# Development of Tropical Cyclone Archive, Climatology and Seasonal Prediction Scheme for the South Indian and South Pacific Oceans

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The island nations and states of the Indian and Pacific Oceans as well as Australia are affected each year by tropical cyclones. In some cases these can have devastating consequences on life, property and the economic well-being of the communities directly affected and the country as a whole. It is critical then that we have a full understanding of these disaster inducing events. During the last few years National Climate Centre, Australian Bureau of Meteorology, leads collaboration among National Meteorological and Hydrological Services (NMHSs) of Australia, Fiji, France and New Zealand on the development of a tropical cyclone (TC) archive, climatology and seasonal prediction scheme for the Southern Hemisphere (SH). Some encouraging results were obtained, and positive feedback about usefulness of the results was received from the NMHSs. The objectives of the project are i) to revise and update TC best track data for the South Indian and South Pacific Oceans, ii) to examine climatological factors influencing TC spatial and temporal variability in the area, and iii) to evaluate indices which might be possible predictors of variables describing the TC season activity (number, cyclone days, trajectories, start and end of the season). TC archive. Historical records on TC occurrences in the Australian region go back to the late 1700s, however there are limitations associated with the older data. It is widely accepted that TC track data in the SH are relatively complete and reliable from 1969/70 TC season after meteorological satellites came in use operationally in the region. Kuleshov (2003) analysed average annual profiles of TC longitude crossings for El Niño, La Niña and neutral years and demonstrated that the position of the minimum in TC occurrences for the SH which is centered on approximately 135°E shifts by only a few degrees longitude with changes in the El Niño – Southern Oscillation (ENSO) phases. He concluded that for climatological studies 135°E could be comfortably chosen as a longitude of division of the SH into two sub-regions: the South Indian Ocean (west of 135°E) and the South Pacific Ocean (east of 135°E). Therefore, we aim to analyse TC track data from 1969/70 onwards, and for the domain 0-40°S, 35-135°E. The National Climate Centre compiled an archive of TC for the SH, which is currently consists of cyclone best track data for the TC seasons from 1969/70 to 2003/04. Quality control/validation procedures were applied as part of the TC archive generation process, and some problems with estimations of TC intensity were identified. Consequently, a recommendation was made that the most suitable use of the TC SH archive in its present form is for the analysis of TC tracks rather than for the analysis of TC intensity.

Therefore, the first objective of the project is to revise and update TC best track data. Spatial and temporal variability of TC in the SIO. The influence of the ENSO phenomenon on variability of tropical cyclone occurrences in the SH and around Australia has been demonstrated by several studies (e.g. Nicholls 1979, 1985, Jury 1993). Climatology of TC tracks in the world oceans was presented in the Global Guide to Tropical Cyclone Forecasting (2000). Recently, spatial profiles of average annual TC track densities, temporal profiles of average annual TC daily frequencies, time series of TC occurrences, and maps of TC average annual occurrence for the SH have been constructed, and influence of the ENSO phases of TC activity was studied (Kuleshov 2003, Kuleshov and de Hoedt 2003). However, there are many other aspects of TC climatology that need to be further investigated. One of the objectives of this project is to analyse TC track climatology parameters for the SH, including TC track density, direction of TC motion, TC speed and variability of TC motion, to select the regions with similarities in trajectory patterns, and to evaluate an influence of the atmospheric and oceanic forcing on TC trajectories, including further analysis of influence of the ENSO phases on TC trajectories in the SH. Seasonal prediction scheme. Indices that capture the large-scale variability in the tropics will be examined. Prime candidates are the ENSO indices such as the atmospheric SOI and SST boxes such as Nino3 and Nino4. Other local SSTs indices, corresponding to major cyclogenesis are might also be investigated, and other atmospheric predictors might become apparent in the course of the analysis of the TC climatology. For example, Jury et al (1999) have demonstrated that the stratospheric quasi-biennial oscillation (QBO) index before the start of the season was a suitable predictor. Recently, Timbal et al (2003) analysed tropical cyclone activity in south-west and central Pacific Ocean and demonstrated that it correlated with indices such as SOI, SSTs, and stratospheric QBO. They also showed that there is a potential skill in forecasting the number of cyclones for localised areas (their studied focused on the area of responsibility of the Météo-France, New Caledonia forecasting centre), in the coming season, using a combination of indices. It should be noted that values of the above mentioned indices are available in October, i.e. prior to the start of the SH TC season (usually November-April), which makes this approach suitable for timely preparing a tropical cyclone seasonal outlook by the NMHSs. Thorough evaluation of possible predictors of variables describing the tropical cyclone season activity for different areas in the South Pacific is one of the objectives of this international project. We believe that expected outcomes of the project (improved quality of the TC archive, updated climatology and seasonal prediction scheme) will advance our understanding of TC formation and development in the SH and significantly improve service provided by meteorological offices to the international community, and we welcome collaboration with meteorological services from other countries in the SH on this project. References Global Guide to Tropical Cyclone Forecasting, 2000: Chief Editor Greg J. Holland. Jury, M. R., 1993: A preliminary study of climatological associations and characteristics of tropical cyclones in the SW Indian Ocean. Meteorol. Atmos. Phys.51, 101-115. Jury, M. R., Pathack, B. and Parker, B.1999: Climatic determinants and statistical prediction of tropical cyclone days in the Southwest Indian Ocean.

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