Radiative-dynamical interaction of tropical upper tropospheric clouds: sensitivity to ice cloud parameterizations

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Supplement

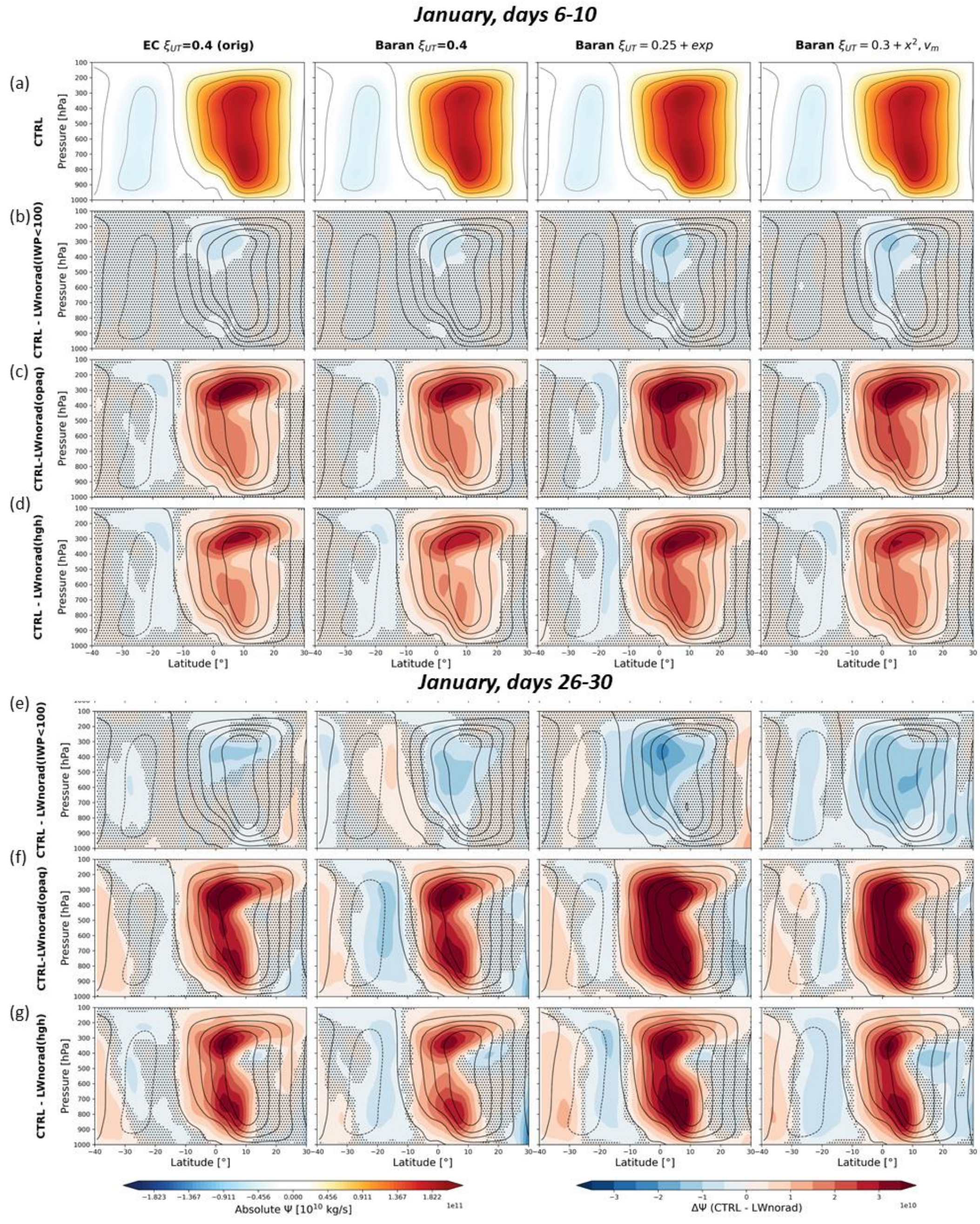

Figure S1: Zonally averaged stream function profiles (row a), and stream function differences between CTRL and LWnorad(IWP<100) (rows b and e), between CTRL and LWnorad(opaq) (rows c and f) and between CTRL and LWnorad(hgh) (rows d and g), for simulations using the parameterizations described above (columns 1-4). Statistics considers days 6-10 (rows a-d) and days 26-30 (rows e-g) of present-day climate January. LWnorad means UT clouds are made transparent to LW radiation only.

