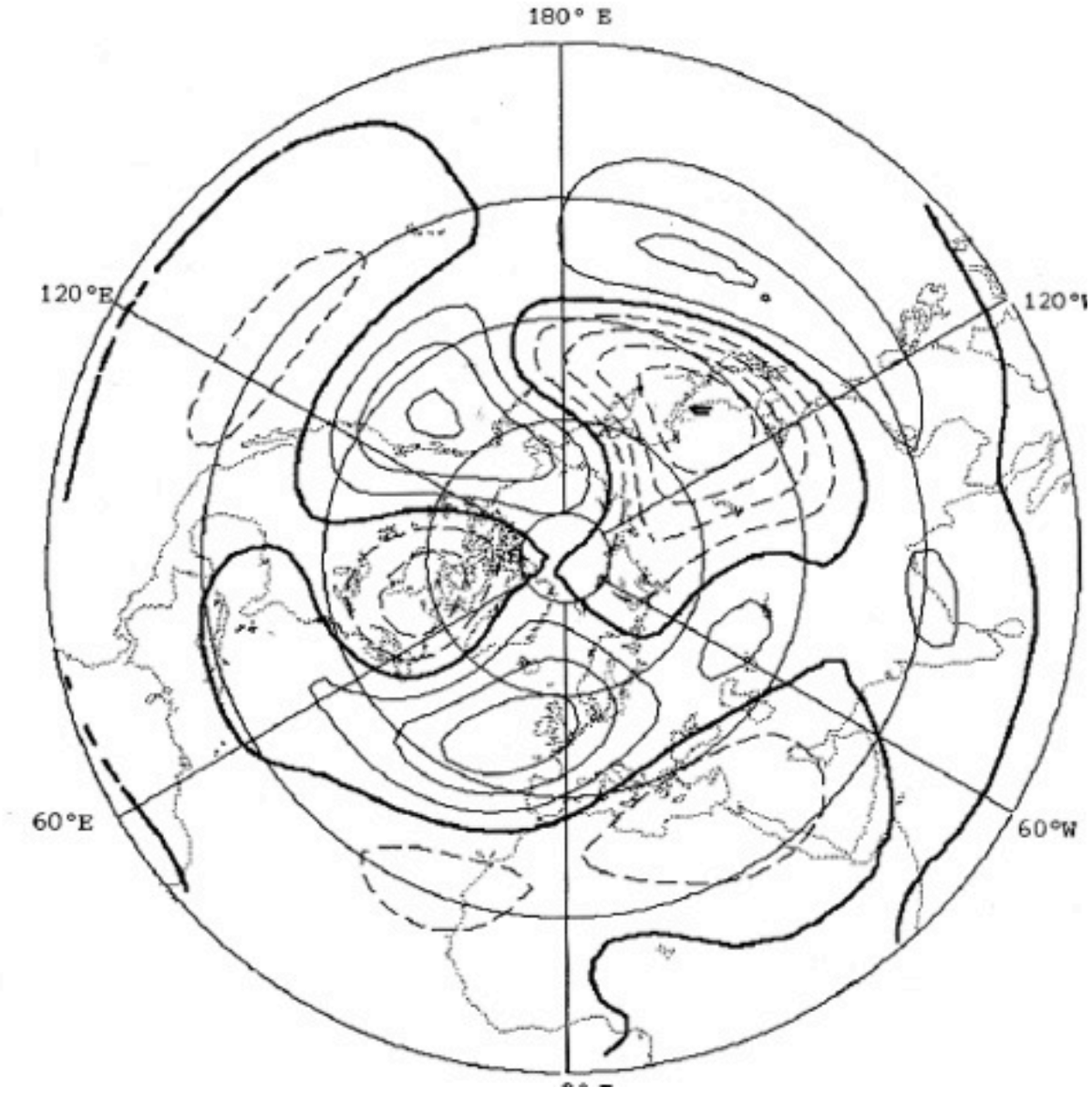
Simulation



J.M. Wallace, Climatological-mean stationary waves. In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.

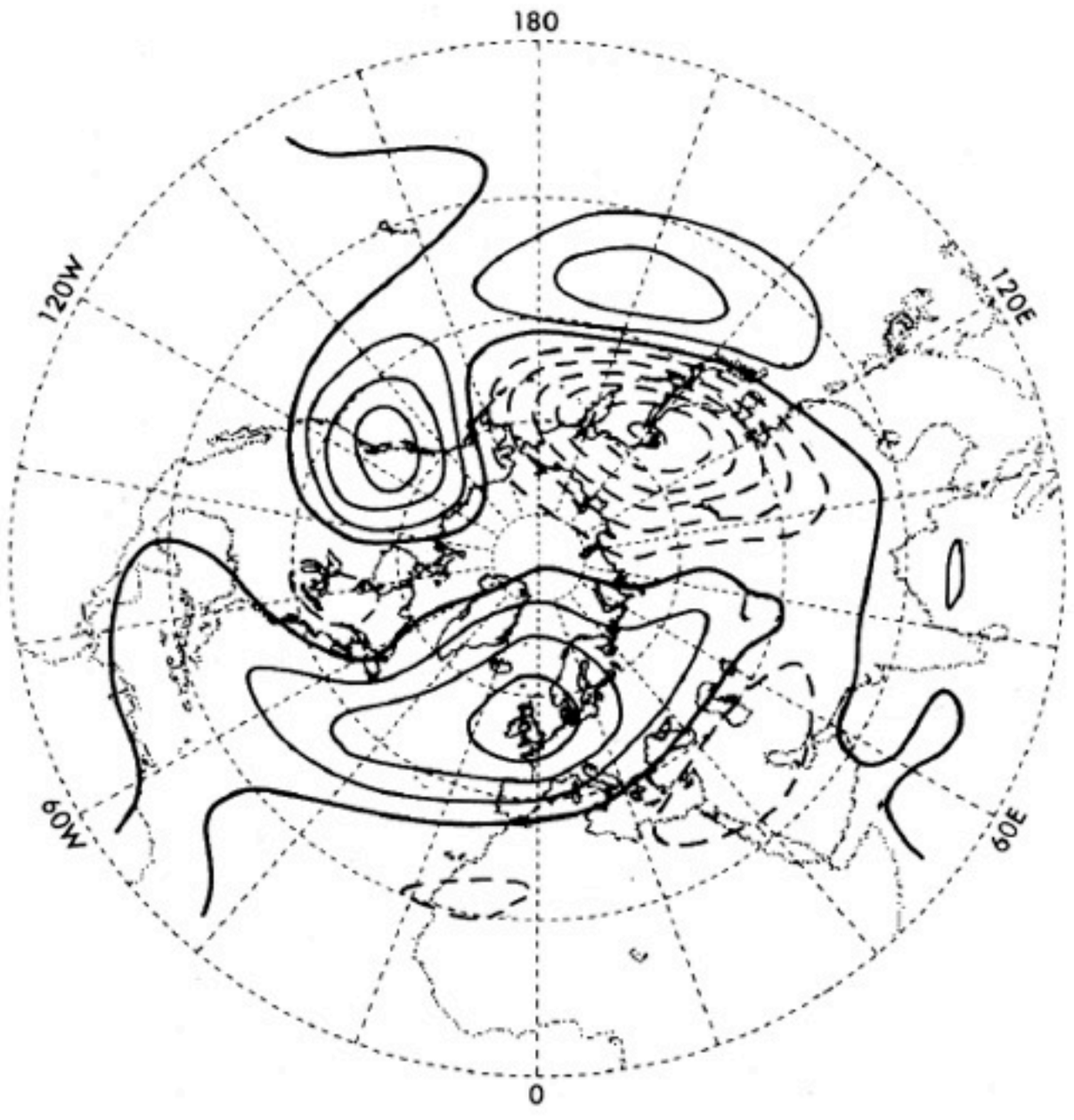
I. M. Held, Theory of Stationary Eddies In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.

