Wave Driving in the Tropical Lower Stratosphere as Simulated by WACCM: Annual Cycle and ENSO-Induced Changes

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ABSTRACT

This study explores wave driving (WD) of the Brewer-Dobson circulation (BDC) especially in the tropical lower stratosphere for two timescales.

1) Annual cycle in control run of WACCM:
Large roles are played by eq. Rossby waves (ERWs) & NH waves.

2) ENSO-induced changes in perp. JAN experiments of WACCM:
WD strengthens for El Nino, with modulation of stationary ERWs.

SUMMARY

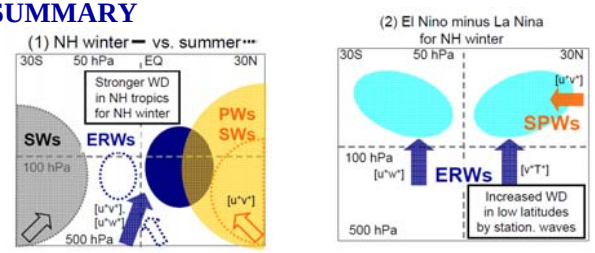

Fig. S: Schematics of WD proposed in this study:
(1) seasonal contrast, and (2) ENSO-induced changes.

1. Mean Annual Cycle

■Motivation

How ERWs & NH waves play roles in WD?
Is [u*w*] of ERWs important?
([ ]: zonal mean, *: wave component)

■50-yr control run w/ WACCM

T63, L66 up to about 140 km
Forced w/ clim. SST/SIC & ozone
NO ENSO, QBO, volcano, solar, etc.

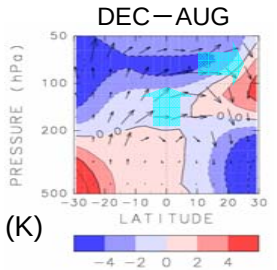

Fig. 1.1: DEC minus AUG diffs in [T] (K) & RMMC ([v]†, [w]†).

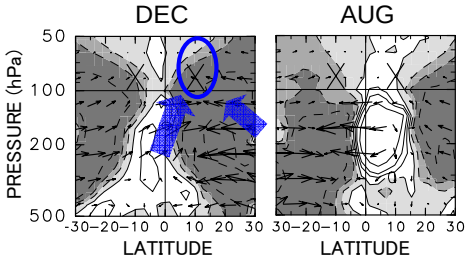

Fig. 1.2: EP flux & WD (m/s/d) for DEC & AUG.

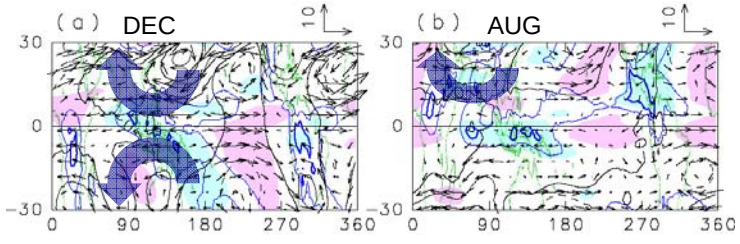

Fig. 1.3: 200-hPa (u*,v*), w* (shading), Z* (black cont), & OLR (blue cont at 200, 240 W/m^2) for (a) DEC & (b) AUG.

2. ENSO-Induced Changes

■Motivation

WD is shown to strengthen for El Nino.
How does this occur (eq. wave response)?

■Perpetual JAN exps. w/ WACCM

Perturbed SSTs over tropical Pacific
Run COLD for La Nina-like case
Run WARM for El Nino-like case
Each 3650-day long

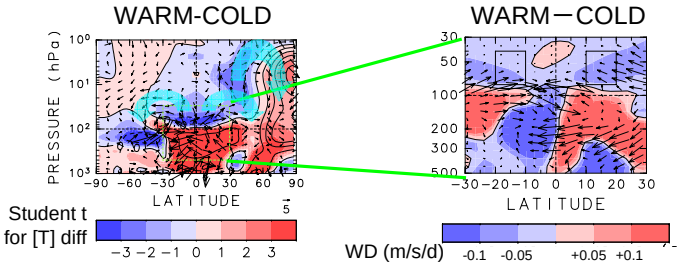

Fig. 2.1: WARM minus COLD diffs in [T] & ([v]†, [w]†).

Fig. 2.2: WARM minus COLD diffs in EP flux & WD (m/s/d).

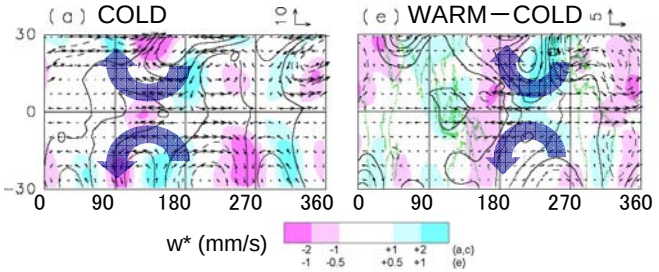

Fig. 2.3: (Left) 80-hPa clim. (u*,v*), w*, Z* for COLD. (Right) WARM minus COLD diffs.