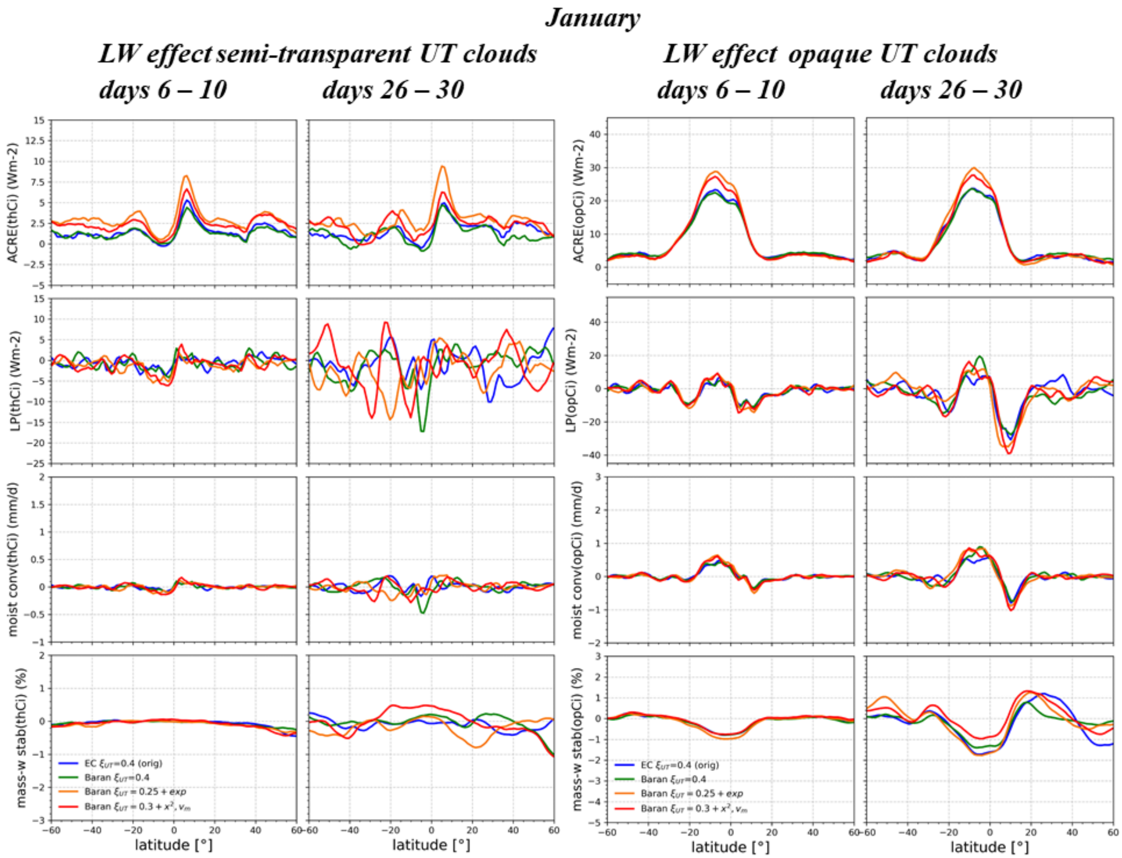

Figure S2: Zonal averages of differences in ACRE, LP, vertically integrated moisture convergence and mass-weighted stability between CTRL and LWnorad(IWP<100) (2 left columns) and between CTRL and LWnorad(opaq) (2 right columns). The first difference shows the LW radiative effects of semi-transparent UT clouds, while the second shows the ones of opaque UT clouds. Statistics considers days 6-10 (left) and days 26-30 (right) of present-day climate January.

