Circulation

Upper level (200hPa) flow and height field anomaly: DJF

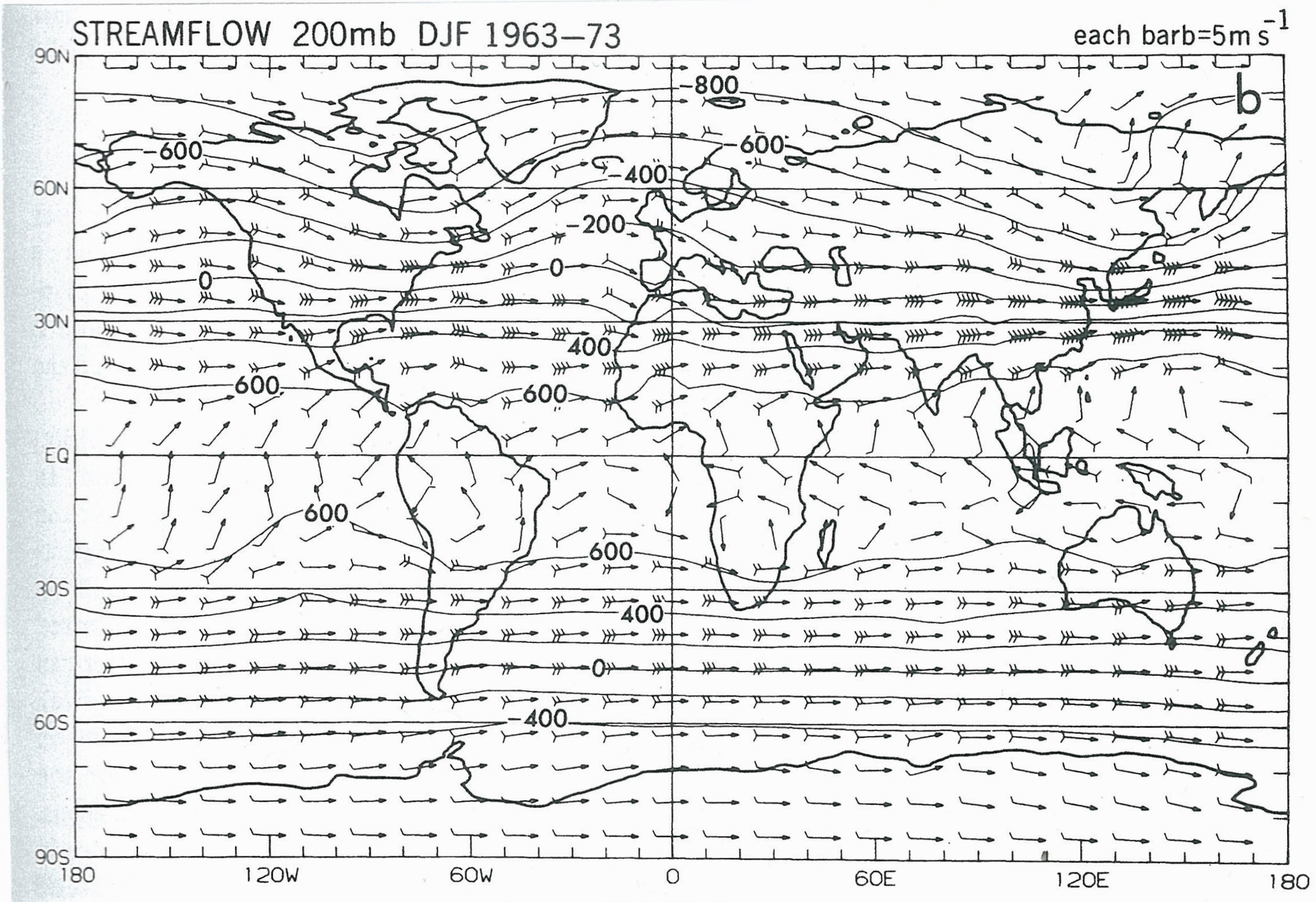
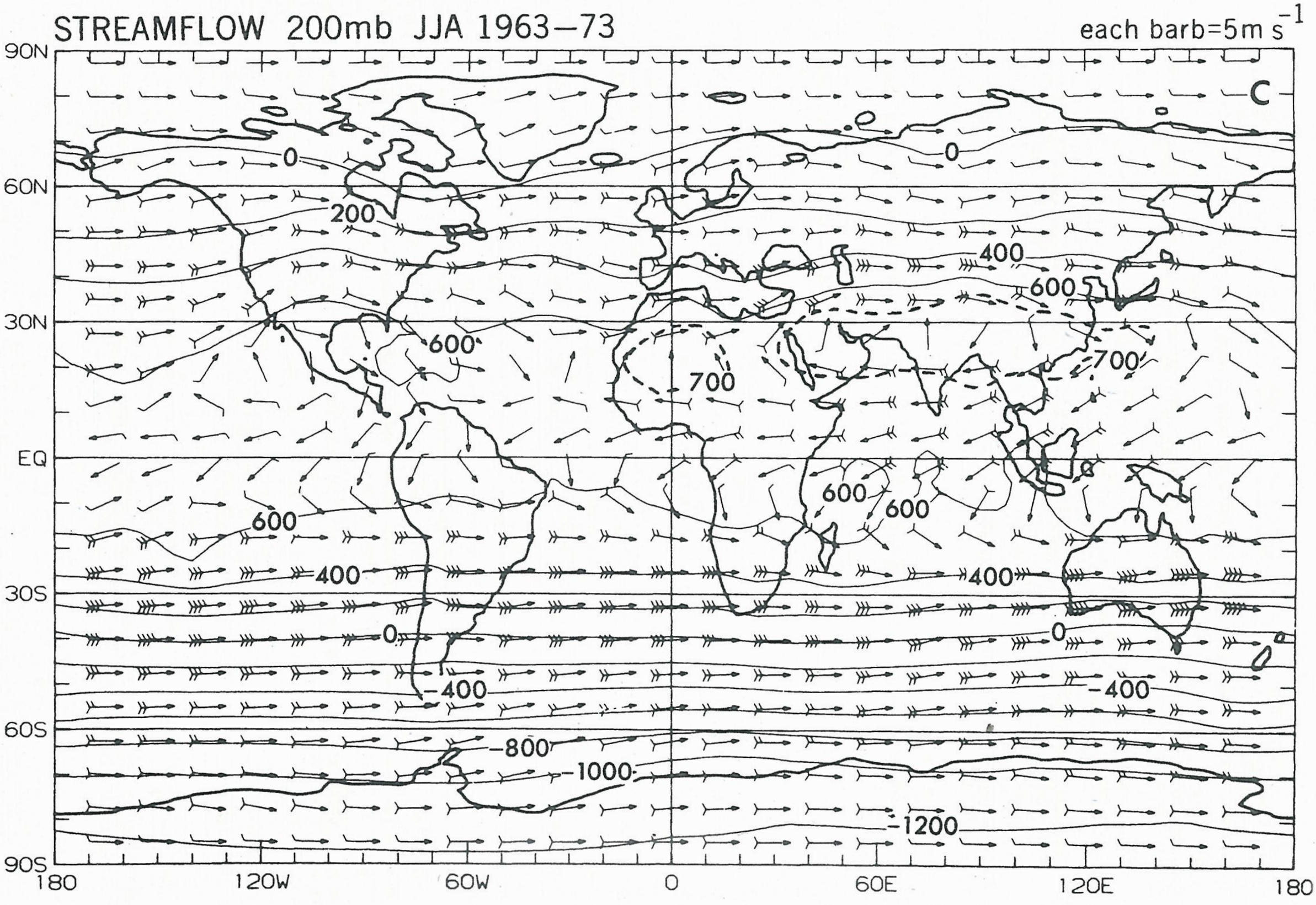


FIGURE 7.13b

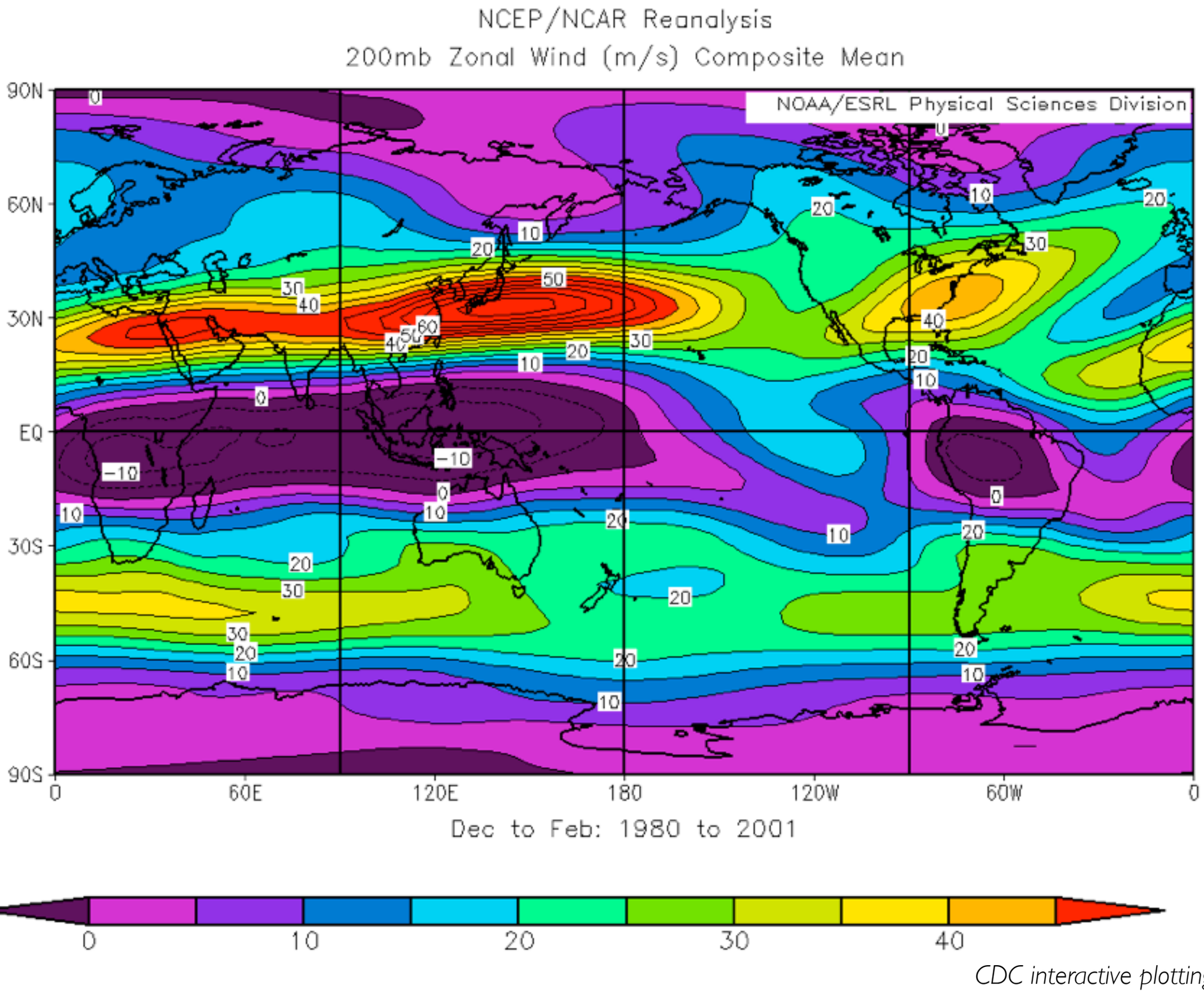
Peixoto and Oort, fig 7.13b; contours are z-11784m at 200hPa