January 300 hPa Z^*



Observations

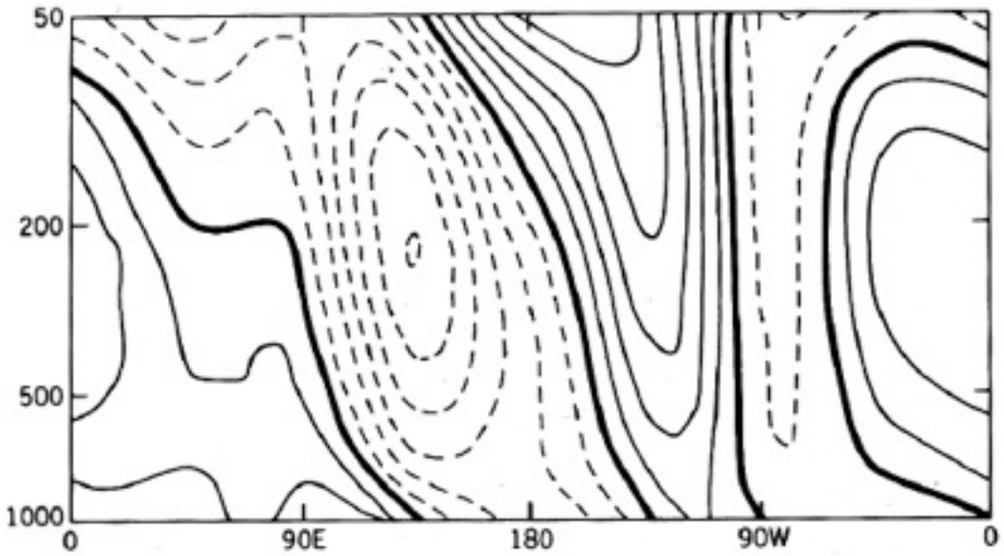
J.M. Wallace, Climatological-mean stationary waves. In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.

