MASTER OF SCIENCE IN METEOROLOGY

OBSERVATIONS OF MESOSCALE CONVECTIVE SYSTEMS DURING TROPICAL CYCONE GENESIS

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A better understanding of the role mesoscale convective systems (MCS) play in the formation stages of tropical cyclones will increase the ability to predict their occurrence and motion. This thesis employs high-resolution geostationary satellite imagery to observe the interaction between MCSs and their environment. Specifically, thirteen cases of tropical disturbances that eventually developed into tropical cyclones are analyzed to determine the role of MCSs in increasing the system organization. Following two conceptual models developed during the Tropical Cyclone Motion (TCM-93) mini-field experiment, each tropical cyclone is classified according to the relative importance of MCS activity to its development. Both conceptual models are verified through analysis and a third model is created to account for tropical cyclone developments that share features of the previous two models. An alternate approach is proposed for determining tropical system organization through severe tropical cyclone strength using only visible and infrared satellite imagery.

DIURNAL VARIATION OVER THE TROPICAL MONSOON REGIONS DURING NORTHERN SUMMER 1991

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This study examines diurnal variation of convection over western India, the Bay of Bengal, Indochina and the northern South China Sea during the 1991 northern summer monsoon using combined Japanese (GMS) and Indian (INSAT) geostationary satellite data, ECMWF 850 hPa wind data, and NCEP sea surface temperature analyses.

The diurnal cycle is examined in terms of spatial and temporal structure prior to onset and during the monsoon. The northern South China Sea is examined to determine how different periods of synoptic influences resulted in an anomalously strong diurnal signal during June. The wind and Sea Surface Temperature (SST) data are used to examine the relationship between the diurnal variation of convection and both low-level convergence and vertical latent heat fluxes.

Convection over west India is most common during May and June and starts as a diurnal system over land that becomes organized and propagates westward over the east Arabian Sea. The Bay of Bengal follows the classic land-sea breeze model and convection is modulated by convergence between the land breeze and large-scale monsoon flow. The diurnal cycle is generally enhanced over the ocean during active phases of convective activity. The maximum latent heat fluxes generally occurs prior to maximum convection due to strong monsoon flow enhancing evaporation.

OPERATIONAL EVALUATION OF THE ELECTRO-OPTIC TACTICAL DECISION AID, VERSION 3.1

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The Electro-Optical Tactical Decision Aid (EOTDA) is a tool weather forecasters use to predict target detection ranges and the performance of various electro-optic precision-guided weapon systems. The user inputs environmental and tactical information, such as the expected atmospheric conditions and target and background descriptions. The primary EOTDA output are target detection ranges and thermal contrast information. The EOTDA supports three types of weapon systems: infrared (8-12 μm), visible (0.4-0.9 μm), and laser (1.06 μm). This study is an evaluation of the EOTDA performance of an infrared (Ho weapons system used during a training exercise at Naval Air Station (NAS) Fallon, Nevada in January 1996. In addition, a sensitivity study of the EOTDA parameters was completed. The results showed that the EOTDA predicted ranges within 20% of the observed detection ranges when correct environmental information was available. The most critical parameters required for the EOTDA were moisture, aerosol selection, the target area forecast, and composition of the target and background. Recognizing the strengths and weakness of the EOTDA will help operational users improve electro-optic forecasts and help guide future research and development efforts.