Upper level (200hPa) flow and height field anomaly: JJA



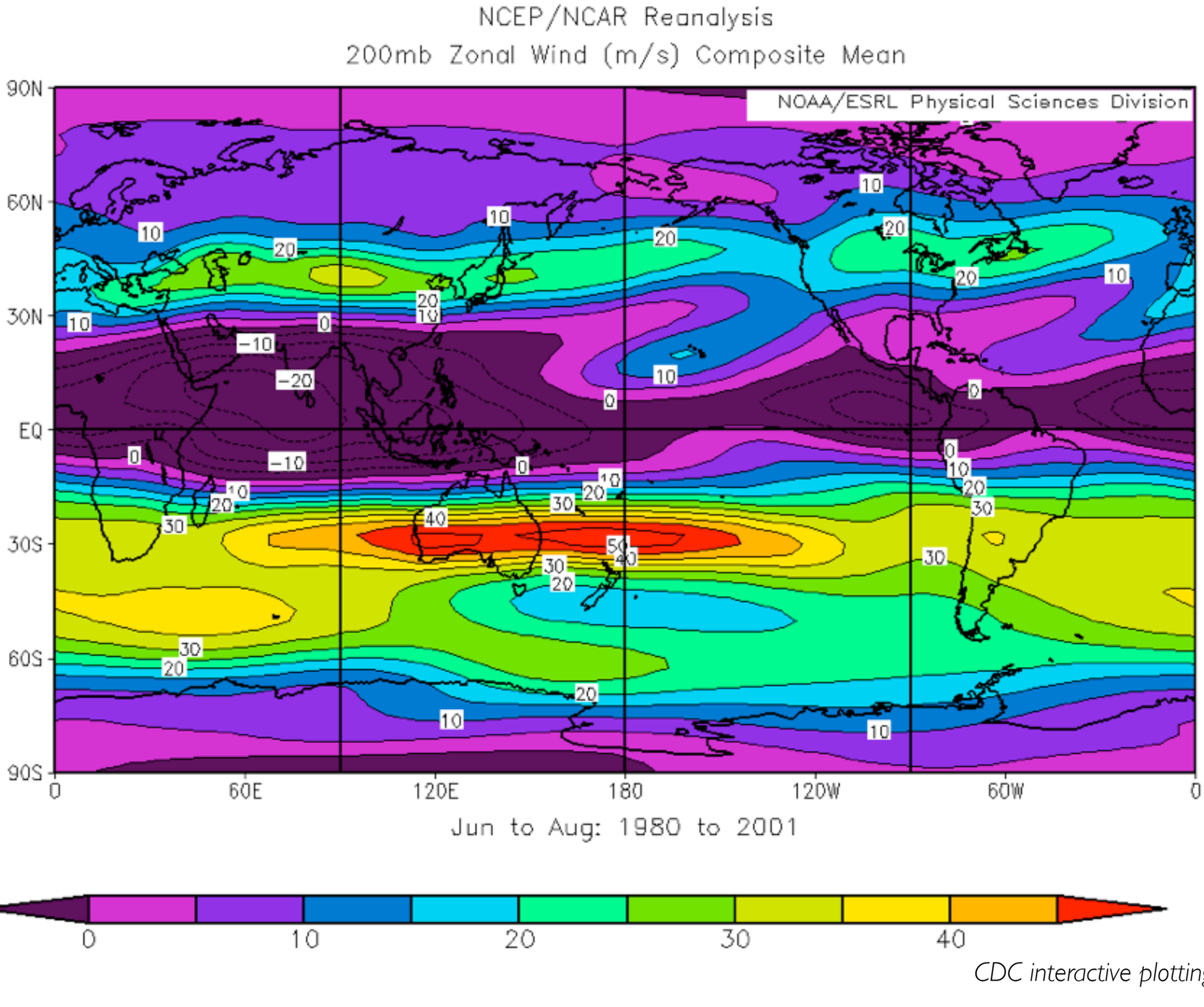
Peixoto and Oort, fig 7.13c

Upper level (200hPa) zonal wind: DJF



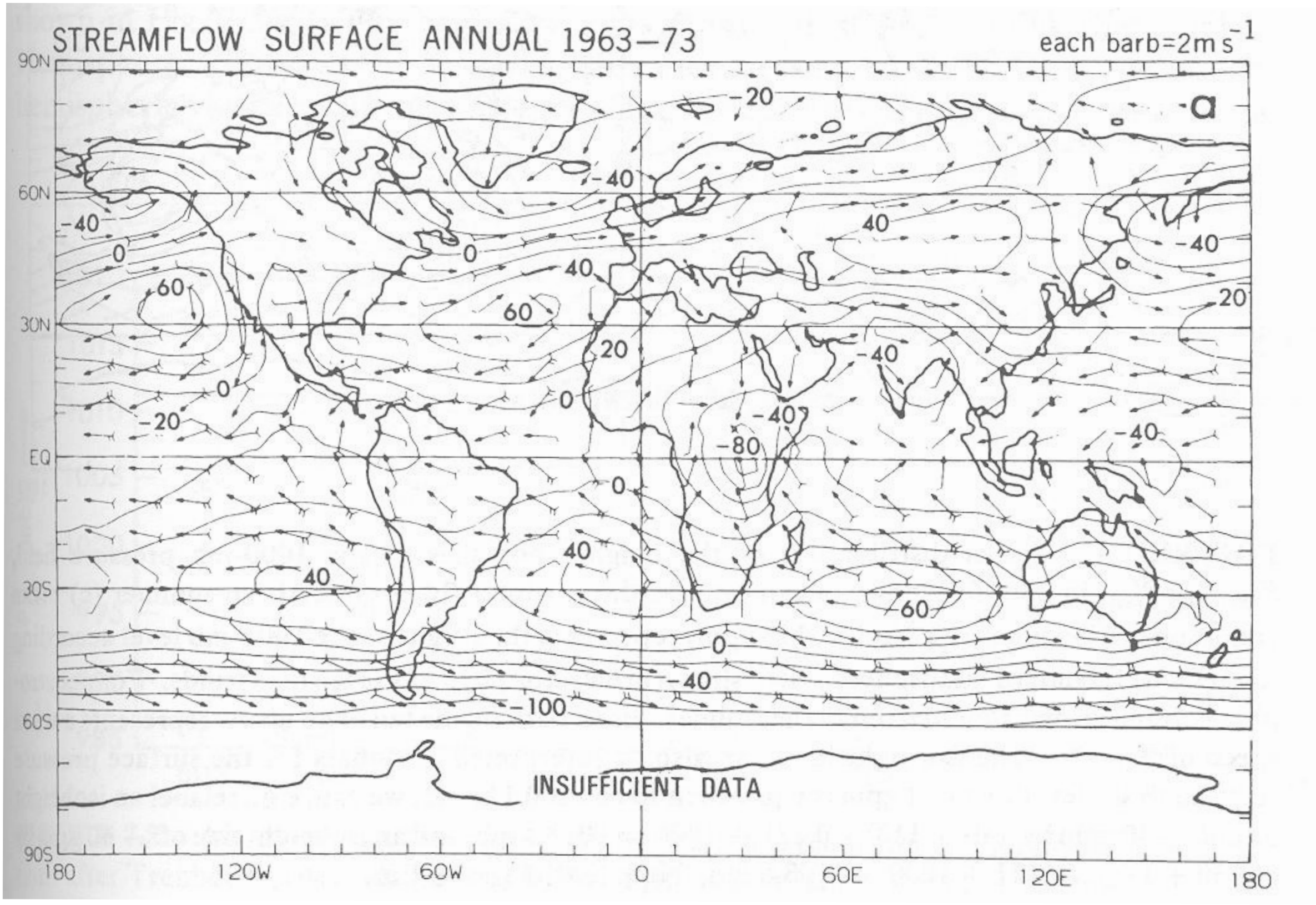
CDC interactive plotting website

Upper level (200hPa) zonal wind: JJA



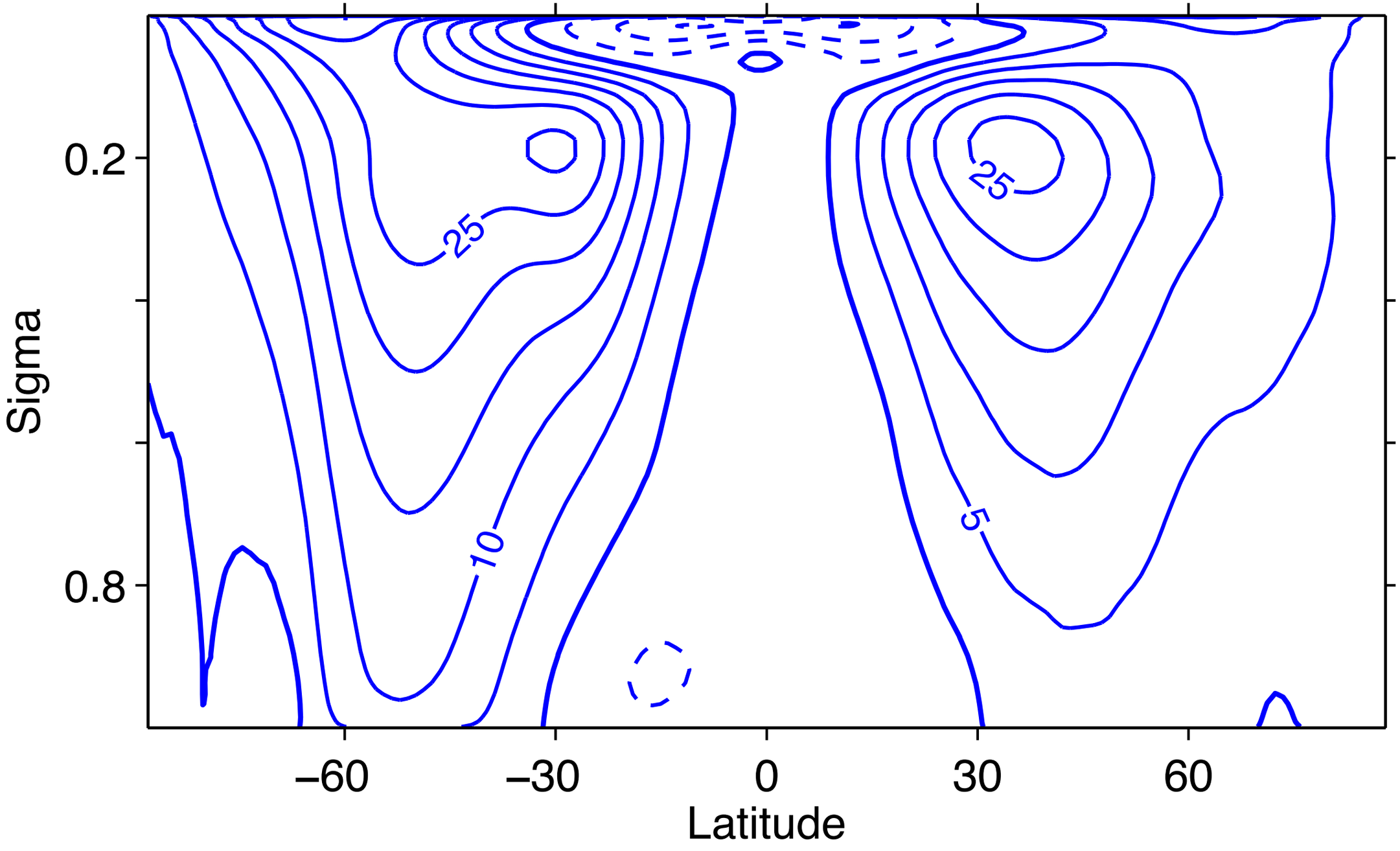
CDC interactive plotting website

Near-surface flow and height field anomaly