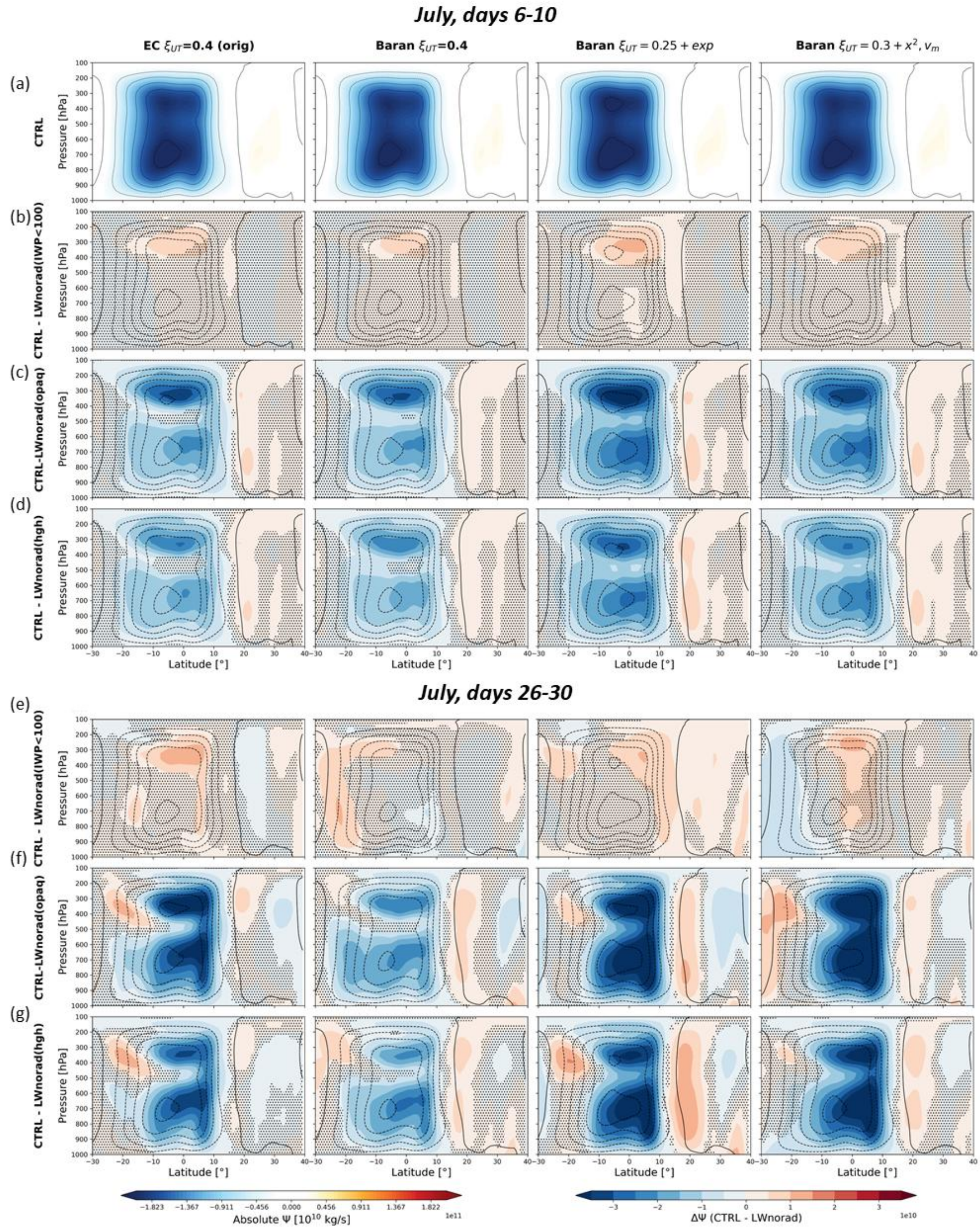

Figure S3: Zonally averaged stream function profiles (row a), and stream function differences between CTRL and LWnorad(IWP<100) (rows b and e), between CTRL and LWnorad(opaq) (rows c and f) and between CTRL and LWnorad(hgh) (rows d and g), for simulations using the parameterizations described above (columns 1-4). Statistics considers days 6-10 (rows a-d) and days 26-30 (rows e-g) of present-day climate July. LWnorad means UT clouds are made transparent to LW radiation only.

