Initial Conditions and Forcing for LES

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Files

- data-CGILS_S11_ctl_InitCond_Forc.nc
- data-CGILS_S12_ctl_InitCond_Forc.nc
- data-DYCOMS_SCM_InitCond.nc
- data-MERRA2_InitCond_Forc.nc

Table 1: Initial conditions

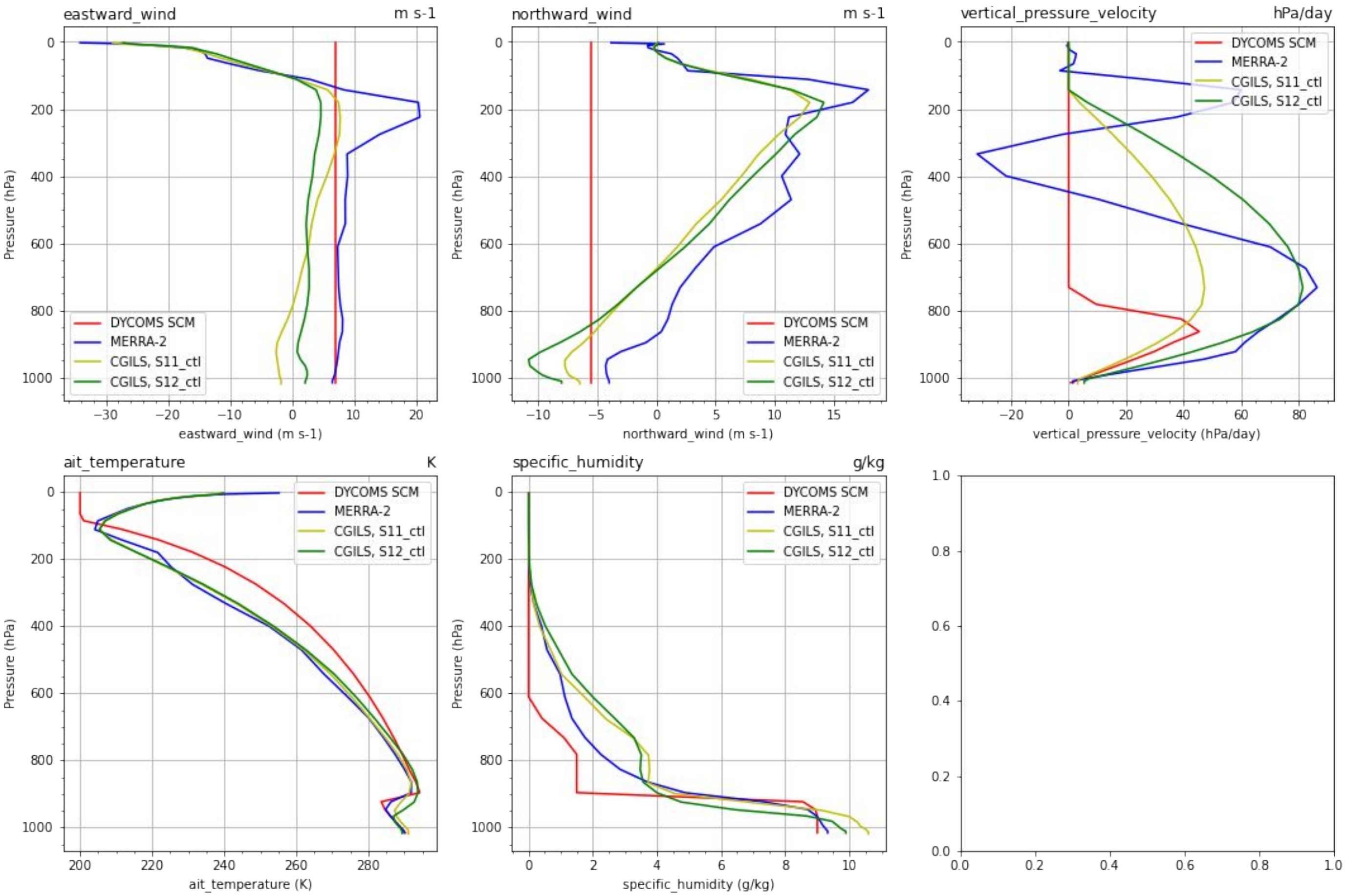
	DYCOMS	MERRA-2	CGILS S11, CTL	CGILS S12, CTL
U, V, T, Q, Ps, and Ts	From Stevens et al. (2005)	3-hourly averaged fields at 1030 UTC, 10 July, 2001 in the DYCOMS region. Note that RF01 is at 06-15 UTC.	From Zhang et al. (2012)	From Zhang et al. (2012)
Pressure levels	On AM4 levels (33 hybrid levels)	On AM4 levels (33 hybrid levels)	On AM4 levels (33 hybrid levels)	On AM4 levels (33 hybrid levels)