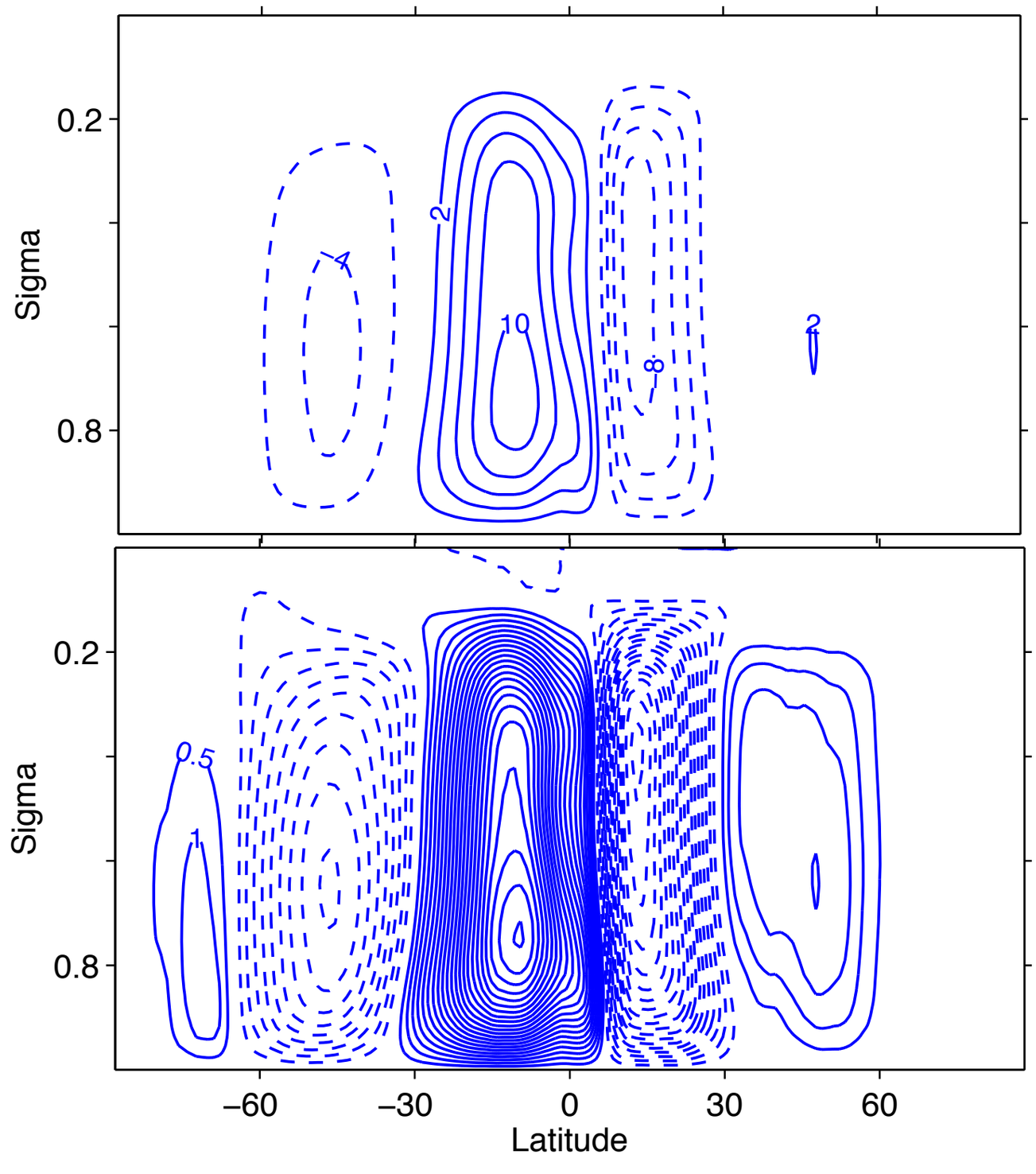
Peixoto and Oort, fig 7.1a; contours are z-13m at 1000hPa

Mean zonal wind (m/s) in latitude-height plane



ERA40 reanalysis 1980-2001

Mean meridional streamfunction (10^{10} kg s^{-1})

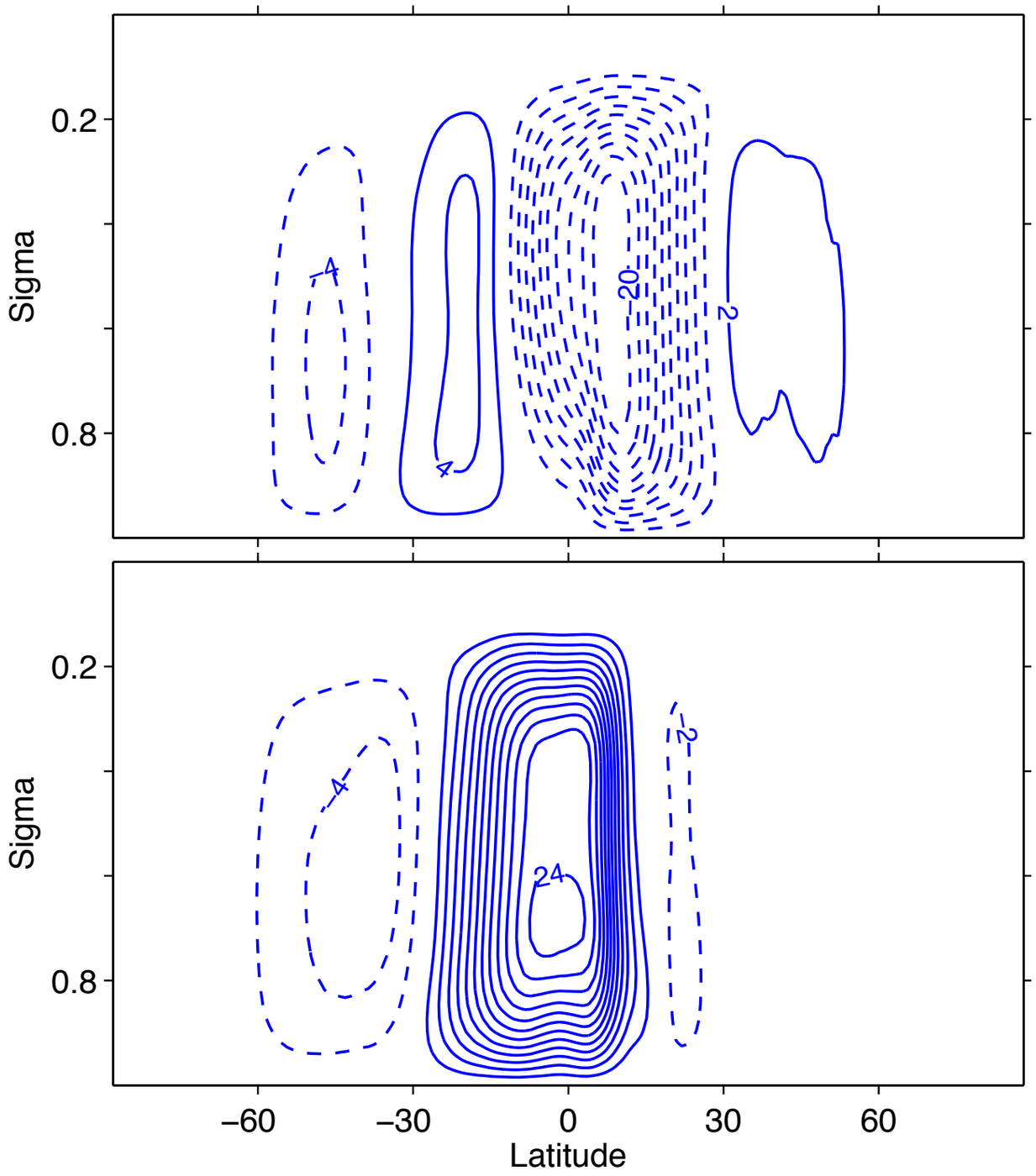


Contour interval 2

Contour interval 0.5

ERA40 reanalysis 1980-2001

Eulerian mean meridional streamfunction (10^{10} kg s^{-1})

