

## Tropical Cyclone Recipe Game – Background Information

The worksheet supplied should be used in conjunction with the game to allow students to work out the recipe for a tropical cyclone. It can easily be differentiated – question 3 is for more able students.

There are six main requirements for tropical cyclone formation: sufficiently warm sea surface temperatures, atmospheric instability, high humidity in the lower to middle levels of the troposphere, enough Coriolis force to sustain a low pressure centre, a pre-existing low level disturbance and low vertical wind shear.

For this exercise, we have used climate data from <https://www.esrl.noaa.gov/psd/cgi-bin/data/composites/printpage.pl> using a 1981-2010 composite of years to represent current climate. For Northern hemisphere places, we have used September data and for the Southern hemisphere we have used March data.

Obviously, tropical cyclone formation will depend on the conditions on a particular day rather than the climatological average. For this reason, the data did have to be altered in a few places to make sure that the map representation covered all the places where tropical cyclones can form.

For surface temperature, we have used 1000hPa Sea Surface Temperature with a 26.5°C threshold for tropical cyclone formation. In practice, temperatures should be over 26.5°C through at least a 50m depth of the ocean for tropical cyclones to form.

For humidity, we used the precipitable water at 1000hPa data to capture whether there was high humidity through the lower and middle troposphere. This data should not be used to give an absolute value over which tropical cyclones can form, but students should appreciate that the value should be high.

To represent wind shear, we used the 200hPa zonal wind field. The wind speed is always faster at upper levels than low down, so for low vertical wind shear, it is reasonable to look for low upper level wind speeds. Again, the data should not be used to give an absolute value under which tropical cyclones can form, but students should appreciate that the value should be low.

A minimum distance of about 500km is required for Tropical Cyclones to form. We have used a threshold of 5°N or S for tropical cyclones to form.

Tropical cyclones can only form over water.

We have also included longitude – this is a red herring! There is no longitudinal dependence on tropical cyclone formation (that is not captured in the other criteria above).