RELATIONSHIP BETWEEN MAXIMUM SUSTAINED WIND SPEED AND CENTRAL PRESSURE OF TROPICAL CYCLONES

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ABSTRACT

This study examines the pressure wind (PW) relationship for three major ocean basins, namely the Western North Pacific (WNP), Northern Indian Ocean (IO) and the Northern Atlantic Ocean (AO). The data record and the information available about the tropical cyclones (TC), particularly the cyclones central pressure and maximum sustained wind speed vary from basin to basin. A review of past studies indicates that problems in data quality and inhomogeneity has being sited as a reason for the differences in conclusion regarding long term trends in TC activity. Various techniques have been developed to provide the best estimate of TC intensity in terms of its maximum sustained wind speed (MSWS) and central pressure. Various forms of the equation relating radial wind speed to the central pressure by assumption of a cyclostrophic flow in TC has being employed to obtain one of these values when the other is known. Dvorak's technique that uses typical storm structures from satellite imagery has being successfully employed to determine the TC intensity where no observations are available.

Our study using the most recent data from 2001 to 2007 showed that the best-fit relationship between central pressure and maximum sustained wind speed corresponds very close to those from previous studies. For the IO and WNP basins the pressure-wind (PW) relation showed no significant difference when the analysis was carried out for TC over land and ocean separately. In the PW relations using the 1-minute MSWS from JTWC and 10-minute MSWS from RSMC for the WNP basin it was found that for central pressures above 990 hPa the 1-minute MSWS was lower then the 10-minute MWSW which is not hypothetically correct. A possible reason for this inconsistency could be that when the cyclones are at the early stages of TC formation the cloud structures may not be well defined and ambiguity in their interpretation by the two different centers could result in biases in assigning Dvorak's CI number and hence the wind speed and central pressure. Our analysis also showed that the 1-minute MSWS is about 1.47 times stronger than the 10-minute MSWS, which is about 30 percent higher than what is quoted for the Atlantic basin. The recent data for the WNP and AO showed that the PW relation is in very close agreement with the Dvorak's pressure wind estimates for these two basins. For the IO where Dvorak has not provided any PW relation we found that for cyclones with MSWS less than about 75 kts the PW relation is in very close agreement with the Dvorak estimates for the WNP, but for wind speeds above 75 kts the TCs in the IO have higher MSWS than their counterpart in the WNP for the same central pressure but lower than that in the AO.