ASR MJO CRM to GCPM Inter-comparison Project

This document describes the file and variable naming convention for the simulations.

MJO case

We intend to target the two successive strong MJO event of Nov 2011.

- Run length Nov 01 -2011 Nov 30 2011.

The requested items to be submitted for each model are as follows

1. **Model description**
   The following details should be submitted as an MS Word/PDF file:
   - Institution
   - Contact person
   - Model name
   - Model version (references if any)
   - Horizontal resolution (in equivalent kilometres at the equator)
   - Integration time step
   - For three dimensional data the date needs to be regridded to the following height levels in meters /50,100,150,200,250,300,350,450,550,650,750,1000,1300,1700,2000,2500,3000, 3500,4000,4500,5000,5500,6000,6500,7000,7500,8000,8500, 9000,9500, 10000, 11000, 12000, 13000,14000,15000,16000,17000,18000,19000/
   - Brief description of the convection, cloud, boundary layer and radiation schemes (and any other physical parameterisations) with relevant references
2. **Temporal data sampling**
   Detailed *time step outputs of all the fields* listed in the next section are to be submitted. Time steps can be different between models and this information has to be included in the time stamp of the output (see sections on Data format and File naming convention).
3. **Spatial domain**
   The data output to be submitted only for the domain 75^{o}E-85^{o}E, 5^{o}S-5^{o}N at the native model grid. Regridding to any other grid is not required.
4. **List of output variables**
   Table 2 lists the required fields to be submitted for the analysis. The labels to be used to represent variables are listed in the last column that is the same as the CMIP5 variables wherever applicable.
5. **Data format**
   Data is to be provided in Net CDF Climate and Forecast (CF) Metadata Convention (http://cf-pcmdi.llnl.gov/). Most of the data analysis tools (e.g. NCL, IDL, ferret, python) have the capability to create such files. One file per variable and per time step is to be created (see Section 4) and the axes should be named as `longitude`, `latitude`, `time` and `level` (for multi level fields). An example of the Net CDF headers of total temperature

tendencies at model levels for a case is given below.

```
netcdf metUM.tnt.20091020.00Z{
dimensions:
        longitude = 180 ;
        latitude = 55 ;
        level = 70 ;
        time = UNLIMITED ; // (240 currently)
variables:
        float longitude(longitude) ;
                longitude:units = "degrees_east" ;
                longitude:point_spacing = "even" ;
        float latitude(latitude) ;
                latitude:units = "degrees_north" ;
                latitude:point_spacing = "even" ;
        float level(level) ;
                level:units = "m" ;
                level:positive = "up" ;
                level:long_name = "hybrid_ht levels" ;
        float time(time) ;
                time:units = "minutes since 2009-10-21 00:00:00" ;
                time:long_name = "time" ;
        float tnt(time, level, latitude, longitude) ;
                tnt:source = "Unified Model Output (Vn 7.8):" ;
                tnt:name = "tnt" ;
                tnt:title = "T TOTAL INCREMENT ON MODEL LEVELS" ;
                tnt:date = "21/10/09" ;
                tnt:long_name = "T TOTAL INCREMENT ON MODEL LEVELS" ;
                tnt:units = "K" ;
                tnt:missing_value = 2.e+20f ;
                tnt:_FillValue = 2.e+20f ;
                tnt:valid_min = -3.268284f ;
                tnt:valid_max = 1.804996f ;
```

6. File naming convention

Suggested filenames for output from this component as follows:

```
model.variable.time.nc
```

where `time` is the time of the single frame in the file. This should also match the time stamp information in the netCDF file. Variable refers to the label in Table 1.
For the purpose of transferring the files they may be grouped as tar balls of convenient sizes.