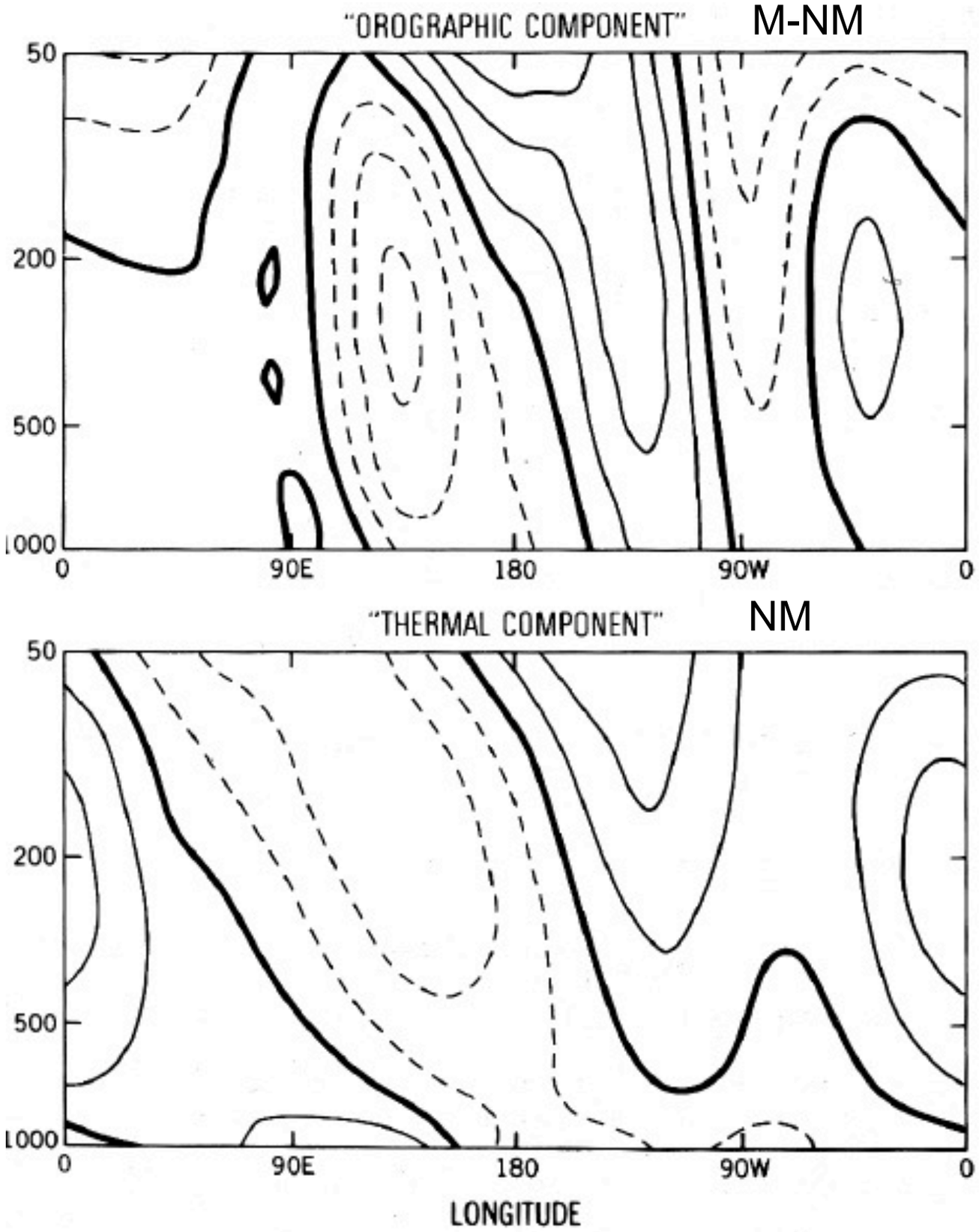


Simulation

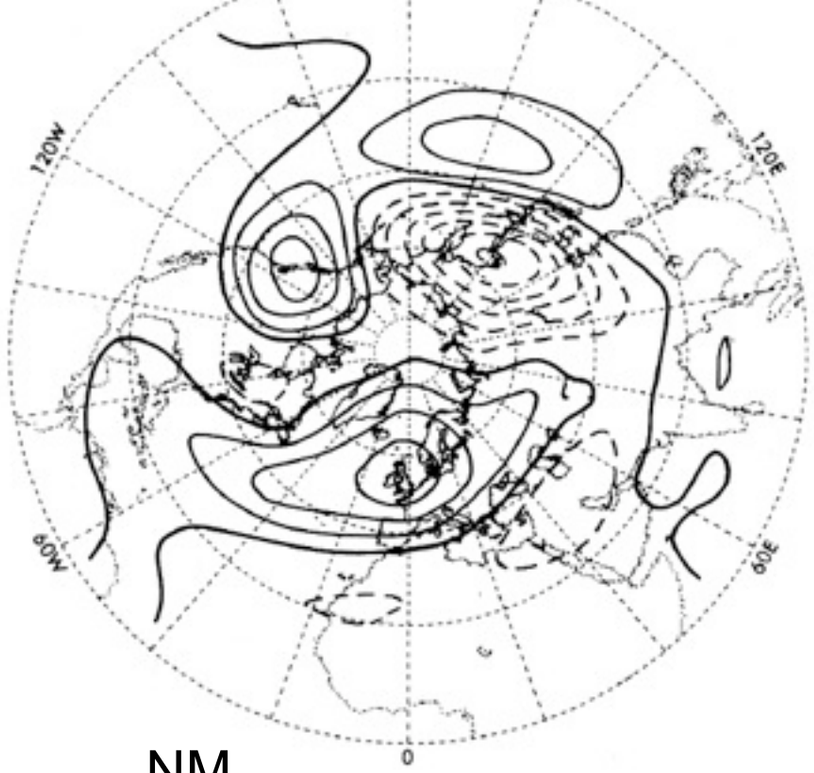
I. M. Held, Theory of Stationary Eddies In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.