(U, V, T, Q, Ps, Ts is zonal wind, meridional wind, temperature, specific humidity, and surface pressure, surface skin temperature, respectively)

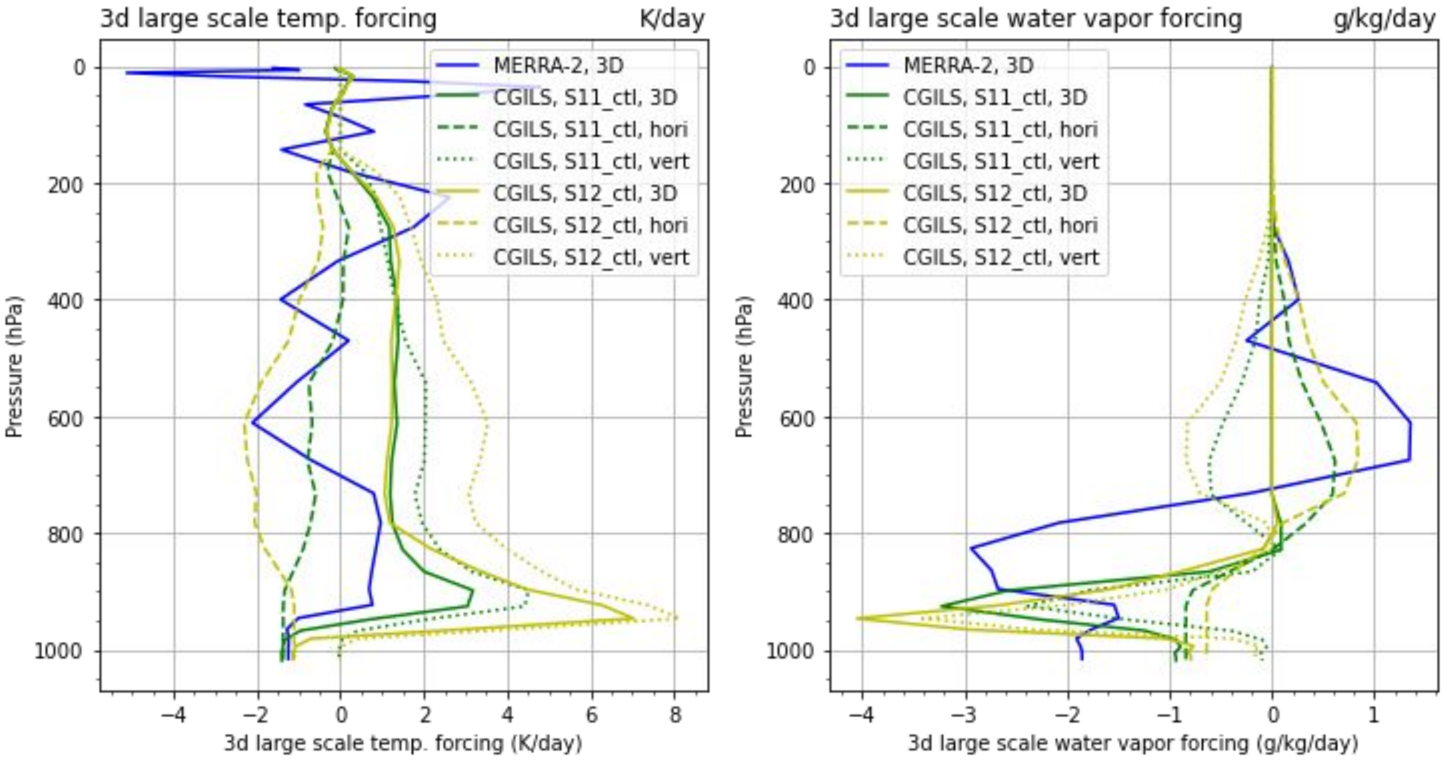
Table 2: Forcing

	MERRA-2	CGILS S11, CTL	CGILS S12, CTL
Omega & 3D dynamical tendencies for T and Q	3-hourly averaged in DYCOMS area on 1030 UTC, 10 July, 2001. (RF01 is 06-15 UTC)	From Zhang et al. (2012)	From Zhang et al. (2012)
Horizontal advective tendencies for T and Q	N/A	From Zhang et al. (2012)	From Zhang et al. (2012)
Geostrophic wind (U_g and V_g)	From Stevens et al. (2005) U_g = 7 m/s V_g = -5.5 m/s	N/A	N/A
Surface fluxes	From Stevens et al. (2005) Sensible heat flux = 15 W m^{-2} Latent heat flux = 115 Wm^{-2}	Bulk formula (Blossey et al. (2013, JAMES) $w's' = c_T(c_p \mathrm{SST} - s_1)$, (A2) $w'q' = c_T(0.98 q_{sat}(P_s, \mathrm{SST}) - q_1)$, (A3)	Bulk formula (Blossey et al. (2013, JAMES) $w's' = c_T(c_p \mathrm{SST} - s_1)$, (A2) $w'q' = c_T(0.98 q_{sat}(P_s, \mathrm{SST}) - q_1)$, (A3)
Pressure levels	On AM4 levels (33 hybrid levels)	On AM4 levels (33 hybrid levels)	On AM4 levels (33 hybrid levels)

Initial Conditions



Forcing



3d large scale temp. forcing
K/day
MERRA-2, 3D
CGILS, S11_ctl, 3D
CGILS, S11_ctl, hori
CGILS, S11_ctl, vert
CGILS, S12_ctl, 3D
CGILS, S12_ctl, hori
CGILS, S12_ctl, vert
Pressure (hPa)
0
200
400
600
800
1000
−4
−2
0
2
4
6
8
3d large scale temp. forcing (K/day)
3d large scale water vapor forcing
g/kg/day