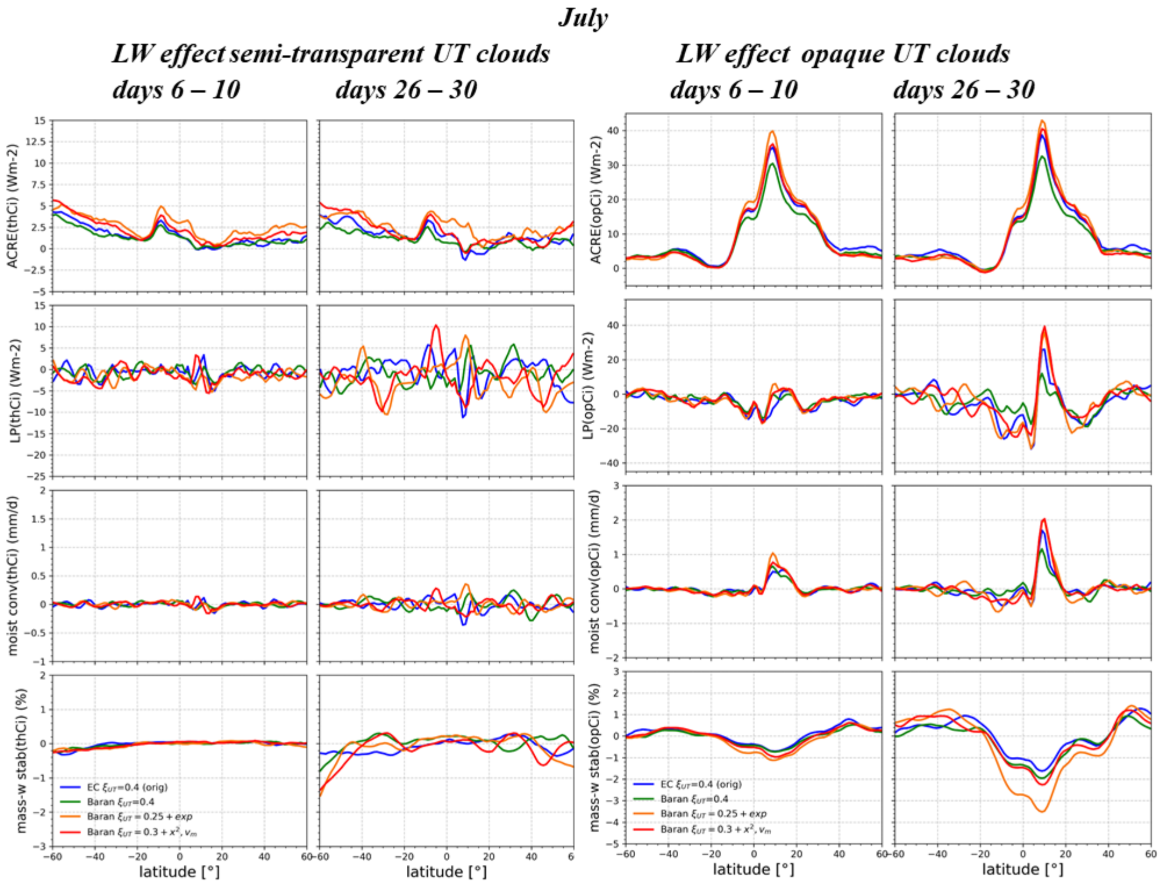

Figure S4: Zonal averages of differences in ACRE, LP, vertically integrated moisture convergence and mass-weighted stability between CTRL and LWnorad(IWP<100) (2 left columns) and between CTRL and LWnorad(opaq) (2 right columns). The first difference shows the LW radiative effects of semi-transparent UT clouds, while the second shows the ones of opaque UT clouds. Statistics considers days 6-10 (left) and days 26-30 (right) of present-day climate July.

Table S1: Average ACRE and LP (in Wm^{-2}) as well as maximum Hadley cell intensity (in %) due to total (LW) radiative interaction of UT cloud types, each for the UT cloud parameterizations EC $\xi_{UT}=0.4$ / Baran $\xi_{UT}=0.3x^2 v_m$. Quasi-equilibrium (days 26 to 30) considered over 40°S to 20°N (January) and 20°S to 40°N (July).

January

cld type	param.	rad. effect	ACRE (Wm^{-2})	LP (Wm^{-2})	max Hadley cell intensity (%)
thinCi	orig/**B**$\xi_{UT}v_m$	tot (LW)	1.4 (1.5) / **2.1** (2.3)	-1.5 (-0.5) / **-2.8** (-2.5)	-5.7 (-5.4) / **-10.6** (-9.5)
opaqCi	orig/**B**$\xi_{UT}v_m$	tot (LW)	14.6 (11.8) / **14.0** (12.9)	-9.3 (-6.2) / **-7.7** (-6.3)	12.8 (25.3) / **19.4** (28.5)
UTcld	orig/**B**$\xi_{UT}v_m$	tot (LW)	16.0 (13.4) / **16.1** (15.2)	-10.8 (-6.7) / **-10.5** (-8.8)	7.1 (19.9) / **8.8** (19.0)

July

cld type	param.	rad. effect	ACRE (Wm^{-2})	LP (Wm^{-2})	max Hadley cell intensity (%)
thinCi	orig/**B**$\xi_{UT}v_m$	tot (LW)	1.0 (1.0) / **1.4** (1.3)	-1.0 (-0.4) / **-0.8** (-0.8)	-1.4 (-6.9) / **-6.4** (-1.7)
opaqCi	orig/**B**$\xi_{UT}v_m$	tot (LW)	12.2 (14.7) / **14.1** (15.1)	-4.4 (-9.1) / **-6.0** (-6.3)	22.7 (23.6) / **31.4** (22.5)
UTcld	orig/**B**$\xi_{UT}v_m$	tot (LW)	13.2 (15.7) / **15.5** (16.4)	-5.4 (-9.5) / **-6.8** (-7.1)	21.3 (16.7) / **25.0** (20.8)