HURRICANES IN THE INDIAN OCEAN

Are they more frequent and more intense as planetary temperatures rise?

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Climate alarmists typically claim that tropical cyclones tend to become both more *frequent* and more *intense* as planetary temperatures rise; and as a result, scientists continually strive to develop ever better temporal histories of these particular TC characteristics for various ocean basins around the world. We here summarize what they have learned with respect to such storms in the Indian Ocean.

Starting with the southeastern Indian Ocean, Hassim and Walsh (2008)[1] analyzed *tropical cyclone* (TC) best track data pertaining to severe storms of the Australian region (5-30°S) forming off Western Australia and the Northern Territory (the western sector: 90-135°E, Indian Ocean) for the presence of systematic intensity and duration trends over the cyclone season from 1969/1970 through 2004/2005. Their results indicated that "the number, average maximum intensity, and duration at the severe category intensities of tropical cyclones [increased] since 1980." Yet a contemporaneous study of roughly the same region and time period by Harper *et al*. (2008)[2] yielded a much different result.

More specifically, in their contribution to the subject, Harper *et al*. analyzed several "potential influences on the accuracy of estimating TC intensity over time due to increasing technology, methodology, knowledge and skill" for TCs that occurred off the coast of northwestern Australia, primarily in a band between 5 and 25°S, over the period 1968/69 to 2000/01. Based on their analysis the four Australian researchers show, in their words, that "a bias towards lower intensities likely exists in earlier (mainly pre-1980) TC central pressure deficit estimates of the order of at least 20 percent in 1970, reducing to around ten percent by 1980 and to five percent in 1985," reporting that "inferred temporal trends in the estimated intensity from the original data-sets are therefore significantly reduced in the objectively reviewed data-set." In fact, when all is said and done, they conclude "there is no prima facie evidence of a potential climate-change induced trend in TC intensity in northwestern Australia over the past 30 years."

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Similar findings were reported two years later by Goebbert and Leslie (2010)[3], who examined interannual TC variability of the northwest Australian (NWAUS) sub-basin of the southeastern

[1] http://www.co2science.org/articles/V11/N44/C2.php.
[2] http://www.co2science.org/articles/V12/N4/C2.php.
[3] http://www.co2science.org/articles/V14/N2/C1.php.

Indian Ocean (0-35°S, 105°-135°E) over the 39-year time period of 1970-2008, using the Woodside Petroleum Ltd. reanalysis TC dataset described by Harper *et al*. (2008), in order to focus on these two important TC characteristics (frequency and intensity), as well as eleven other TC metrics. In doing so, the two researchers report they could find "no significant linear trends in either mean annual TC frequencies or TC days," and they say there was also "no trend in the number of intense TCs for the NWAUS sub-basin." In fact, they state that "none of the 13 NWAUS TC metrics exhibited statistically significant linear trends." And they add that "known climate indices -- such as Niño-3.4, Niño-4, SOI, NOI, PDO, NAO, and others -- generally were found not to be significantly correlated to the variability of TC frequency or TC days in the NWAUS region."

Further support that TCs are not on the rise in the southeast Indian Ocean comes from the work of Hall (2004)[4], who analyzed characteristics of cyclones occurring south of the equator from longitude 90°E to 120°W in the South Pacific and southeast Indian Oceans, concentrating on the 2001-2002 cyclone season and comparing the results with those of the preceding four years and the 36 years before that. This work revealed that "the 2001-2002 tropical cyclone season in the South Pacific and southeast Indian Ocean was one of the quietest on record, in terms of both the number of cyclones that formed, and the impact of those systems on human affairs." In the southeast Indian Ocean, for example, Hall determined that "the overall number of depressions and tropical cyclones was below the long-term mean." Further east, he found that broad-scale convection was near or slightly above normal, but that "the proportion of tropical depressions and weak cyclones developing into severe cyclones was well below average," which result represented "a continuation of the trend of the previous few seasons." Consequently, Hall's work too, like that of Harper *et al*. (2008) and Goebbert and Leslie (2010), suggests a likely *decline* in both the intensity and frequency of Indian-Ocean tropical cyclones if the world warms in the future.

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Moving northward, Singh *et al*. (2000[5], 2001[6]) analyzed 122 years of tropical cyclone data from the North Indian Ocean over the period 1877-1998. Since this was the period of time during which the planet recovered from the global chill of the Little Ice Age, it is logical to assume that their findings would be indicative of changes in hurricane characteristics that might be expected if the Earth were to warm by that amount again, which is what the IPCC models project it will do. So, what did Singh *et al*. find?

