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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "The influence of sea surface temperature on the intensity and associated storm surge of tropical cyclone Yasi: A sensitivity study" *by* Sally L. Lavender et al.

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The authors thank Craig for his constructive comments.

RC1, comment 1: Abstract should be significantly shortened and focus on key outcomes of the study (see 6th point below). It is not immediately clear from the abstract what the focus of the study is - the ability of the model to simulate TC Yasi, or influence of SST changes on storm morphology or the resulting storm surge heights.

Response: A possible revised abstract:

"Tropical cyclones (TCs) cause widespread damage associated with strong winds,

heavy rainfall and storm surge. TC Yasi was one of the most powerful TCs to impact the Queensland coast since records began. Prior to Yasi, the SSTs in the Coral Sea were higher than average by 1-2°C, primarily due to the 2010/2011 La Niña event. In this study, a conceptually simple idealised sensitivity analysis is performed using a high resolution regional model to gain insight into the influence of SST on the track, size intensity and associated rainfall of TC Yasi. A set of nine simulations with uniform SST anomalies of between -4°C and 4°C applied to the observed SST's are carried out. The resulting surface winds and pressure are used to force a barotropic storm surge model to examine the influence of SST on the associated storm surge of TC Yasi. An increase in SST results in an increase in intensity, precipitation and integrated kinetic energy of the storm, however there is little influence on track prior to landfall. In addition to an increase in precipitation, there is a change in the spatial distribution of precipitation as the SST increases. Decreases in SSTs result in an increase in the radius of maximum winds due to an increase in the asymmetry of the storm, although the radius of gale-force winds decreases. These changes in the TC characteristics also lead to changes in the associated storm surge. Generally, cooler (warmer) SST lead to reduced (enhanced) maximum storm surges. However, the increase in surge reaches a maximum with an increase in SST of 2 °C. Any further increase in SST does not affect the maximum surge but the total area and duration of the simulated surge increases with increasing upper ocean temperatures. A large decrease in maximum storm surge height occurs when a negative SST anomaly is applied, suggesting if TC Yasi had occurred during non-La Niña conditions the associated storm surge would have been greatly diminished, with a decrease in storm surge height of over 3m when the SST is reduced by 2 °C. In summary, increases in SST lead to an increase in the potential destructiveness of TCs with regards to intensity, precipitation and storm surge, although this relationship is not linear."

RC1, comment 2: There is no further mention in the manuscript of impacts or mitigation - suggest removing this from the abstract.

Response: This line will be removed from the abstract.

RC1, comment 3: Page 3, line 5: in-text reference to Miglietta (2011) should be Miglietta et al. (2011).

Response: Thanks for spotting this, altered.

RC1, comment 4: Page 8, lines 11-14: The sensitivity of maximum storm surge height to TC forward speed, location of landfall and RMW would be useful to open the discussion on the sensitivity to SST. I suggest reworking this paragraph and the preceding one to indicate the above characteristics influence storm surge height as background to the discussion on variability with SST (i.e. move these lines ahead of the preceding paragraph to help set the context of the discussion on SST influence).

Response: Moved and reworked in revised version.

RC1, comment 5: Page 10, line 11: in-text reference to Evans et al. (2004) - should this be Evans et al. (1994), or is there a reference missing in the reference list?

Response: Yes, it should be 1994, thanks for spotting. Changed accordingly

RC1, comment 6: I would like to see more discussion (throughout if possible) on the final point made in the manuscript: "...the results suggest maximum storm surge heights would have been several metres less had a similar TC formed when overall SST were 1-2C lower...". This is probably the most important outcome of the sensitivity study, but it is only included as the second to last sentence. In the context of future climate scenarios, increasing storm surge heights (and precipitation) associated with increasing SSTs is a major finding and deserves more (and more prominent) discussion.

Response: Agreed. This is discussed further in the discussion of Fig 6 (pg 8) and further emphasised in the reworked abstract.

RC1, comment 7: Figure 4: caption for subplots (b) and (c) need to be swapped.

Response: Thanks for spotting, altered.

RC1, comment 8: Figure 5: all panels need a label on the horizontal axis.

Response: Label added to x-axis: “hours since 31/01/2011 00Z”

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