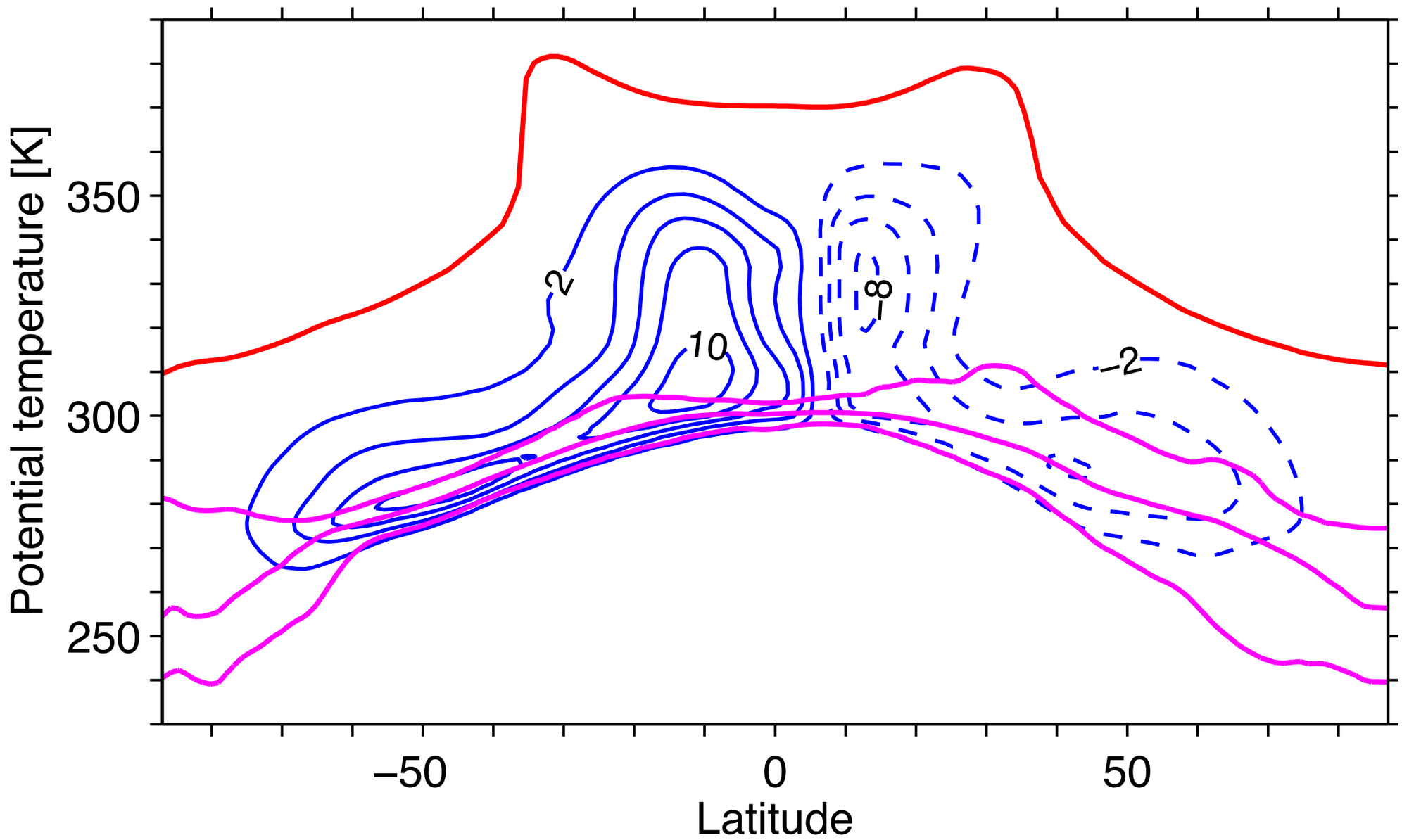


DJF

JJA

(ERA40 reanalysis 1980-2001)

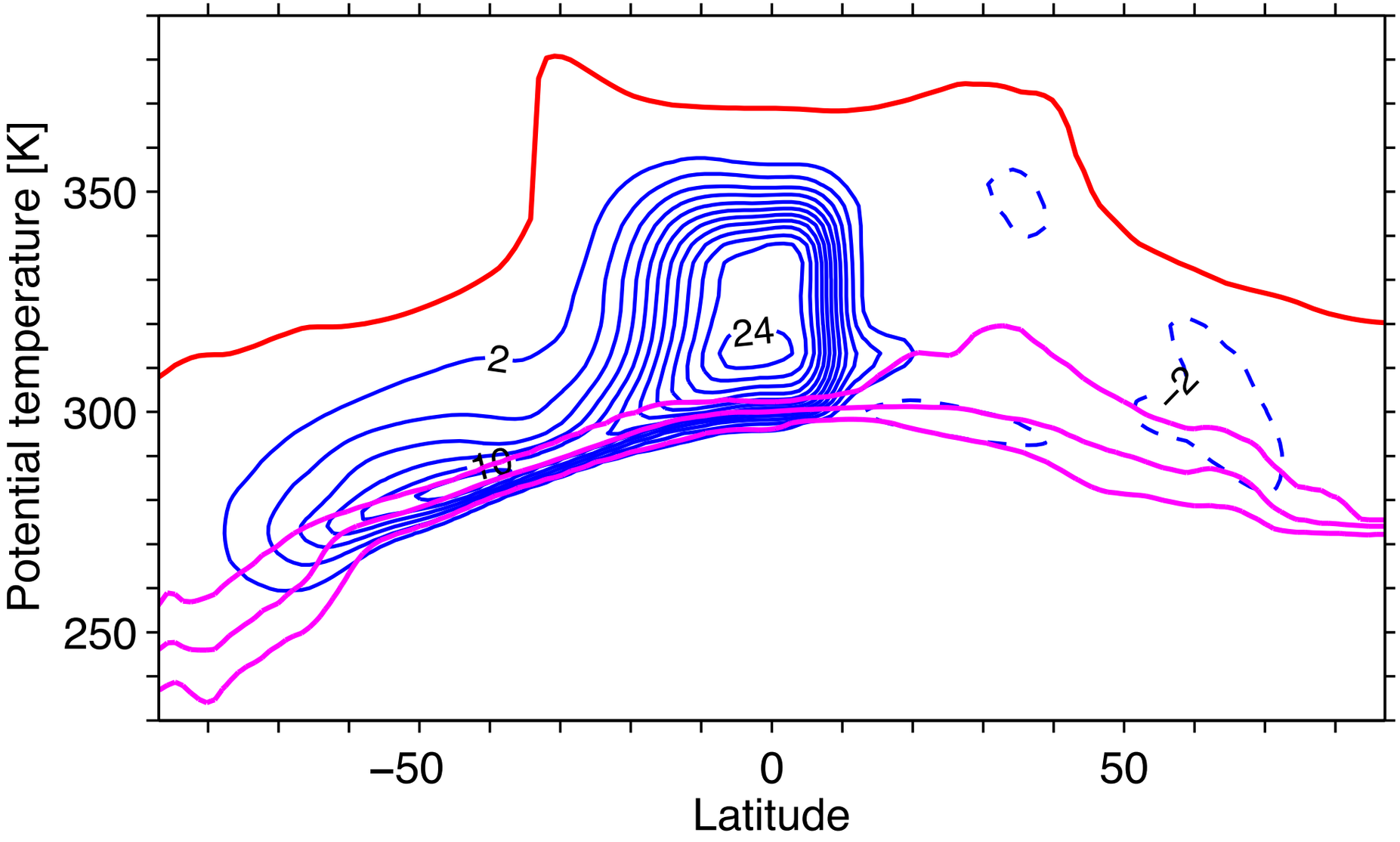
Dry-isentropic mean meridional streamfunction (10^{10} kg s^{-1})



Red: Tropopause
Magenta: 10, 50, 90 percentiles of surface potential temperature distribution

ERA40 reanalysis 1980-2001

Dry-isentropic mean meridional streamfunction (10^{10} kg s^{-1}): JJA



Red: Tropopause
Magenta: 10, 50, 90 percentiles of surface potential temperature distribution

ERA40 reanalysis 1980-2001

Mean meridional circulation on dry and moist isentropes

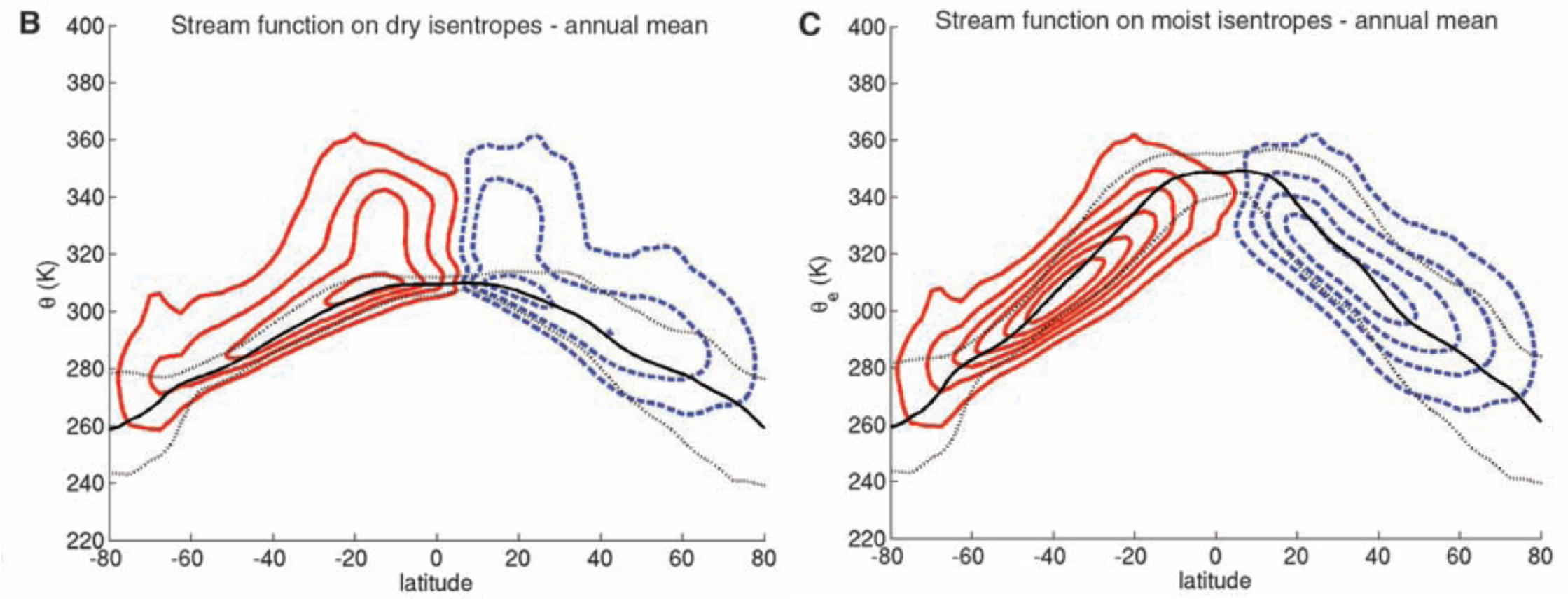
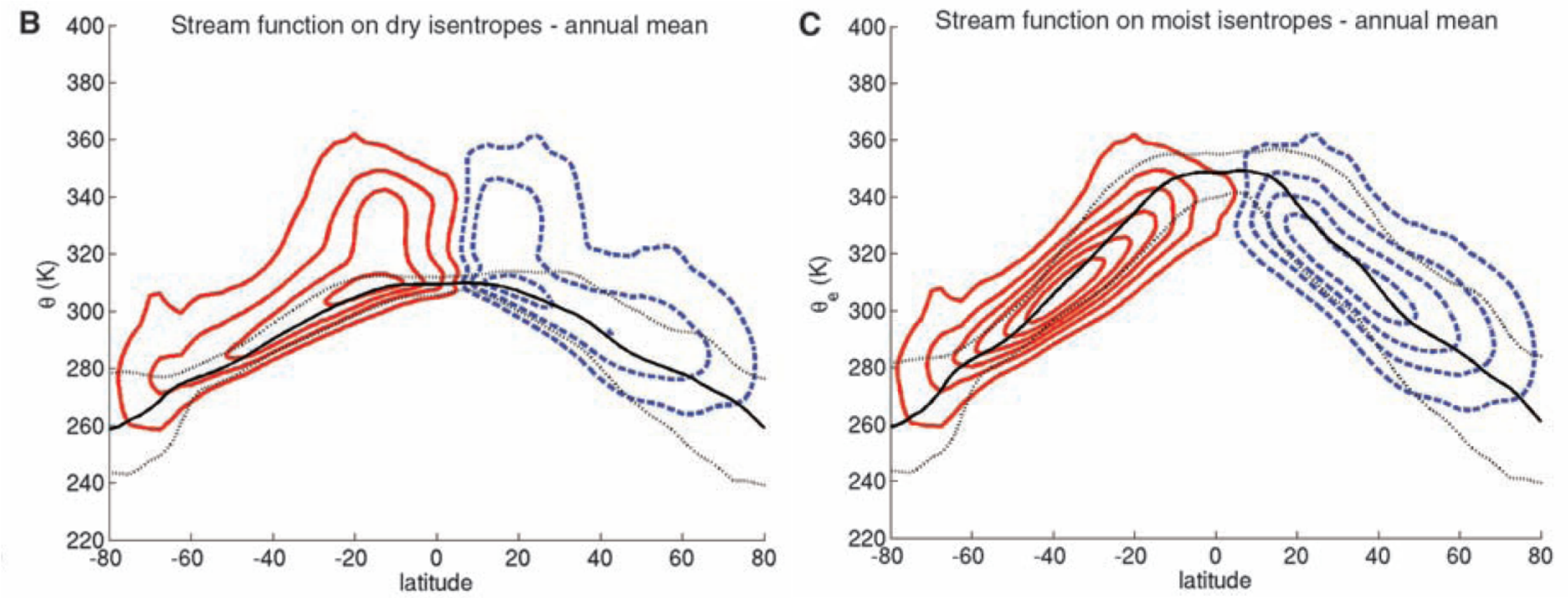