MERRA-2, 3D
CGILS, S11_ctl, 3D
CGILS, S11_ctl, hori
CGILS, S11_ctl, vert
CGILS, S12_ctl, 3D
CGILS, S12_ctl, hori
CGILS, S12_ctl, vert
Pressure (hPa)
0
200
400
600
800
1000
−4
−3
−2
−1
0
1
3d large scale water vapor forcing (g/kg/day)

CGILS LES settings

Ref: Blossey, P. N., and Coauthors, 2013: Marine low cloud sensitivity to an idealized climate change: The CGILS les intercomparison. J. Adv. Model. Earth Syst., 5, 234–258, https://doi.org/10.1002/jame.20025.

Table 1. LES Domain Size and Resolution for CGILS Cases

Case	Δx (m)	Δz_{inv} (m)	$L_{x,y}$ (m)	z_{relax}[a] (m)	z_{relax}^{+}[a] (m)	c_T (m s^{-1})	z_1 (m)	D_{srf}[b] (s^{-1})
S6	100	40	9600	4000	4800	0.0081	20	5.25×10^{-6}
S11	50	5[c]	4800	2500	3000	0.0081	12.5	3.25×10^{-6}
S12	25	5[c]	2400	1200	1500	0.0104	2.5	1.68×10^{-6}

[a]Nudging rate increases with height as specified in section A1 from zero at the base of the thermodynamic nudging layer, z_{relax}, to 1 h^{-1} at z_{relax}^{+} and above.
[b]Divergence of the large-scale velocity field at the surface.
[c]LaRC used coarser Δz_{inv} of 25 m in S11 and 7.5 m in S12.

$$w's' = c_T\left(c_p \mathrm{SST} - s_1\right), \qquad \text{(A2)}$$

$$w'q' = c_T(0.98 q_{\mathrm{sat}}(P_s, \mathrm{SST}) - q_1), \qquad \text{(A3)}$$

$$c_T = c_q U_{\mathrm{spd}} \left\{\frac{\ln(10/z_0)}{\ln(z_1/z_0)}\right\}^2, \qquad \text{(A4)}$$

U_{spd}: 10-m surface wind speed
C_q = 1.2 x 10^{-3}
z_0 (surface momentum and scalar roughness length) = 10^{-4}m