7. Table 1: List of output variables

	Variable	Common symbol (unit)	label (to be used for file and variable naming)	Comments
1	Pressure	P (hPa)	p	For models with non-pressure level vertical coordinates
2	Temperature	T (K)	ta	
3	Potential Temperature	θ (K)	theta	
5	Water vapour mixing ratio	q (kg kg^{-1})	hus	

6	Relative humidity	R (%)	hur	
7	Zonal wind velocity	u (m s^{-1})	ua	
8	Meridional wind velocity	v (m s^{-1})	va	
9	Pressure vertical velocity	ω (Pa s^{-1})	wap	
11	Mass Fraction of Cloud Liquid Water	(%)	clwc	Calculated as the mass of convective cloud liquid water in the grid cell divided by the mass of air (including the water in all phases) in the grid cell. This includes precipitating hydrometeors ONLY if the precipitating hydrometeors affect the calculation of radiative transfer in model. (See CMIP5 data requirements)
12	Mass Fraction of Cloud Ice	(%)	clic	Calculated as the mass of convective cloud ice in the grid cell divided by the mass of air (including the water in all phases) in the grid cell. This includes precipitating hydrometeors ONLY if the precipitating hydrometeors affect the calculation of radiative transfer in model. (See CMIP5 data requirements)
13	Apparent heat source	$Q_1 = \frac{\partial T}{\partial t} - \left.\frac{\partial T}{\partial t}\right\|_{LS} - Q_R$ (K s^{-1})	Q1	
14	Apparent moisture sink	$Q_2 = \frac{\partial q}{\partial t} - \left.\frac{\partial q}{\partial t}\right\|_{LS}$ (s^{-1})	Q2	
15	Mass Fraction of Stratiform Cloud Ice	(%)	clis	Calculated as the mass of stratiform cloud ice in the grid cell divided by the mass of air (including the water in all phases) in the grid cell. This includes precipitating hydrometeors ONLY if the precipitating hydrometeors affect the calculation of radiative transfer in model. (See CMIP5 data requirements)
16	Convective updraft mass flux (if appropriate)	$M_c u$ (kg m^{-2} s^{-1})	mcu	
17	Shortwave radiative heating rate	$Q_R{}^{SW}$ (K s^{-1})	tntrsw	
18	Longwave radiative heating rate	$Q_R{}^{LW}$ (K s^{-1})	tntrlw	
19	Clear-sky shortwave heating rate	$Q_R{}^{SW}(clear)$ (K s^{-1})	tntrswcs	
				Clear-sky Longwave radiative heati

Budget terms of T $\frac{\partial T}{\partial t} = \left.\frac{\partial T}{\partial t}\right|_{LS} + \left.\frac{\partial T}{\partial t}\right|_{Phys}$

Total rate of change of temperatur

20	Rate of change of temperature due to convection	$\left.\frac{\partial T}{\partial t}\right\|_{conv}$ (K s^{-1})	tntc	

21	Rate of change of temperature due to Boundary layer	$\left.\frac{\partial T}{\partial t}\right\vert_{BL}$ (K day^{-1})	tntpbl	
22	Rate of change of temperature due to large scale cloud, precipitation (Separate the components if available)	$\left.\frac{\partial T}{\partial t}\right\vert_{LSCprecip}$ (K s^{-1})	tntlscp	
23	Rate of change of temperature due to advection	$\left.\frac{\partial T}{\partial t}\right\vert_{adv}$ (K s^{-1})	tnta	
24	Rate of change of temperature due to horizontal diffusion +gravity wave drag+ any other terms	$\left.\frac{\partial T}{\partial t}\right\vert_{diff}$ (K s^{-1})	tntd	'Any other terms' here means terms in addition to those listed here that can change T. They may be smaller but our aim is to have a closed T budget. Any additional terms may be named accordingly. E.g., "tntlsc" for large-scale cloud and "tntlsp" for large-scale precipitation
25	Rate of change of temperature due to convection	$\left.\frac{\partial T}{\partial t}\right\vert_{conv}$ (K s^{-1})	tntc	
26	Rate of change of temperature due to Boundary layer	$\left.\frac{\partial T}{\partial t}\right\vert_{BL}$ (K day^{-1})	tntpbl	
27	Total rate of change of q	$\frac{dq}{dt}$ (s^{-1})	tnhus	
28	Rate of change of q due to convection	$\left.\frac{\partial q}{\partial t}\right\vert_{conv}$ (s^{-1})	tnhusc	
29	Rate of change of water vapour due to boundary layer	$\left.\frac{\partial q}{\partial t}\right\vert_{BL}$ (s^{-1})	tnhuspbl	