Fig. 1. The global mean circulation from the NCEP-NCAR Reanalysis. (**A**) Stream function on pressure surfaces Ψ_p. (**B**) Same as (A) for the stream function on dry isentropes Ψ_θ. (**C**) Same as (A) for the stream function on moist isentropes Ψ_{θ_e}. Contour interval is 2.5×10^{10} kg s^{-1}. Solid contours are positive values of the stream function and correspond to northward flow at low levels, whereas dashed contours are negative values of the stream function and correspond to southward flow at low levels. In (B) and (C), the thin solid line and two dotted black lines show the 50, 10, and 90 percentiles, respectively, of the surface potential or surface equivalent potential temperature distributions.

Pauluis et al, Science, 2008

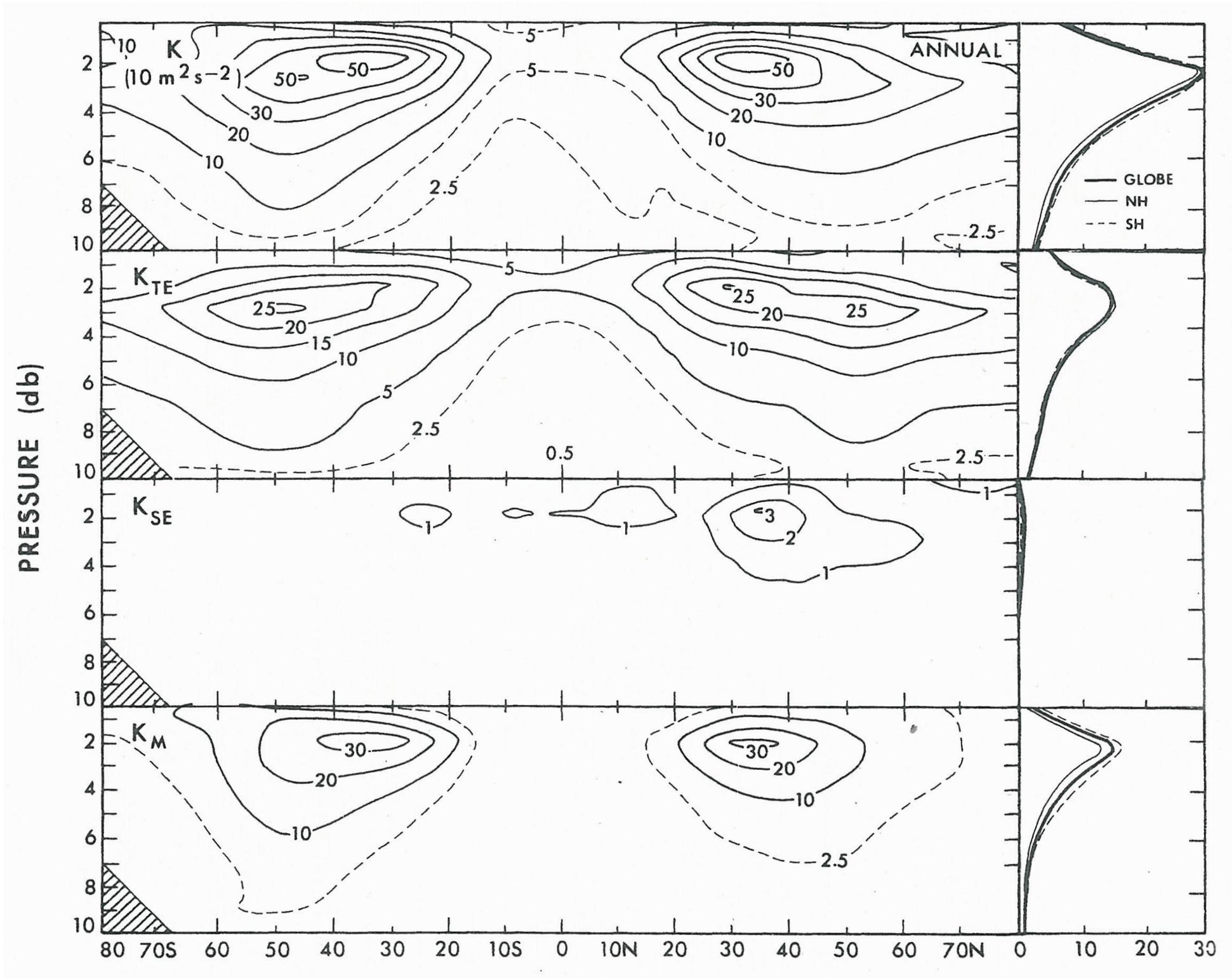
Mean meridional circulation on dry and moist isentropes



Another step in the Lorenz epistemology of the general circulation?

Pauluis et al, Science, 2008

Kinetic energy (m s^{-2})



