Status of Bleaching Heat Stress on the Great Barrier Reef, Australia – 2020

Update: February 27, 2020

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The prognosis for a coral bleaching event on the Great Barrier Reef (GBR), Australia in 2020 continues to be likely. All indications at this stage point to a widespread bleaching event that will be relatively mild in comparison to the intense events of 2016 and 2017.

While it was close to the Gulf of Carpentaria, Tropical Cyclone (TC) Esther provided the GBR with good cloud cover (Figure 1, left). However, as it has moved west, its influence over the GBR weather has weakened, such that most of the reef is now in clear skies (Figure 1, right). Note that the cloud cover associated with an offshore trough along the Queensland (Figure 2) coast is not over the GBR, but on the seaward side of it, providing little to no shade effect.

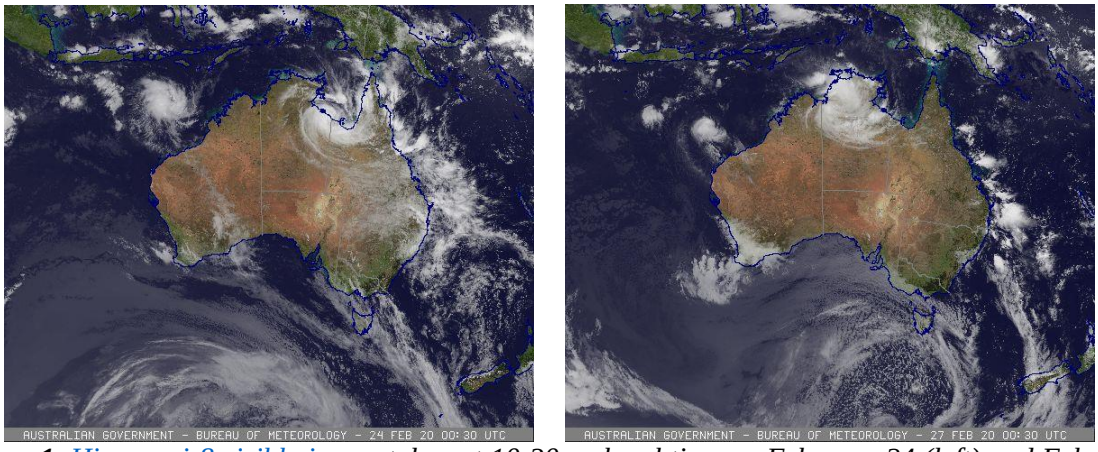

Figure 1. *Himawari-8 visible image taken at 10:30am local time on February 24 (left) and February 27, 2020 (right). Image courtesy of the Australian Bureau of Meteorology (BoM).*

Figure 2 is a series of weather charts from the Australian BoM that presents the surface pressure forecasts, from today (February 27) until 10:00pm local time on March 1, 2020. Note the following about these surface pressure charts:

First: today's chart (Figure 2, top left) suggests there should be widespread rain over north Queensland; however, the satellite imagery in Figure 1 (right) shows little to no cloud over that region. This is because the rain prediction, indicated on the charts as hashes, includes everything from very heavy, widespread rain, to extremely light, very scattered rain. It appears the hashes over north Queensland today fall into the latter category.

Secondly: the surface pressure charts suggest that by the time the neap tides are due to occur (Figure 3) on March 1, 2020, doldrums-like conditions are predicted over the GBR.