Rate of change of water vapour du large scale cloud, precipitation (Se the components if available)

Budget terms of q $\frac{\partial q}{\partial t} = \left.\frac{\partial q}{\partial t}\right|_{LS} + \left.\frac{\partial q}{\partial t}\right|_{Phys}$

Rate of change of water vapour du advection

30	Rate of change of water vapour due to horizontal diffusion +gravity wave drag+ any other terms	$\left.\frac{\partial q}{\partial t}\right\vert_{diff}$ (s^{-1})	tnhusd	'Any other terms' here means terms in addition to those listed here that can change q. They may be smaller but our aim is to have a closed q budget
31	Rate of change of q due to convection	$\left.\frac{\partial q}{\partial t}\right\vert_{conv}$ (s^{-1})	tnhusc	

32	Rate of change of water vapour due to boundary layer	$\left.\frac{\partial q}{\partial t}\right\|_{BL}$ (s^{-1})	tnhuspbl		
33	Total rate of change of q_c	$\frac{dq_c}{dt}$ (s^{-1})	tnqc	Total condensate=ice and liquid (and precipitating hydrometeors if they are known).	
34	Rate of change of q_c due to convection	$\left.\frac{\partial q_c}{\partial t}\right\|_{conv}$ (s^{-1})	tnqcc		
35	Rate of change of q_c due to boundary layer	$\left.\frac{\partial q_c}{\partial t}\right\|_{BL}$ (s^{-1})	tnqcpbl		
					Rate of change of q_c due to large s cloud, precipitation (Separate the components if available)
Budgets for total condensate (q_c)					Rate of change of q_c due to advect
36	Rate of change of q_c due to horizontal diffusion +gravity wave drag+ any other terms	$\left.\frac{\partial q_c}{\partial t}\right\|_{diff}$ (s^{-1})	tnqcd	'Any other terms' here means terms in addition to those listed here that can change q_c. They may be smaller but our aim is to have a closed budget	
37	Rate of change of q_c due to convection	$\left.\frac{\partial q_c}{\partial t}\right\|_{conv}$ (s^{-1})	tnqcc		
38	Rate of change of q_c due to boundary layer	$\left.\frac{\partial q_c}{\partial t}\right\|_{BL}$ (s^{-1})	tnqcpbl		
39	Total rate of change of u, v	$\frac{du}{dt}, \frac{dv}{dt}$ (m s^{-1} day^{-1})			
40	Rate of change of u, v due to convection	$\left.\frac{\partial u}{\partial t}\right\|_{conv}, \left.\frac{\partial v}{\partial t}\right\|_{conv}$ (m s^{-1} day^{-1})			
41	Rate of change of u, v due to boundary layer	$\left.\frac{\partial u}{\partial t}\right\|_{BL}, \left.\frac{\partial v}{\partial t}\right\|_{BL}$ (m s^{-1} day^{-1})			
					Rate of change of u, v due to adve
					Rate of change of u, v due to horiz diffusion +gravity wave drag+ any terms
42	Total rate of change of u, v	$\frac{du}{dt}, \frac{dv}{dt}$ (m s^{-1} day^{-1})			