Total

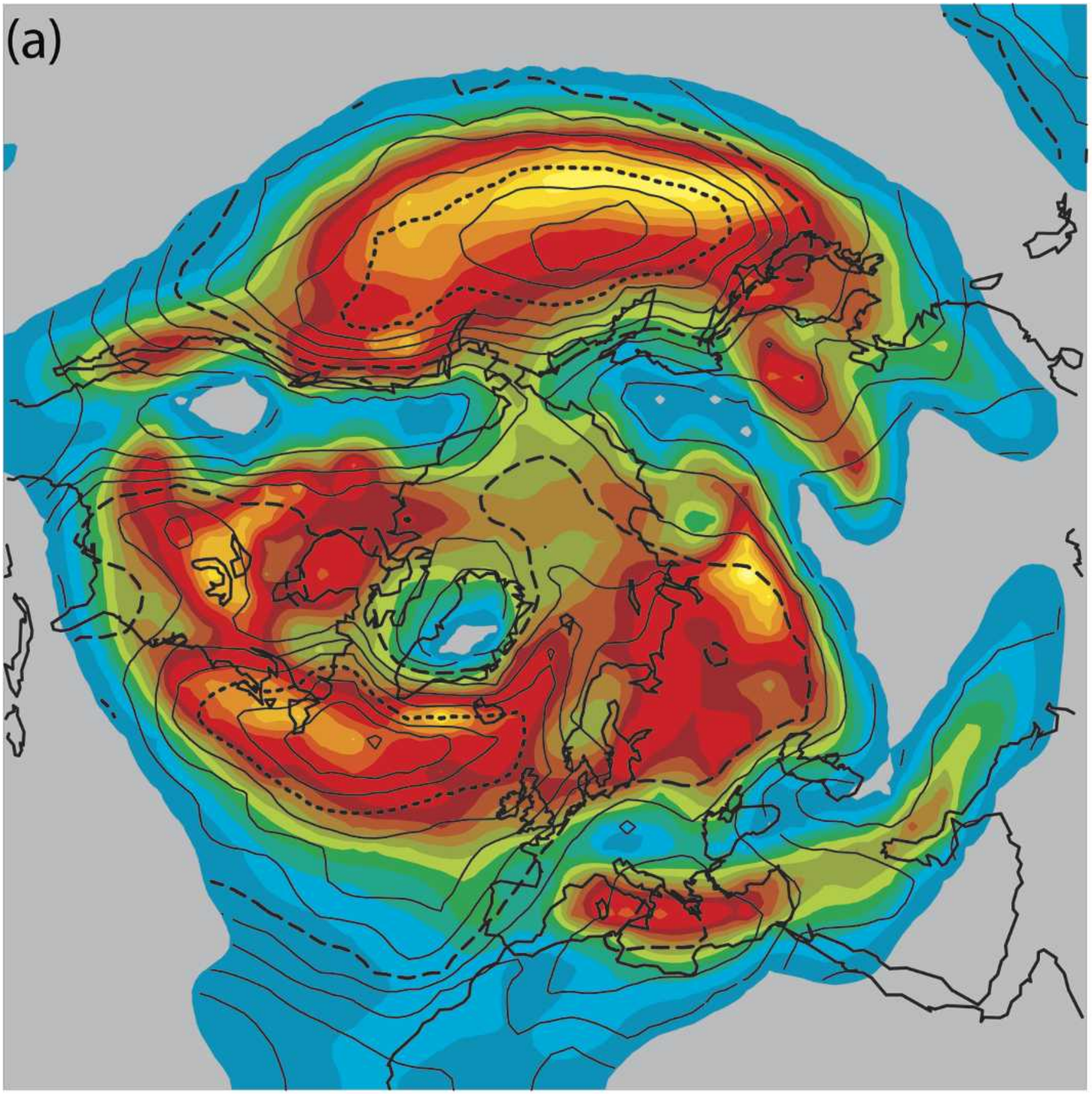
Transient

Stationary

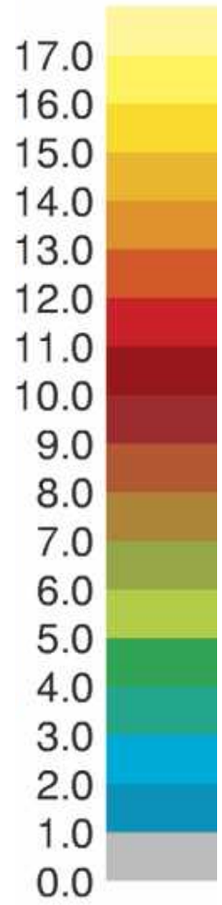
Mean

Peixoto and Oort, fig 7.22

Cyclone tracks: NH DJF



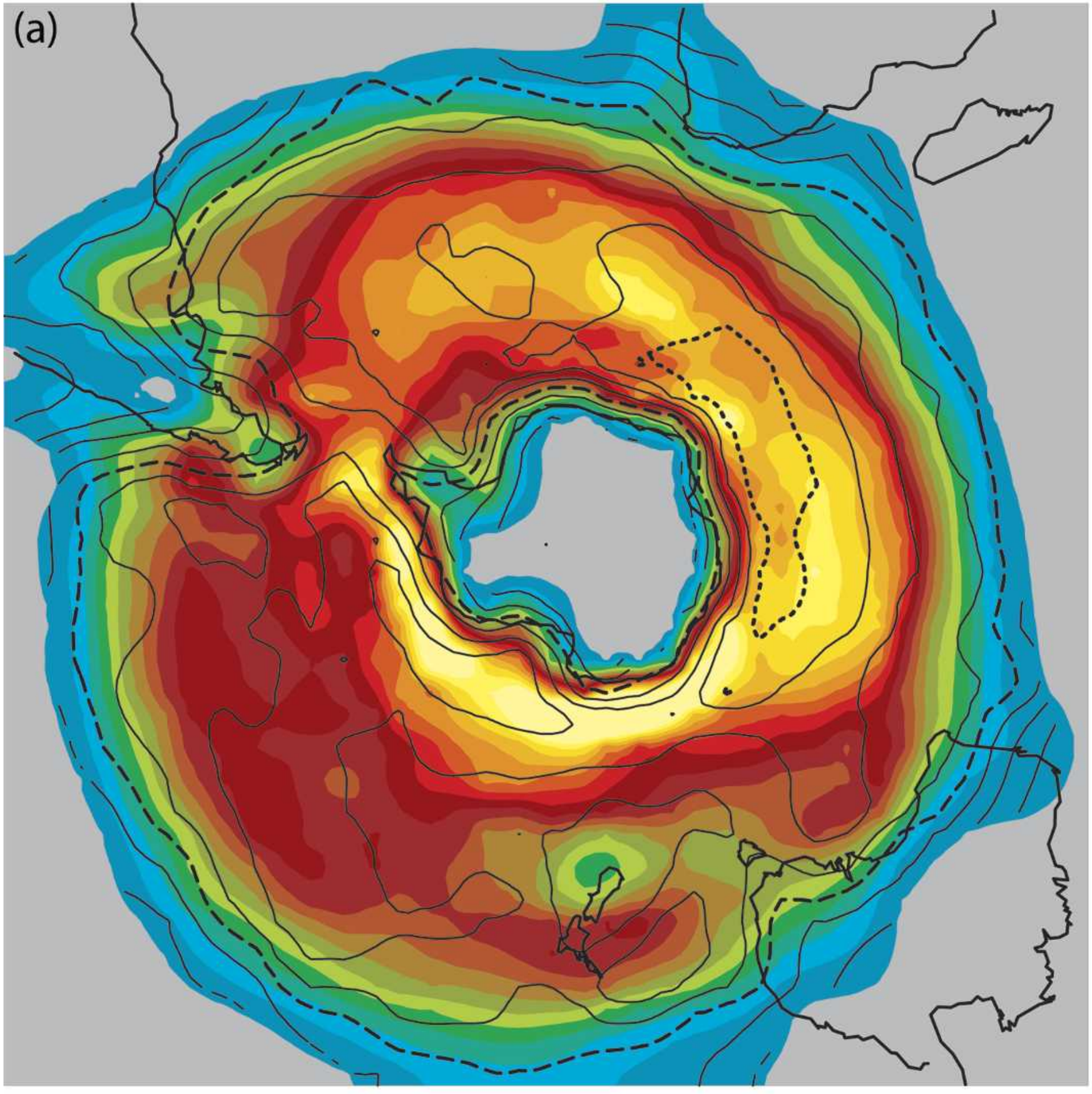
Track density (per month per 10^6 km^2)



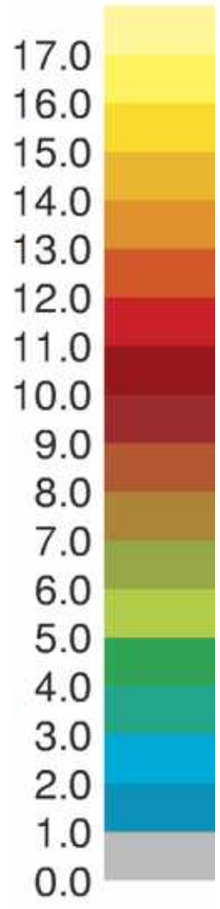
Intensity (contours; 10^{-5} s^{-1}) – – – – – – $4x10^{-5}$ ---------- $6x10^{-5}$

ERA40
based on 850hPa relative vorticity
from Bengtsson et al 2006

Cyclone tracks: SH JJA



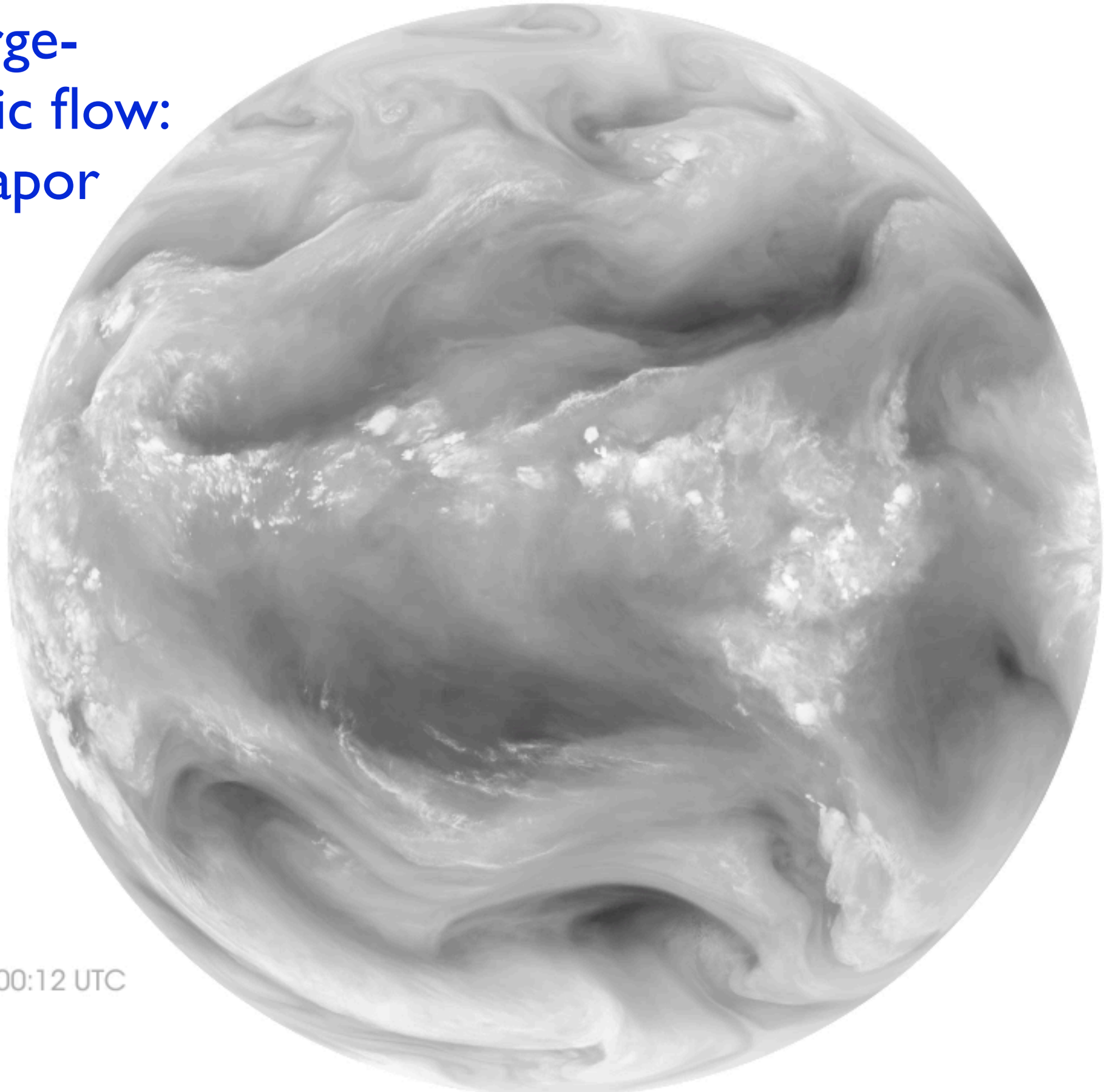
Track density (per month per 10^6 km^2)



