Geophysical Research Abstracts
Vol. 17, EGU2015-11600, 2015
EGU General Assembly 2015

A Climatological study of sea breezes in the Red Sea region of Saudi Arabia

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Long term near surface observations from 20 stations, buoys, high resolution model data from European Centre for Medium-Range Weather Forecasts (ECMWF) and Weather Research and Forecasting Modeling System (WRF(ARW)) are used to investigate the climatology of sea breezes over the Eastern side of the Red Sea region. Additionally, satellite data from second-generation Meteosat (MSG) and Radar soundings have also been analyzed to investigate major characteristics of sea breeze flow. Sea breezes blow under anticyclonic synoptic conditions, weak gradient winds, intense radiation, relatively cloud-free skies and strong near surface sea – land thermal gradient. In order to identify sea breeze signal a set of criteria based on synoptic condition, diurnal reversal of wind direction and thermal gradient has been devised. Results show that sea breezes in this region occur almost all year, but this meso-scale phenomenon is most frequent in summer months (May to August) when it occurs for almost half of the summer days. The onset of the sea breeze in this region is about 0800 LST (Local Standard Time). The sea breeze decays after 1700 LST, however, the timing of the onset and decay could be affected by season, sea-land thermal gradient, topography, sea-land orientation and the direction and strength of the prevailing wind. The depth of the predicted inflow layer reaches 1 kilometer while the height of sea breeze head may reach 3 kilometers. The rocky mountain range of Al-Sarawat, east of the Red Sea coast, restricts the inland propagation of sea breeze and significantly affects the structure of the flow. A detailed process analysis of the available data is being conducted to better understand the Sea Breeze and its effect on the local meteorology.