WP1.4.2 : EMBRACE aquaplanet experiments

(a) QOBS : the CMIP5 AquaControl simulation (SST profile called "QOBS" in the APE project)

(b) CtlAPE : a simulation with a "sharper" SST profile (called "control" in the APE project)

(c) Flat : a simulation with a flattop SST profile (called "flat" in the APE project)

(d) QOBSWP2 : a simulation with the AquaControl ("QOBS") SST profile with an additional +2 degC anomaly (warm pool) on the equator.

→ The SST profiles for (a), (b), (c) are defined the same way as in Blackburn & Hoskins, 2013 (J. Meteor. Soc. Japan, doi :10.2151/jmsj.2013-A01). See slide 2.

→ The SST profile with an additional warm pool on the equator (d) is defined in slide 3.

SST profiles for (a), (b, (c) : APE definitions (Blackburn & Hoskins, 2013)

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APE Sea Surface Temperatures

1. CONTROL:

$$T_{S1}(\lambda,\phi) = \begin{cases} 27\left(1-\sin^2\left(\frac{3\phi}{2}\right)\right)^\circ C & ; \quad -\frac{\pi}{3} < \phi < \frac{\pi}{3} \\ 0^\circ C & ; \quad \text{otherwise} \end{cases}$$

2. PEAKED:

$$T_{S2}(\lambda,\phi) = \begin{cases} 27\left(1-\frac{3|\phi|}{\pi}\right)^\circ C & ; \quad -\frac{\pi}{3} < \phi < \frac{\pi}{3} \\ 0^\circ C & ; \quad \text{otherwise} \end{cases}$$

3. FLAT:

$$T_{S3}(\lambda,\phi) = \begin{cases} 27\left(1-\sin^4\left(\frac{3\phi}{2}\right)\right)^\circ C & ; \quad -\frac{\pi}{3} < \phi < \frac{\pi}{3} \\ 0^\circ C & ; \quad \text{otherwise} \end{cases}$$

4. QOBS:

$$T_{S4}(\lambda,\phi) = (T_{S1} + T_{S3})/2$$

Exp (d) : $+2^o$ warmpool on top of the QOBS profile

The warm Pool anomaly is added on top of the "QOBS" profile (defined as in the APE project). lat and lon are the latitude and longitude in degrees.

The warm pool (WP) is centered on the equator, at longitude $rclon = 110^o$.
$WP_{amp} = +2^oC$ is the max amplitude of the WP anomaly at the centre,
$WPlat = 30^o$ is the half length of the WP in latitude,
$WPlon = 50^o$ the half length of the WP in longitude.

If lat $\in [-WPlat, +WPlat]$ and lon $\in [rclon - WPlon, rclon + WPlon]$, the sst profile is defined as :

$$SST_{wp} = SST_{qobs} + WP_{amp} \times \cos^2\left(\frac{\pi}{2}\frac{lat}{WPlat}\right) \times \cos^2\left(\frac{\pi}{2}\frac{lon - rclon}{WPlon}\right) \quad (1)$$

Otherwise :

$$SST_{wp} = SST_{qobs} \quad (2)$$