ERA40
based on 850hPa relative vorticity
from Bengtsson et al 2006

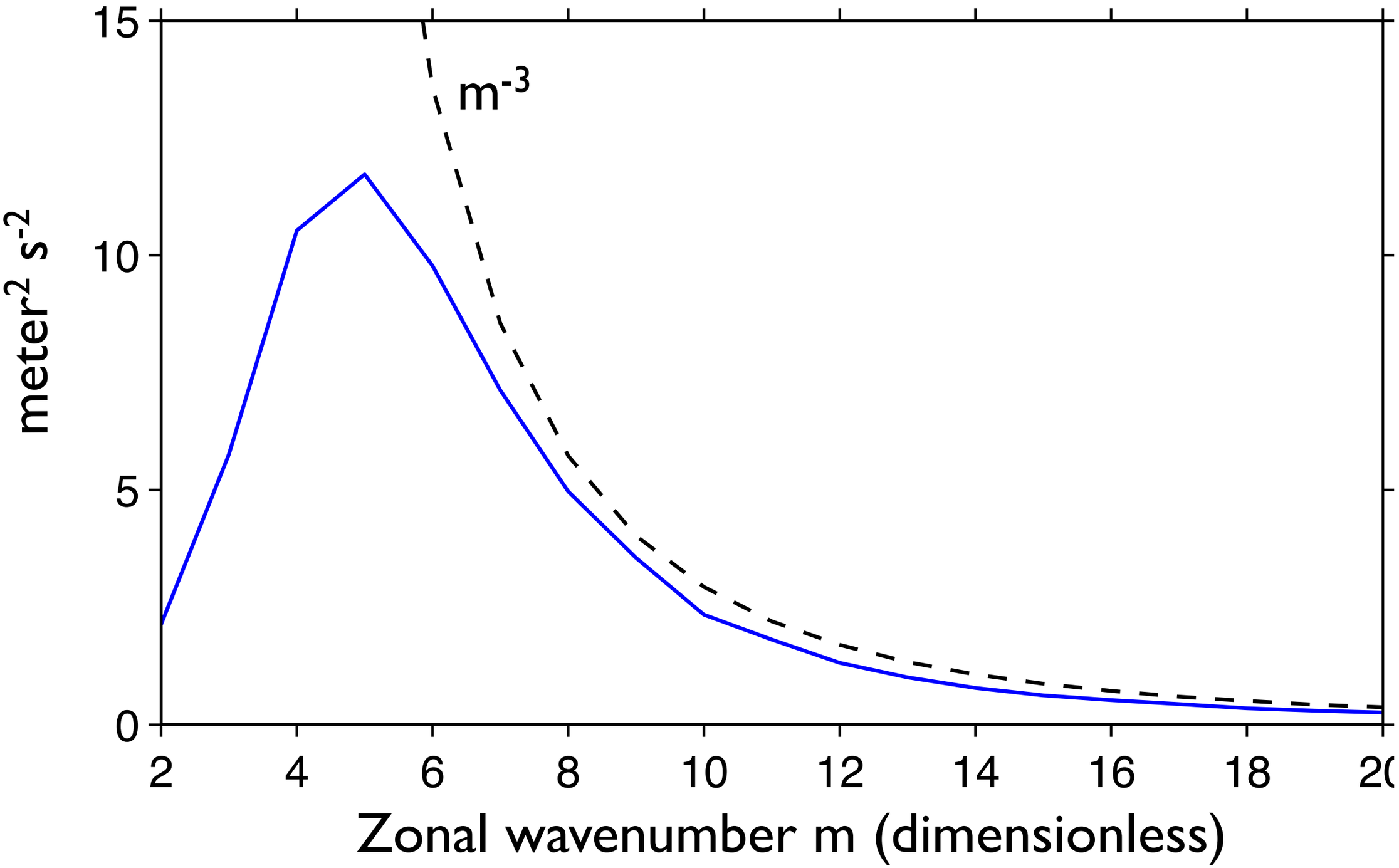
Large-scale turbulent flow in the atmosphere

Illustration of large-scale atmospheric flow: satellite water vapor imagery

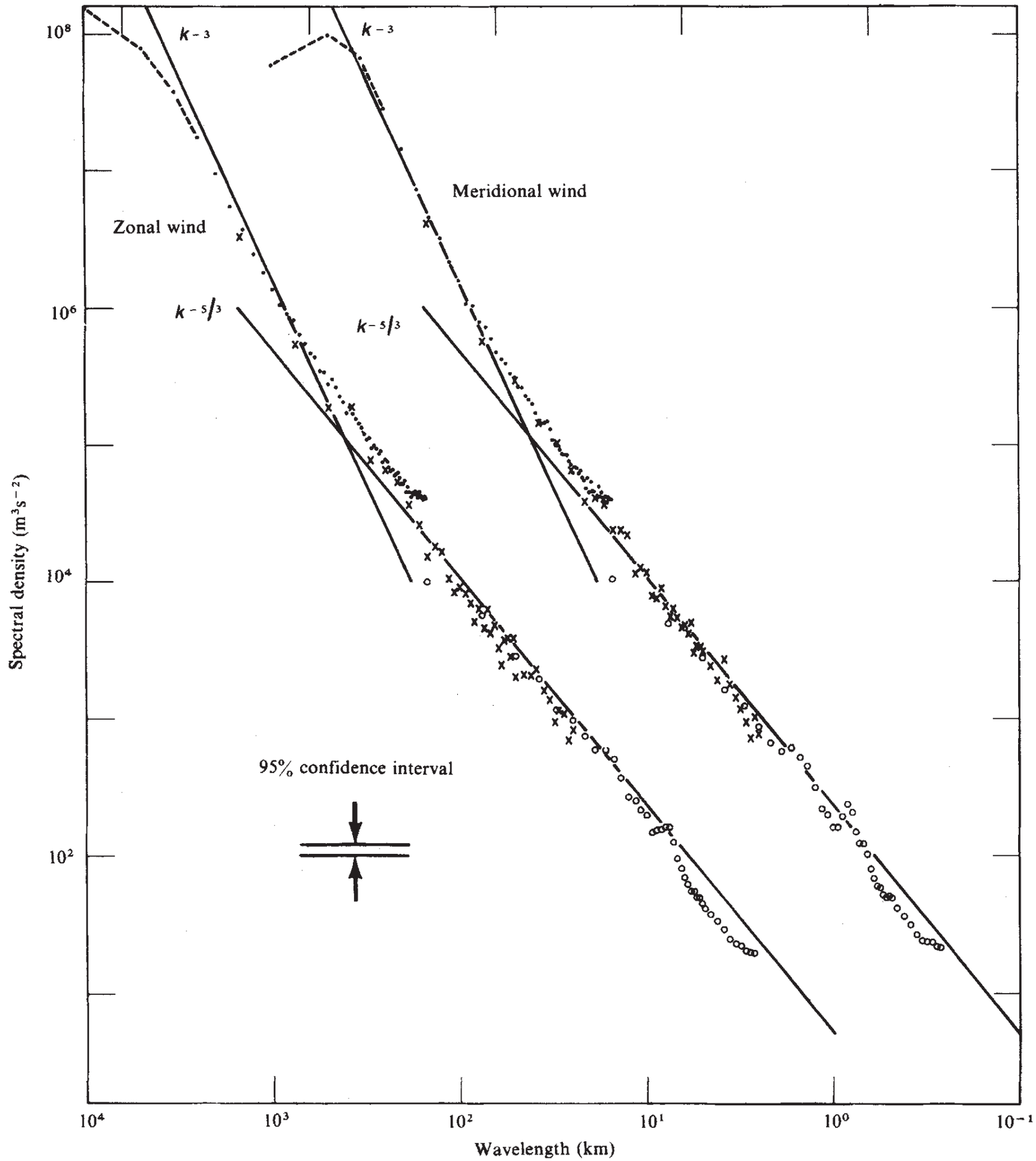


Animation: Robert Simmon,NASA
Data: Seviri water vapor (IR)

Power spectrum of meridional wind at 45S



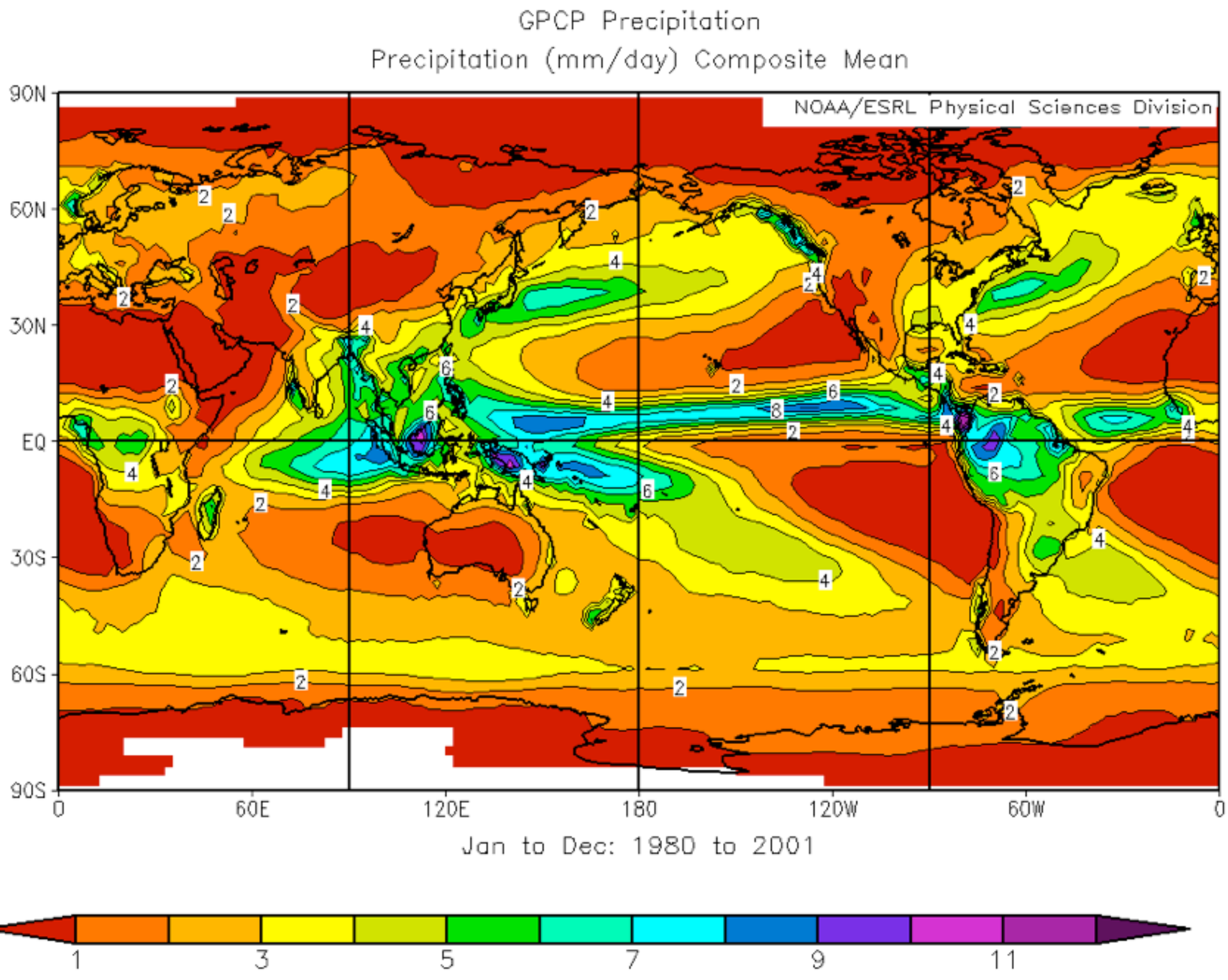
Based on ERA40 winds. The spectrum sums to the vertically averaged zonal variance of v cos(phi) where phi is latitude.