Total field M





I. M. Held, Theory of Stationary Eddies In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.

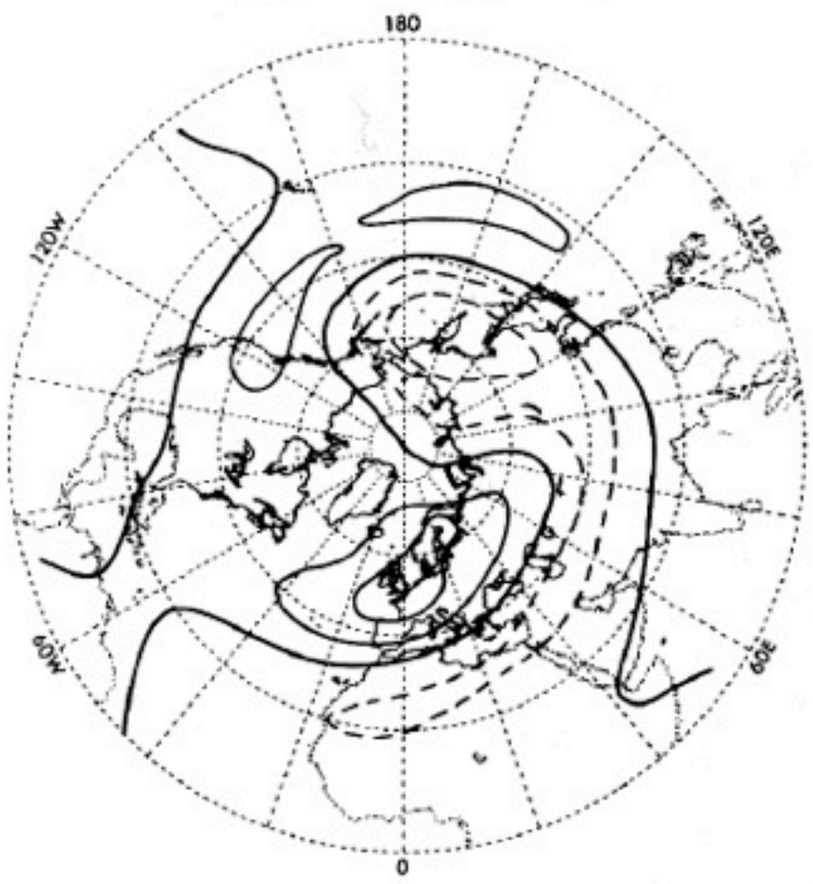


TOTAL M

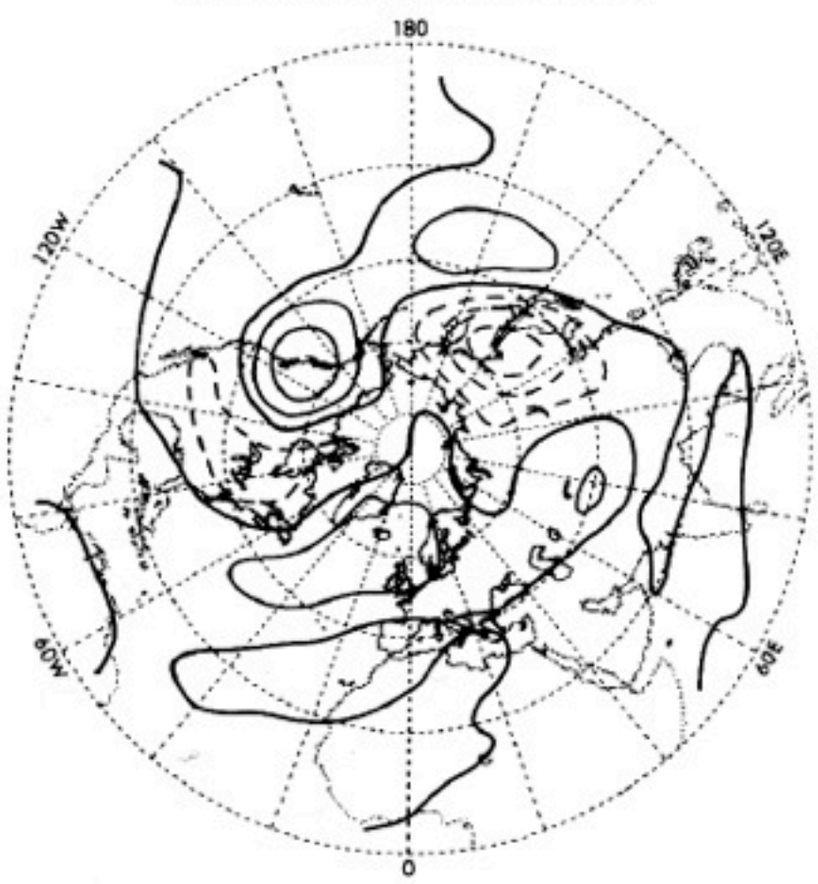
NM

M-NM

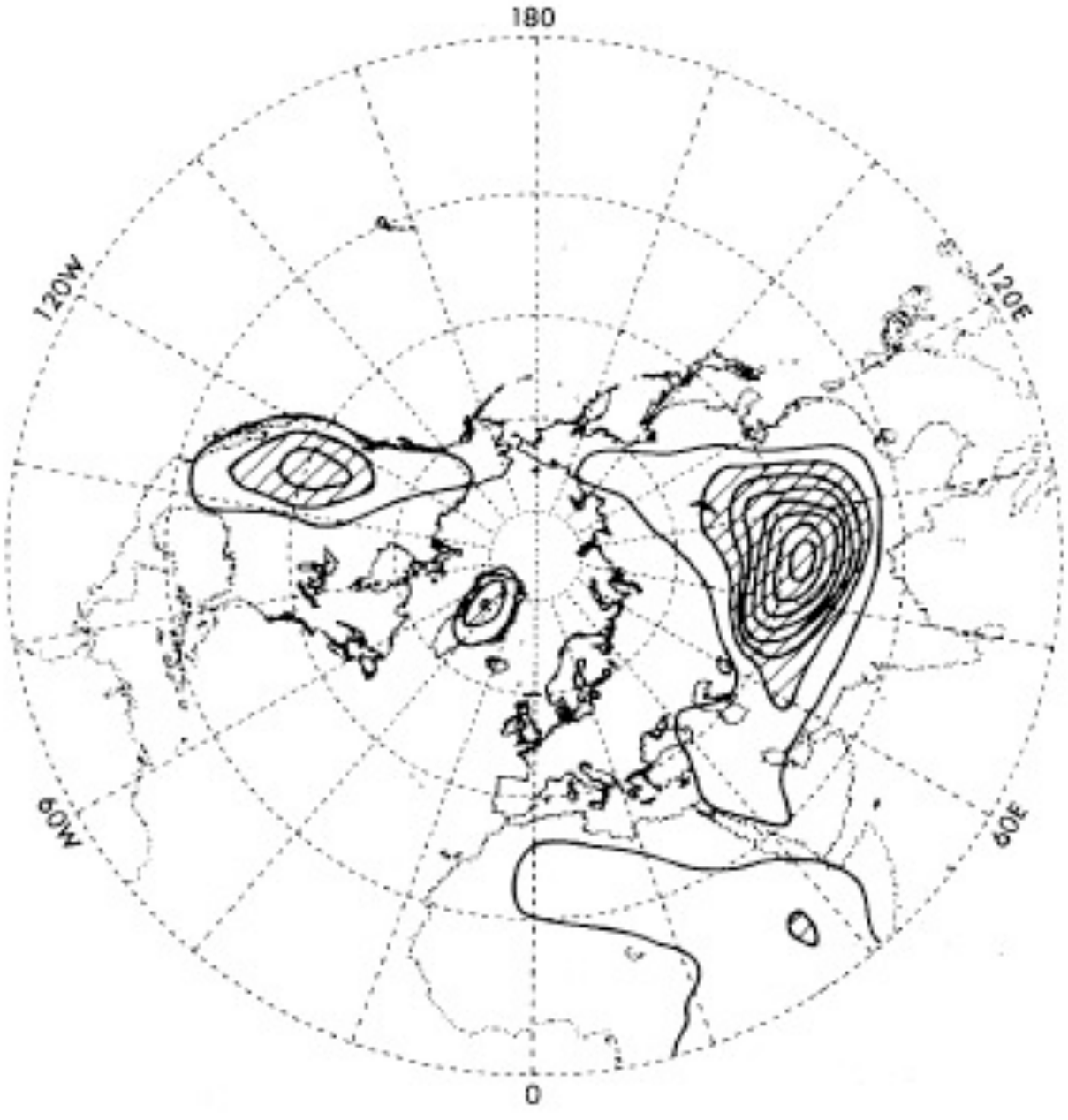