43	Rate of change of u, v due to convection	$\left.\frac{\partial u}{\partial t}\right\|_{conv}, \left.\frac{\partial v}{\partial t}\right\|_{conv}$ (m s^{-1} day^{-1})			
44	Surface temperature	T_s (K)	ts		
45	Near surface dry static energy (at the first model level)	S_0 (kJkg^{-1}); $s = c_pT + gz$	ss		
46	Near-Surface Specific Humidity	q_0 (g kg^{-1})	huss		
					Near surface moist static energy
Single level variables					Near surface zonal wind velocity
47	Near surface meridional wind velocity	v_0 (m s^{-1})	vas		
48	Surface turbulent flux of sensible heat	F_{s0} (W m^{-2}); $F_s = \rho c_p \left(\frac{p}{p_0}\right)^{R/c_p} \langle w^{"}\theta^{"}\rangle$	hfss		
49	Surface turbulent flux of latent heat	$L_v F_{q0}$ (W m^{-2}); $F_q = \langle w^{"}q^{"}\rangle$	hfls		
50	Surface turbulent flux of horizontal momentum in the x-direction	F_{u0} (N m^{-2}); $F_u = \rho\langle w^{"}u^{"}\rangle$	tauu		
51	Surface turbulent flux of horizontal momentum in the y-direction	F_{v0} (N m^{-2}); $F_v = \rho\langle w^{"}v^{"}\rangle$	tauv		
52	Surface downwelling shortwave radiation	F^{-}_{SW0} (W m^{-2})	rsds		
53	Surface downwelling Longwave Radiation	F^{-}_{LW0} (W m^{-2})	rlds		
54	Surface upwelling shortwave radiation	F^{+}_{SW0} (W m^{-2})	rsus		
55	Surface upwelling Longwave Radiation	F^{+}_{LW0} (W m^{-2})	rlus		
56	TOA (top of atmosphere) downwelling shortwave radiation	F^{-}_{SWT} (W m^{-2})	rsdt		
57	TOA upwelling shortwave	F^{+}_{SWT} (W m^{-2})	rsut		

	radiation			
58	TOA upwelling Longwave Radiation	OLR (W m^{-2})	rlut	
59	Clear Sky Surface downwelling shortwave radiation	$F_{SW0}^{-}(clear)$ (W m^{-2})	rsdscs	
60	Clear Sky Surface downwelling Longwave Radiation	$F_{LW0}^{-}(clear)$ (W m^{-2})	rldscs	
61	Clear Sky Surface upwelling shortwave radiation	$F_{SW0}^{+}(clear)$ (W m^{-2})	rsuscs	
62	Clear Sky Surface upwelling Longwave Radiation	$F_{LW0}^{+}(clear)$ (W m^{-2})	rluscs	
63	Clear Sky TOA upwelling shortwave radiation	$F_{SWT}^{+}(clear)$ (W m^{-2})	rsutcs	
64	Clear Sky TOA upwelling Longwave Radiation	OLR^{clear} (W m^{-2})	rlutcs	
65	Surface precipitation rate	PPT (kg m^{-2} s^{-1})	pr	
66	Water vapour path	PW (kg m^{-2}); $PW = \int_0^{z_t} \rho q dz$ where z^t is the model top height	prw	
67	Cloud liquid water path	LWP (kg m^{-2}); $LWP = \int_0^{z_t} \rho q_c dz$	clwvi	
68	Cloud ice path	IWP(kg m^{-2}); $LWP = \int_0^{z_t} \rho q_i dz$	clivi	
69	Convective precipitation	PPT_{Conv} (mm day^{-1})	prc	
70	Large-scale precipitation	PPT_{LS} (mm day^{-1})	prls	
71	Land-sea mask	“0” - ocean, “1” - land	landsea	Time invariant
72	Surface orography	(m)	oro	Time invariant surface orography field. Would be useful to interpret the data over the maritime continent.
73	Cloud ice path	IWP(kg m^{-2});	clivi	

		$LWP = \int_0^{z_t} \rho q_i dz$		
74				
75				
76				
77				