[4] http://www.co2science.org/articles/V8/N23/C1.php.
[5] http://www.co2science.org/articles/V4/N3/C1.php.
[6] http://www.co2science.org/articles/V4/N30/C2.php.

On an annual basis, they report there was a slight *decrease* in tropical cyclone frequency, such that the North Indian Ocean, on average, experienced about one *less* hurricane per year at the end of the 122-year record in 1998 than it did at its start in 1877. In addition, based on data from the Bay of Bengal, they found that tropical cyclone numbers *dropped* during the months of most *severe* cyclone formation (November and May), when the El Niño-Southern Oscillation was in a *warm* phase. In light of these real-world observations, therefore, it would appear that if tropical cyclones of the North Indian Ocean were to change *at all* in response to global warming, their overall frequency and the frequency of the most intense such storms would likely *decrease*, which is just the opposite of what climate alarmists typically claim will occur.

Moving on to the work of Raghavan and Rajesh (2003)[7], these two researchers reviewed the general state of scientific knowledge relative to trends in the frequency and intensity of tropical cyclones throughout the world, giving special attention to the Indian state of Andhra Pradesh, which borders on the Bay of Bengal. For the North Indian Ocean (NIO), comprising both the Bay of Bengal and the Arabian Sea, they report that for the period 1891-1997 there was a significant *decreasing* trend (at the 99% confidence level) in the frequency of cyclones with the designation of "cyclonic storm" and above, and that "the maximum decrease was in the last four decades," citing the work of Srivastava *et al*. (2000). In addition, they note that Singh and Khan (1999), who studied 122 years of data, also found the annual frequency of NIO-basin tropical cyclones to be decreasing.

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In commenting on their findings, Raghavan and Rajesh say "there is a common perception in the media, and even government and management circles, that [increased property damage from tropical cyclones] is due to an increase in tropical cyclone frequency and perhaps in intensity, probably as a result of global climate change." However, as they continue, "studies all over the world show that though there are decadal variations, there is no definite long-term trend in the frequency or intensity of tropical cyclones." Hence, they confidently state that "the specter of tropical cyclones increasing alarmingly due to global climate change, portrayed in the popular media and even in some more serious publications, does not therefore have a sound scientific basis."

In one final study, and writing as background for their work, Kumar and Sankar (2010)[8] say that "an important concern about the consequences of the global warming scenario is its impact on the frequency, the intensity and the duration of tropical cyclones," noting that "theoretical and

[7] http://www.co2science.org/articles/V6/N24/C1.php.
[8] http://www.co2science.org/articles/V14/N15/C2.php.

modeling studies indicate that tropical cyclone winds would increase with increasing ocean temperature." To see to what extent the implications of these theoretical model studies harmonize with what actually occurred throughout the North Indian Ocean over the period 1901-2007, Kumar and Sankar employed "various datasets, such as the NCEP/NCAR Reanalysis dataset, the ERSST and the tracks of storms and depressions over the north Indian Ocean for different seasons based on the period 1901-2007," comparing "changes that occurred during the period 1951-2007 and the previous period, 1901-1951," while over the most recent of these periods they compared the sub-period 1951-1978 (epoch I) with the sub-period 1979-2007 (epoch II).

Based on their analyses, the two researchers determined that "the frequency of storms and severe storms do not show a dramatic rise in spite of a substantial increase in the sea surface temperature in the Bay of Bengal from 1951-2007 compared to 1901-1951." Secondly, while noting that "the Bay of Bengal has been warming throughout the year during epoch II compared to epoch I," they report that "the number of both storms and severe storms, have decreased largely over the Bay of Bengal." Such findings, in the words of Kumar and Sankar, "clearly indicate that warm SST's alone are not sufficient for the initiation of convective systems over the Arabian Sea and the Bay of Bengal," noting that their results suggest a "decreasing trend in the frequency of storms over the Bay of Bengal, contrary to the popular belief that there will be an increase."

Such findings clearly indicate that warm SST's alone are not sufficient for the initiation of convective systems over the Arabian Sea and the Bay of Bengal.

In considering the findings reported in the studies examined above, the *theoretical contentions* of more frequent and more powerful tropical cyclones projected by climate alarmists are *not* supported by *real-world data*.

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