THERMAL COMPONENT

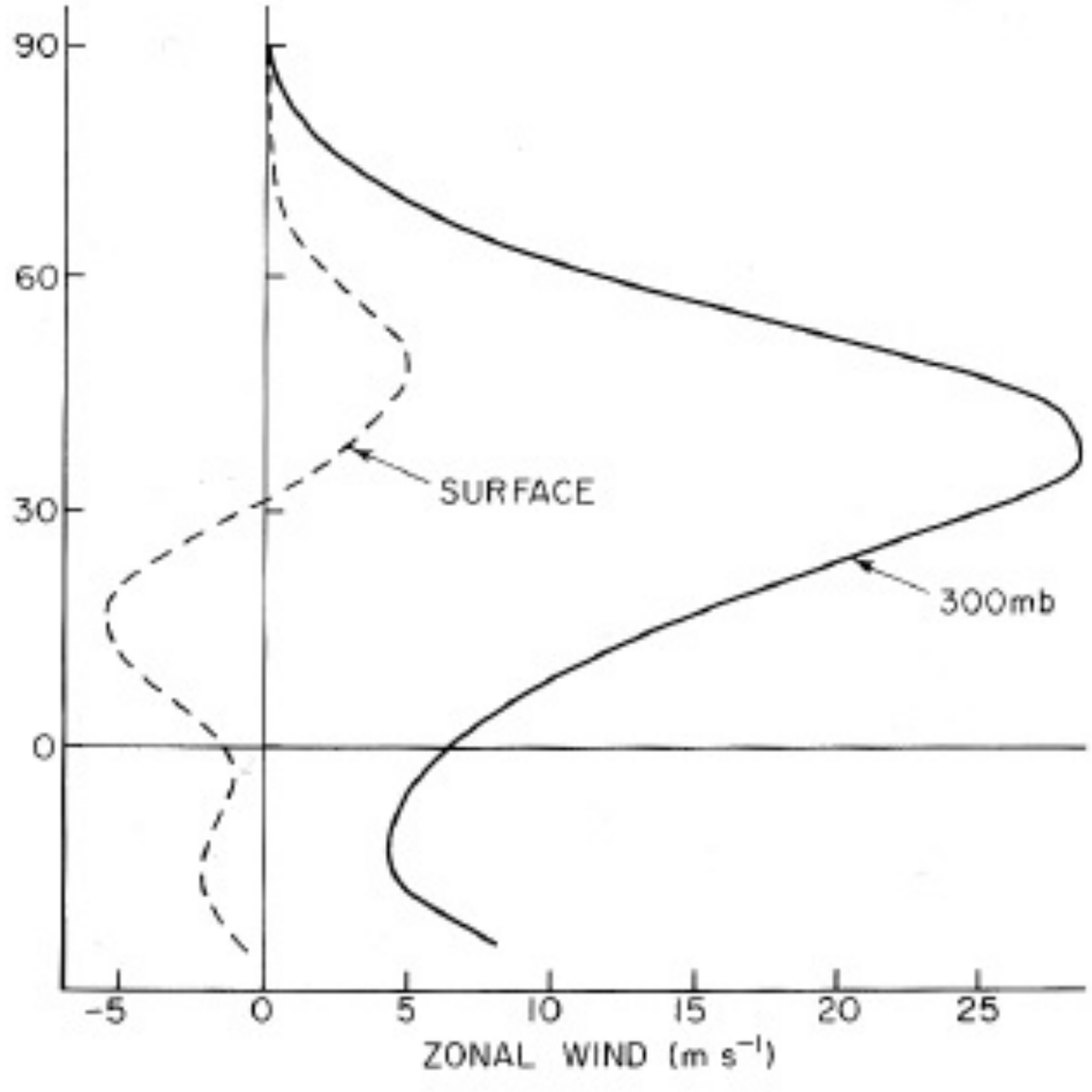


OROGRAPHIC COMPONENT

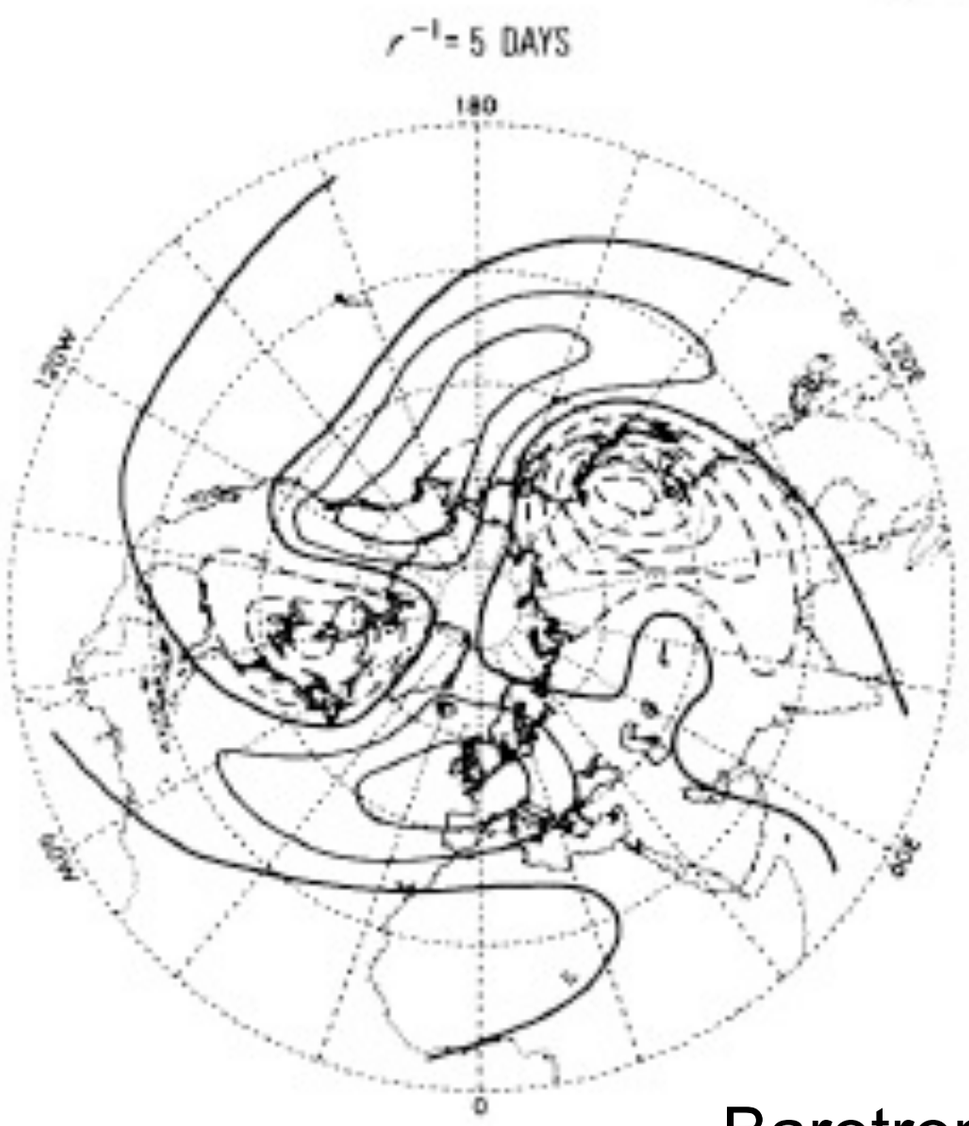


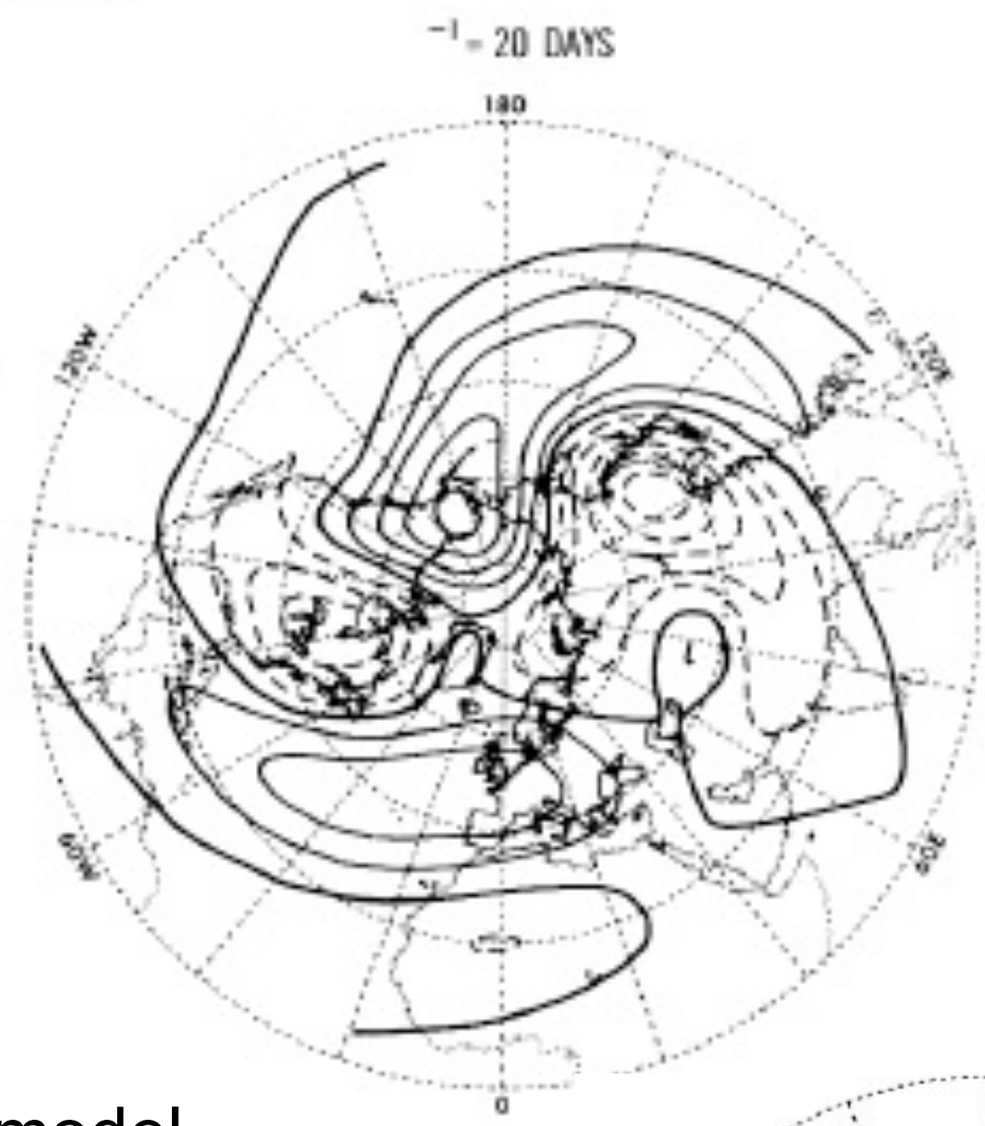
I. M. Held, Theory of Stationary Eddies In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.