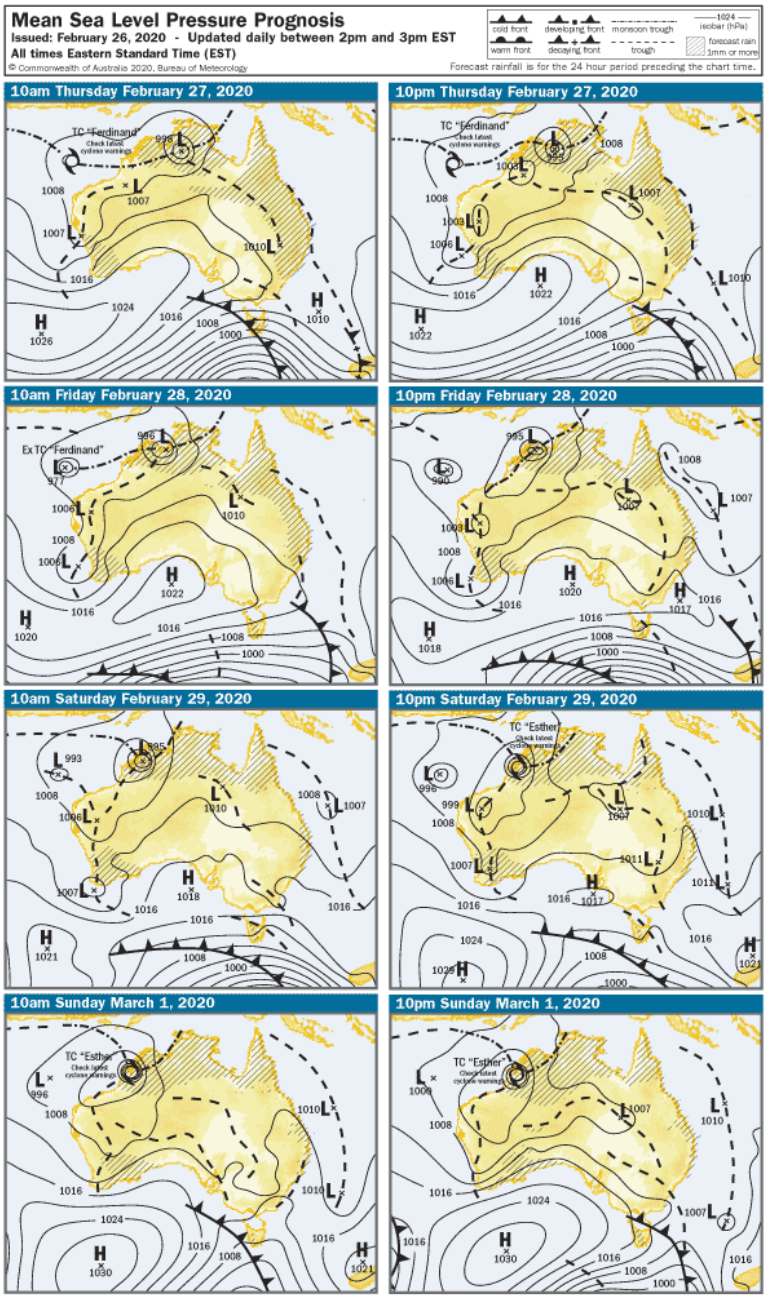

Figure 2. *Surface pressure charts (courtesy of the Australian BoM) covering forecasts from February 27-March 1, 2020.*

In addition, along with increased heating from the predicted clear skies, Figure 3 indicates that cooling from mixing will be at a minimum during the same period, due to the neap tides around March 1. Coincident clear skies and neap tides are a receipt for elevated heating rates.

It is also noteworthy to consider the effect of changing light (which influences the intensity of coral bleaching) due to TC Esther. Although temperature is driving the current mass bleaching event, and indeed, TC Esther was beneficial in terms of its cooling effect on sea surface temperatures (SSTs) along the GBR, the cyclone also provided significant cloud cover, decreasing light levels. Some corals photo-adapt rapidly to changing light, meaning it only takes about two weeks for these corals to mostly adapt to new light levels (such that the effect of the new light levels is similar to the effect prior to the change). During TC Esther, these corals were adapting to lower light. Now that the cloud along over the GBR from TC Esther

has diminished, higher light levels exist. The photo-adapting corals will adapt to these higher light levels, but it will take a few weeks to negate the effect; meanwhile the higher light levels will be contributing to bleaching. Whether or not this plays a significant role in further bleaching remains to be seen. It is worth noting that this effect is in addition to the expected heat stress effects of elevated temperatures during the same period.

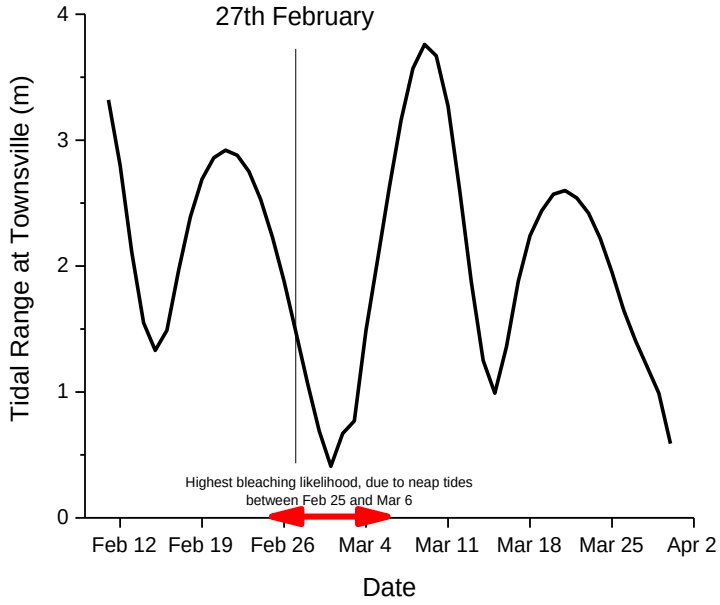

***Figure 3**. Plot of Townsville, Australia tidal range for February 11 to March 30, 2020.*

NOAA Coral Reef Watch's (CRW) latest [daily global 5km Coral Bleaching HotSpot] for the GBR (Figure 4) shows TC Esther-related clouds continue to cool the GBR. However, much of the lower half of the GBR continues to accumulate heat stress (Figures 4 and 5).