Nastrom et al, Nature, 1984: Fig. 1 commercial aircraft data near the tropopause (meridional data is shifted one decade to the right)

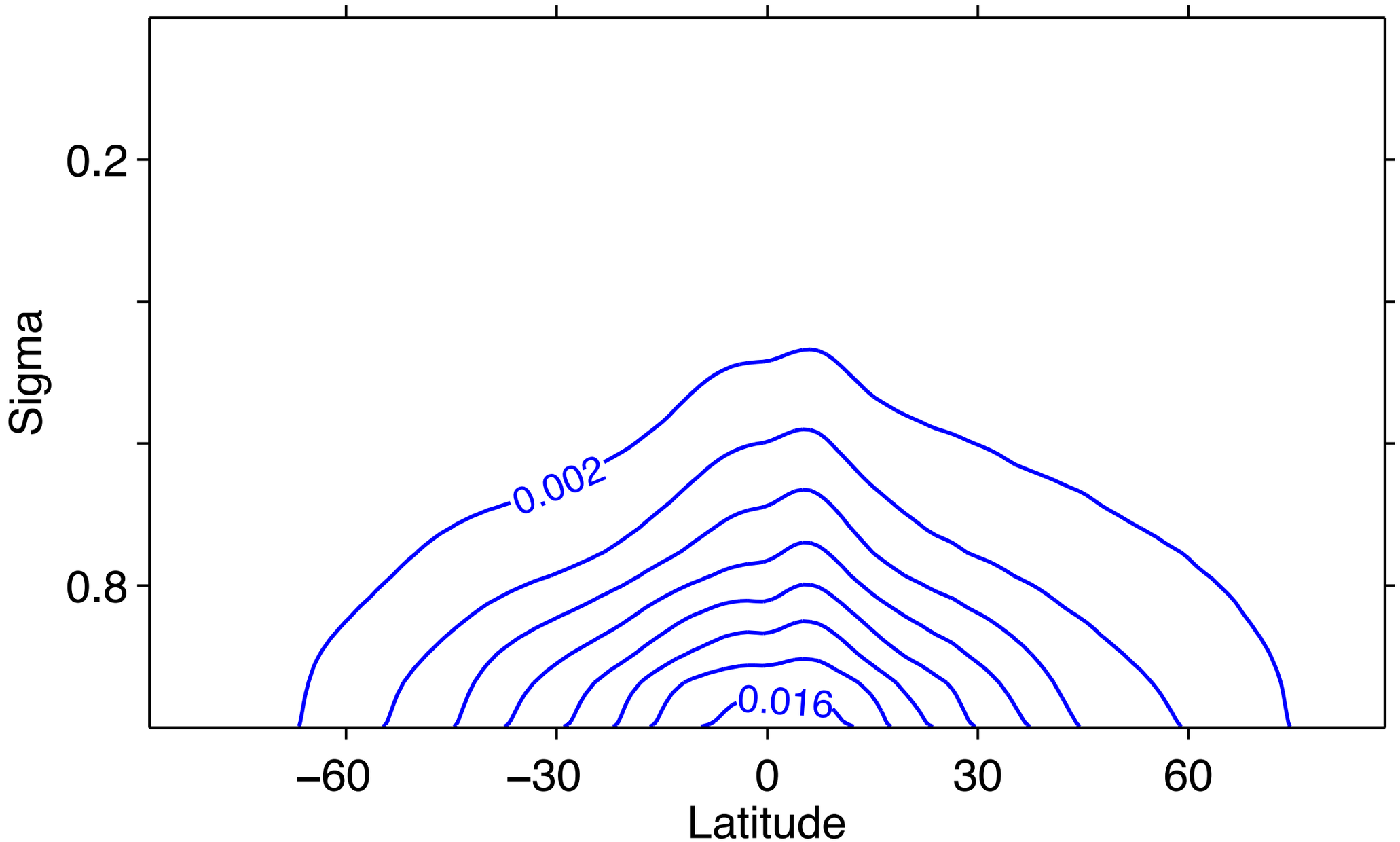
Water vapor and the hydrological cycle

Precipitation (mm/day)



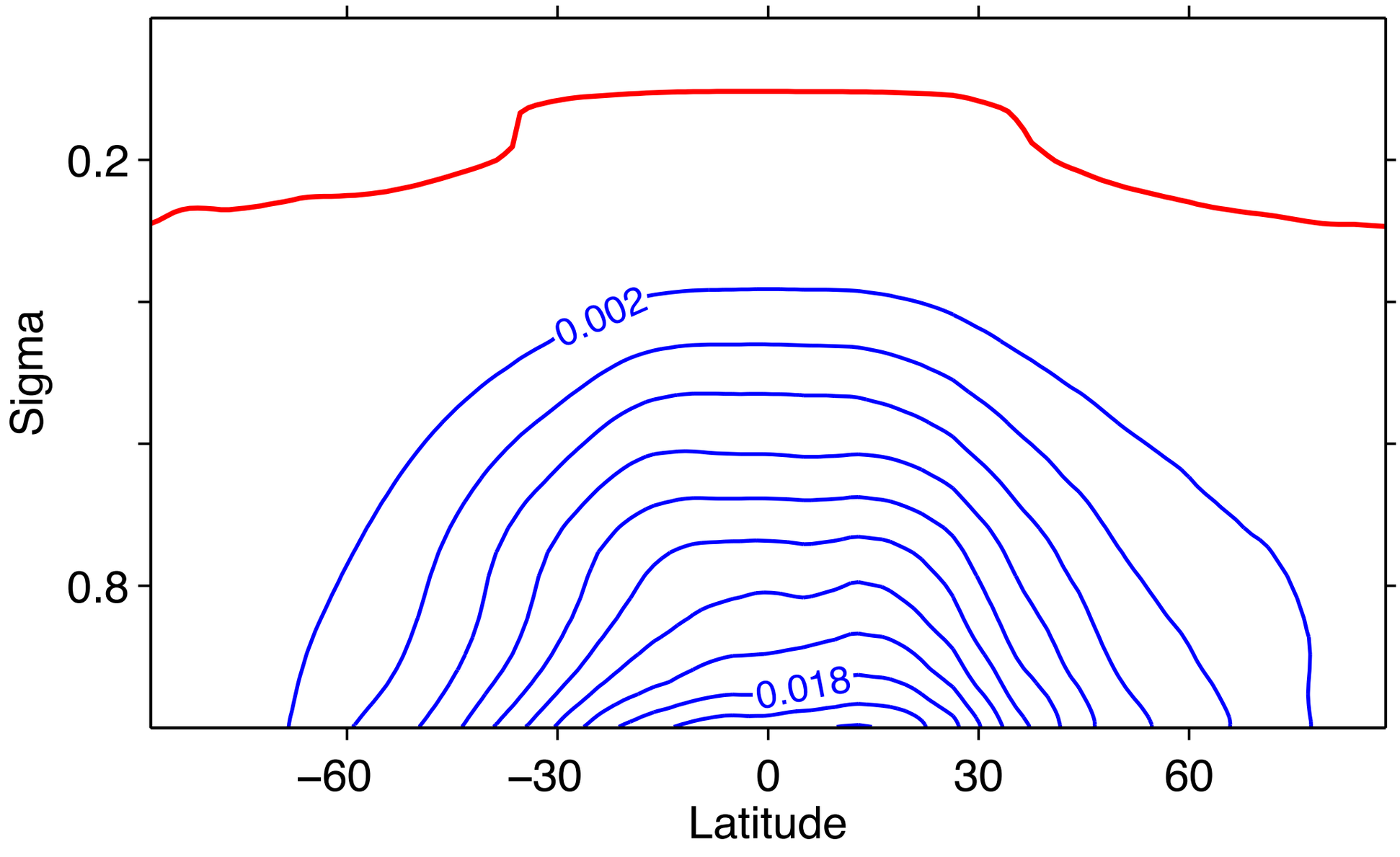
CDC interactive plotting website

Time and zonal mean specific humidity



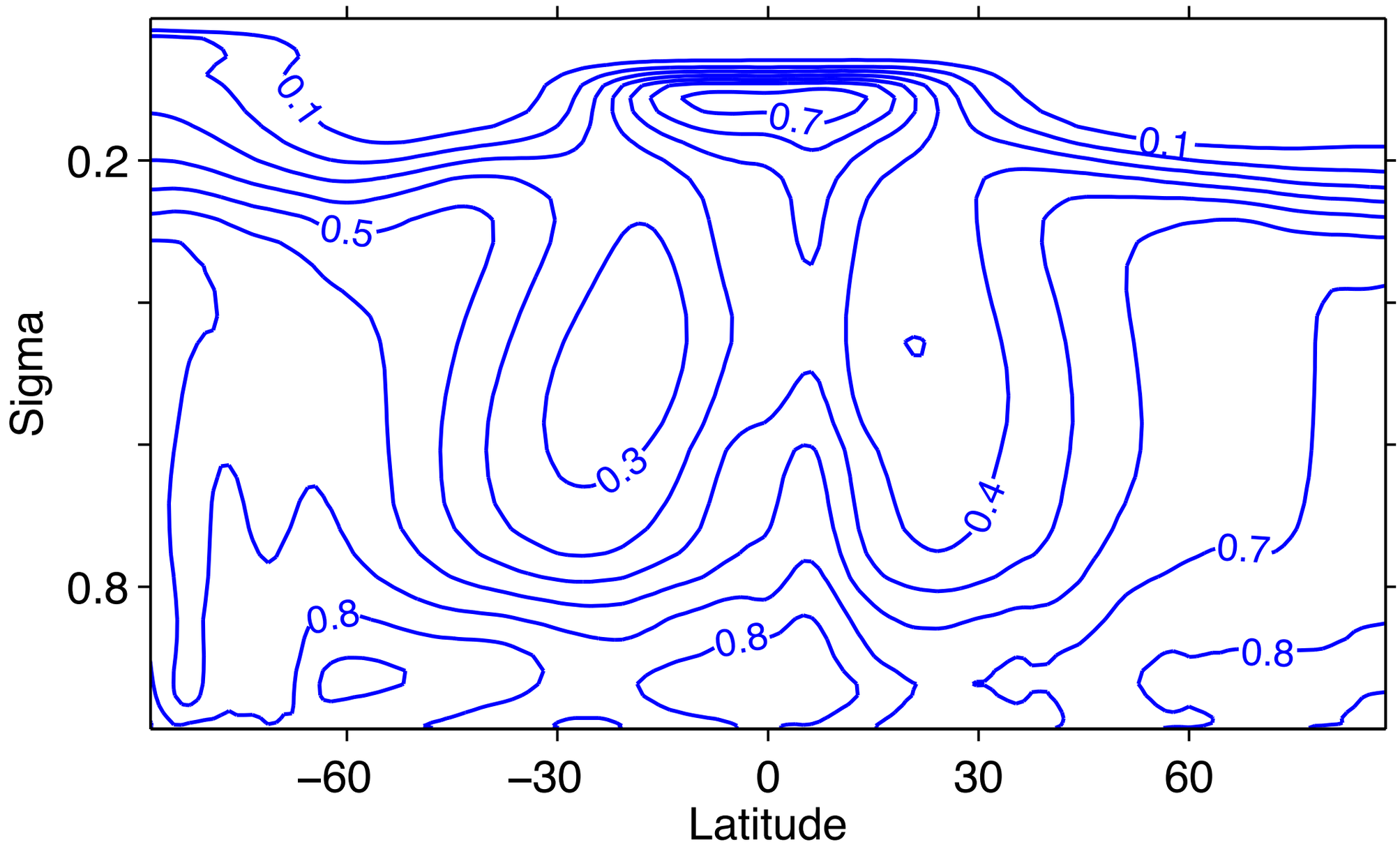
ERA40, 1980-2001

Time and zonal mean *saturation* specific humidity



ERA40, 1980-2001

Time and zonal mean *relative* humidity



ERA40, 1980-2001

Next steps

- Understand maintenance of:
  - *thermal structure*
  - *mean surface winds*
  - *relative humidity and precipitation*