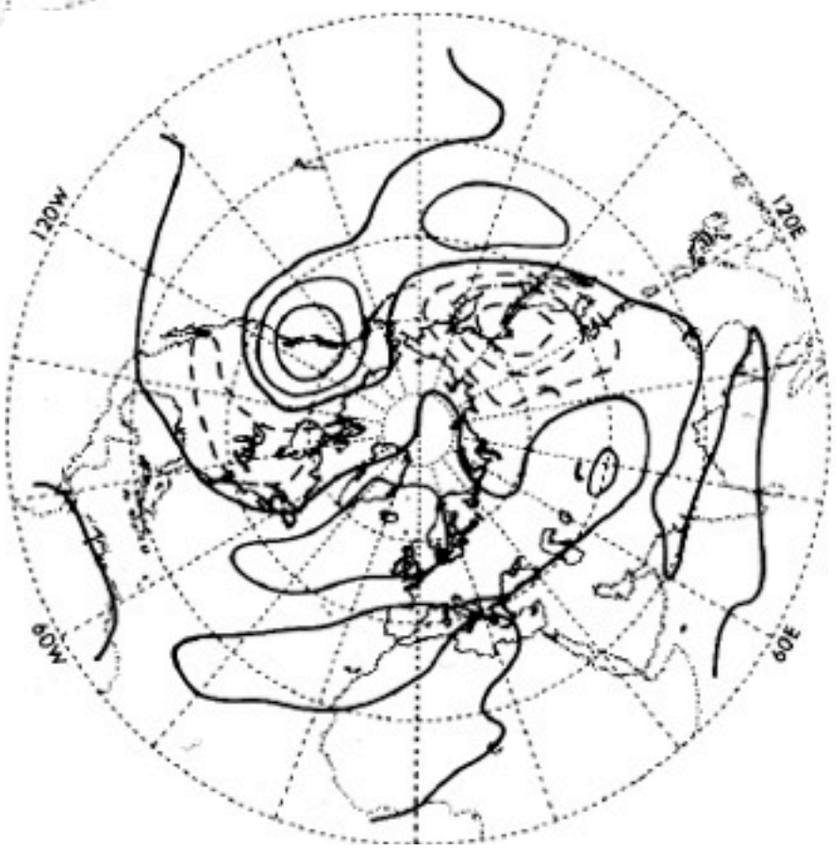
I. M. Held, Theory of Stationary Eddies In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.