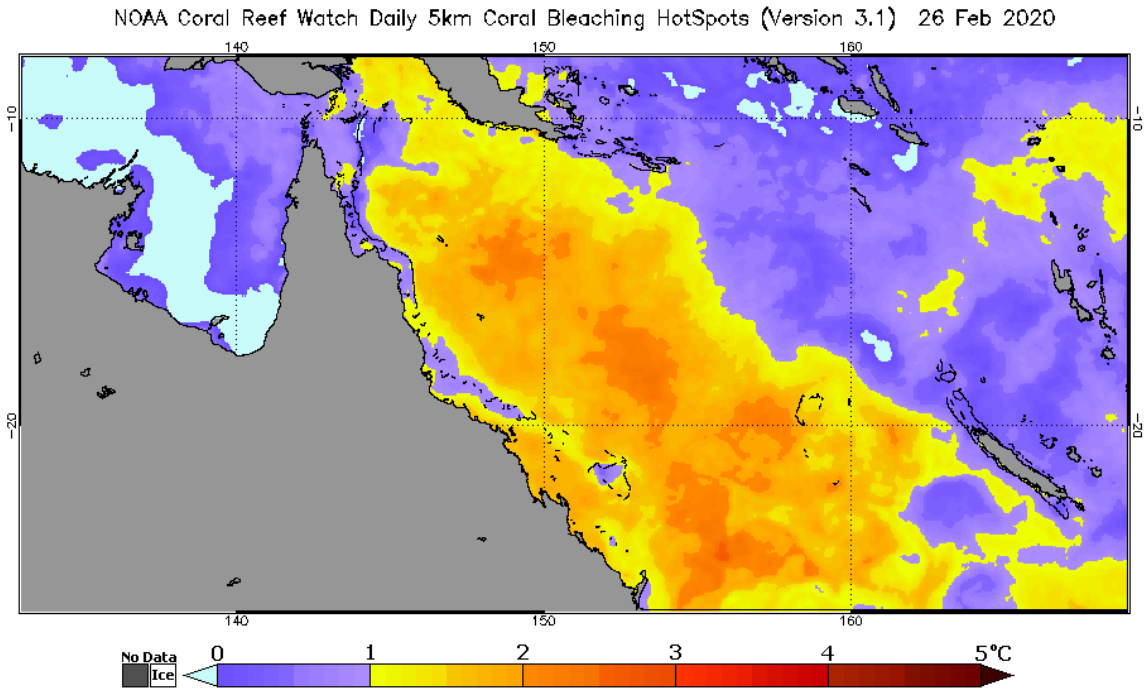

Figure 4. *CRW's daily global 5km Coral Bleaching HotSpot product for the GBR. Heat stress capable of causing bleaching continues to accumulate along the lower half of the GBR, as indicated by the yellow and orange coloring in the image.*

CRW's daily global 5km coral bleaching Degree Heating Week (DHW) for the GBR (Figure 5) indicates that most of the GBR is yet to bleach extensively (based on accumulate heat stress) – although it is on the cusp of doing so. Of note is the region of significant bleaching heat stress in the central GBR, and on outer reefs such as Flinders and Osprey. Most of the inner reef tract has reached bleaching levels as well.

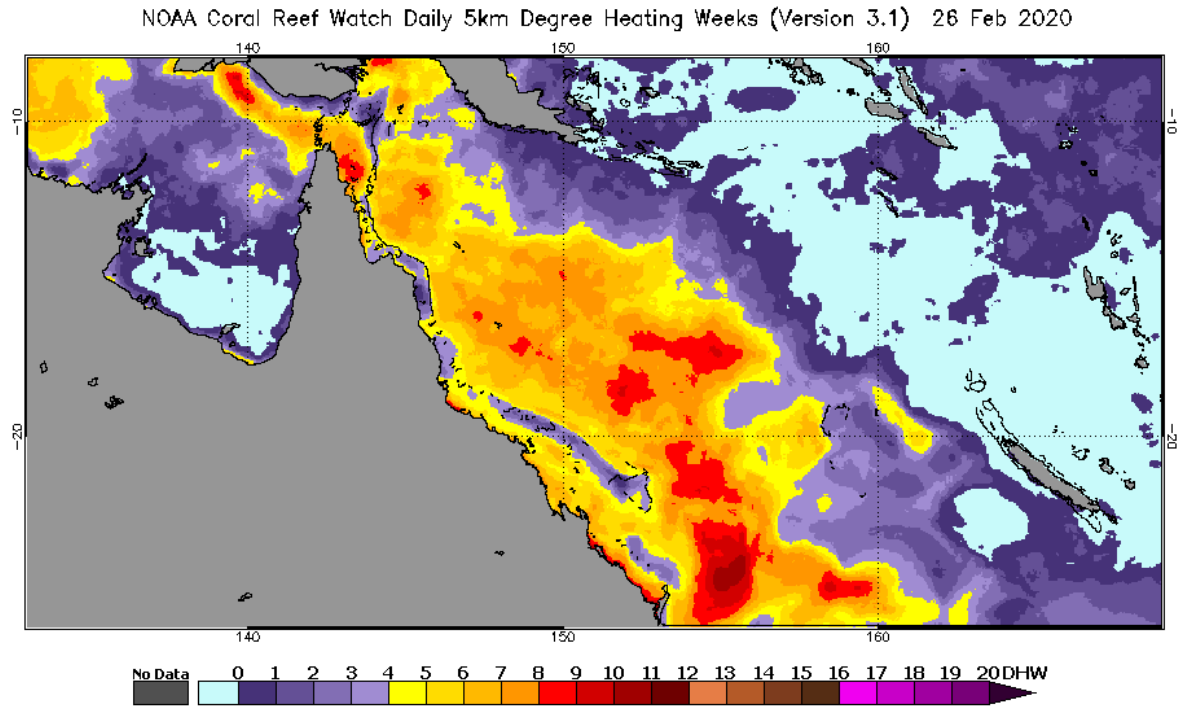

Figure 5. *CRW's daily global 5km coral bleaching Degree Heating Week (DHW) for the GBR.*

On a positive note, although NOAA CRW's DHW (Figure 5) indicates the far northern GBR has already accumulated bleaching-level heat stress, the Coral Bleaching HotSpot (Figure 4) clearly shows that with the exception of one small area, this region of the GBR is no longer accumulating additional heat stress, presumably due to TC Esther.

NOAA CRW's Four-Month Coral Bleaching Outlook for the GBR region (Figure 6) shows the probability of significant coral bleaching for the weeks starting on March 1 (left) and March 8, 2020 (right). The Outlook suggests that the probability for significant bleaching is greater than 80% for most of the GBR, and 100% for the lower half of the GBR. Note that the forecast SSTs, upon which the modeled Outlook is based, are derived in the absence of a knowledge of tides. This, and the knowledge that some corals may be more susceptible to bleaching due to light conditions, following recent persistent cloud events, means that the prediction of widespread bleaching along the entire length of the GBR continues to hold firm.

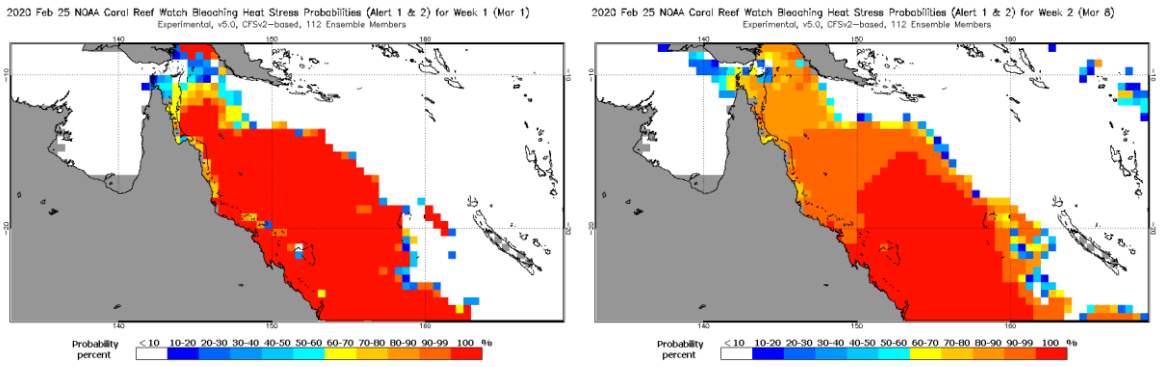

Figure 6. *CRW's current Four-Month Coral Bleaching Outlook, for the GBR region, displaying the probability, for the week beginning March 1 (left) and March 8 (right), that the bleaching heat stress level will reach or exceed Bleaching Alert Levels 1 (associated with significant bleaching) and 2 (associated with severe, widespread bleaching and significant mortality).*

There is a reasonable chance that the effects of TC Esther, and the current convective activity due to atmospheric instability, are helping to reduce (but not halt) coral bleaching impacts along the GBR. So while this bleaching event will probably be widespread, there is still hope that it will be relatively mild in comparison to the intense events of 2016 and 2017.