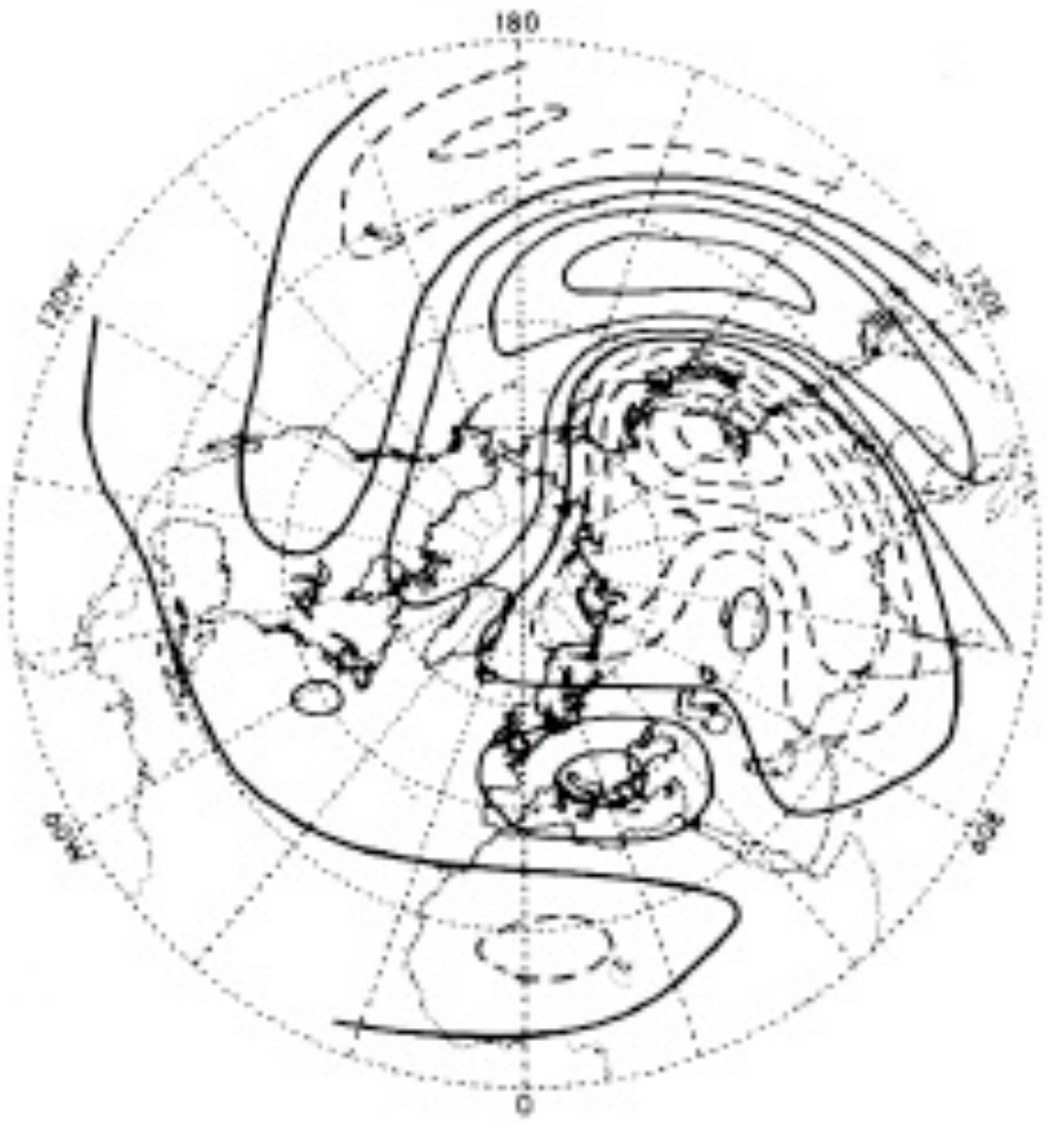
Barotropic model

M-NM GCM

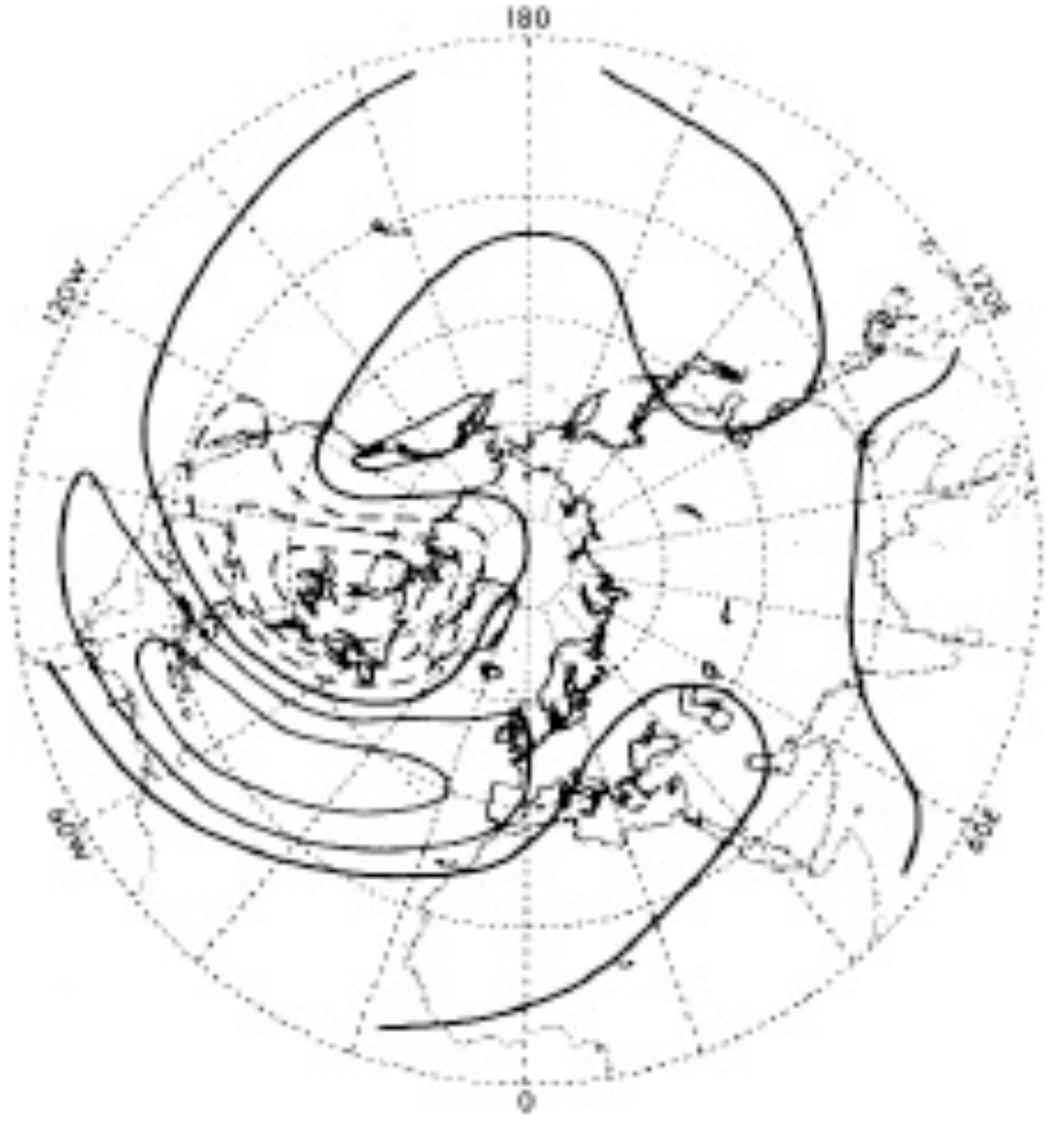


I. M. Held, Theory of Stationary Eddies In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.

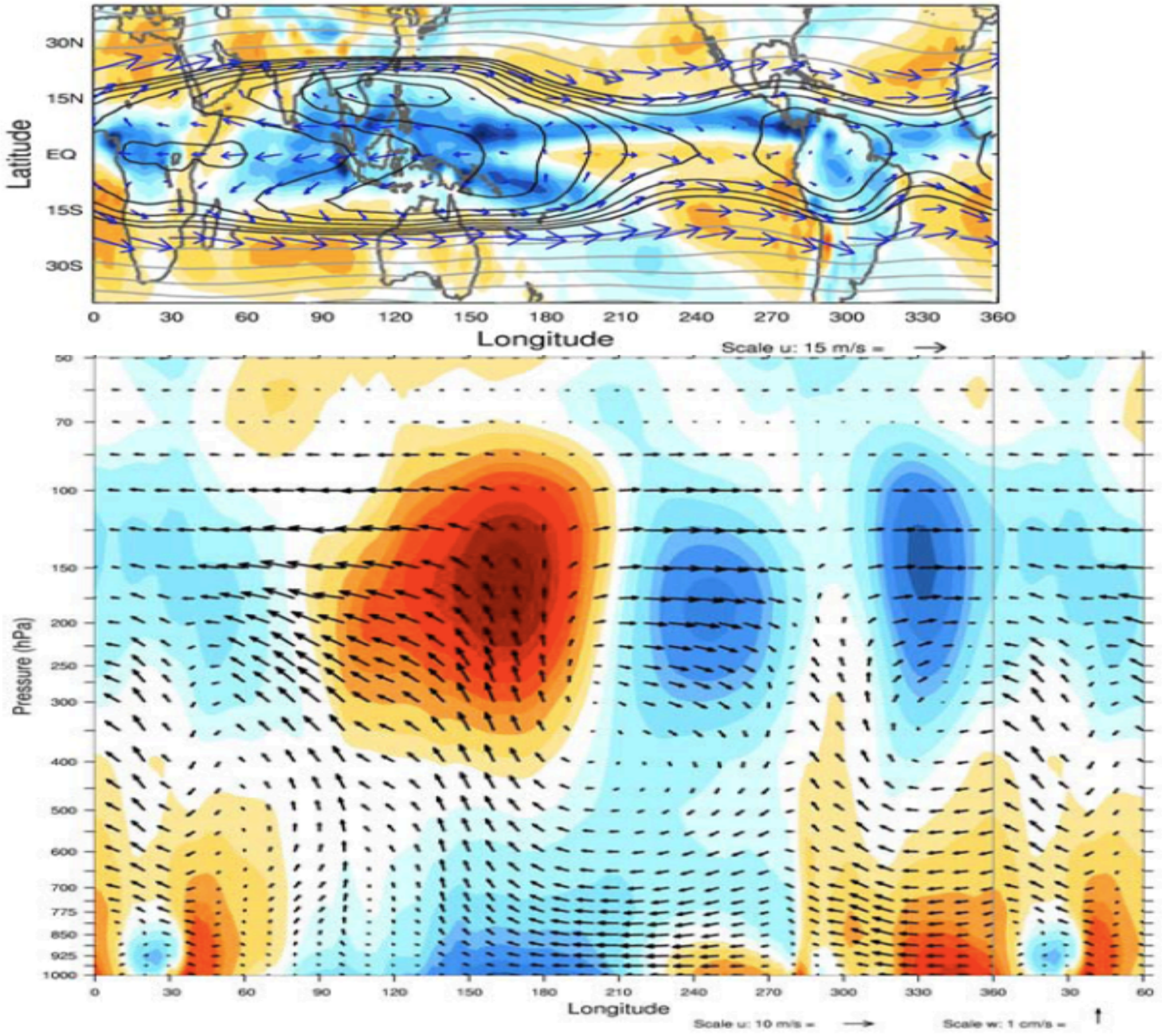
EASTERN

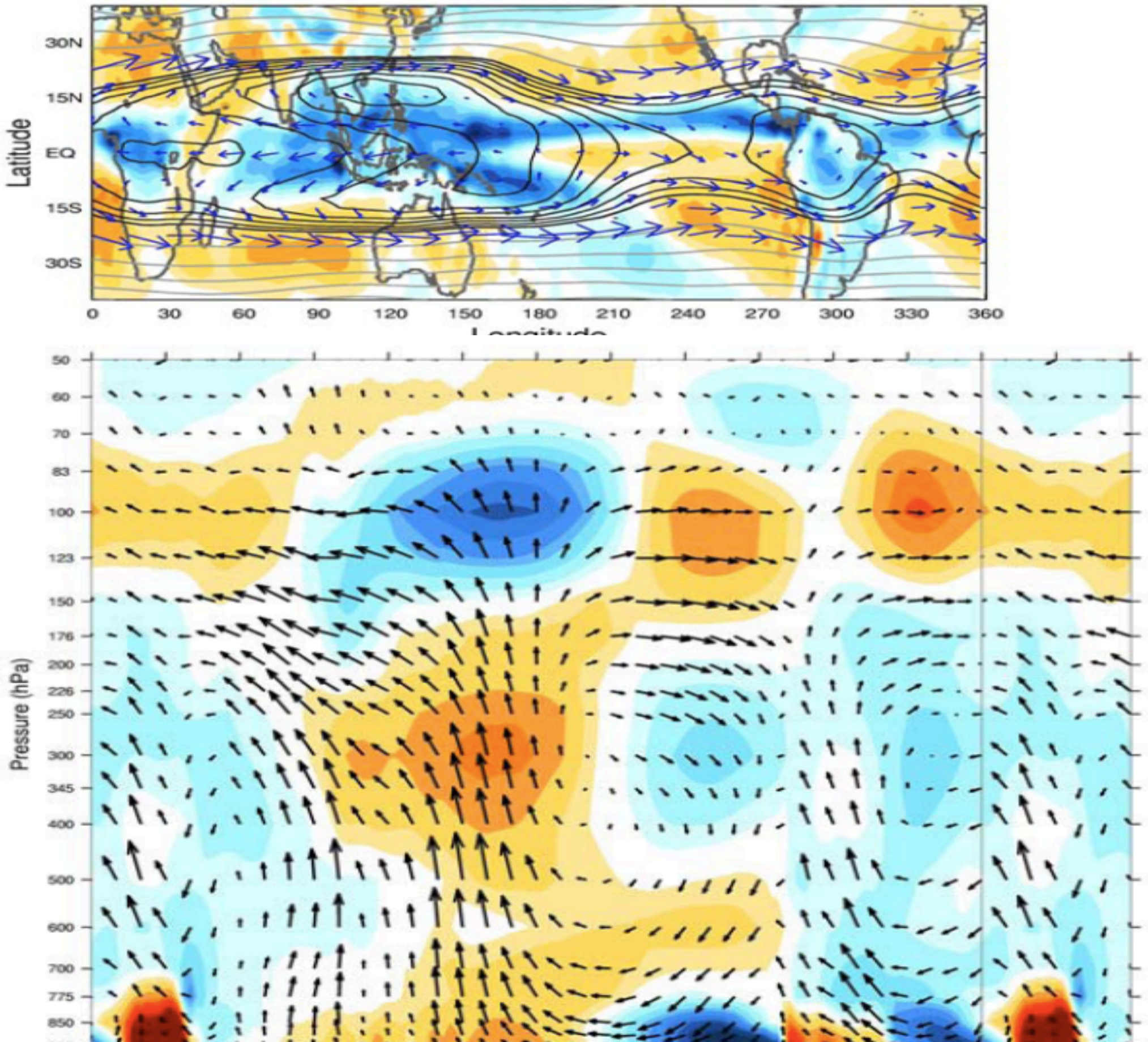


WESTERN



I. M. Held, Theory of Stationary Eddies In *Large Scale Dynamical Processes in the Atmosphere,* Academic Press, 1983.


30N
15N
EQ
15S
30S
Latitude
0
30
60
90
120
150
180
210
240
270
300
330
360
Longitude
Scale u: 15 m/s =
50
70
100
150
200
250
300
400
500
600
700
775
850
925
1000
Pressure (hPa)
0
30
60
90
120
150
180
210
240
270
300
330
360
30
60
Longitude
Scale u: 10 m/s =
Scale w: 1 cm/s =


30N
15N
EQ
15S
30S
Latitude
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30
60
90
120
150
180
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240
270
300
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360
Longitude
50
60
70
83
100
123
150
176
200
226
250
300
345
400
500
600
700
775
850
Pressure (hPa)

The Stationary Waves
Dynamics

- forced by mountains and land-sea thermal contrasts
  width of mountain range is important
- strongest in high latitude NH, winter
- poleward heat flux, upward EP flux centered ~60°N
- dispersion to lower latitudes at jet level
- interaction with transients not discussed here
- waves interact with polar night jet
- there also exist equatorially-trapped planetary waves