Synoptic and Dynamical Analysis of Haiyan Tropical Cyclone

Project Managers**: Dr. Nafiseh Pegahfar**
Contributors**: Dr. Parvin ghafarian, Elaheh Owlad**

Abstract

Investigation on rotational systems and their strengthening and weakening causes and process has a high degree of importance in meteorology, due to their huge damage to the life and property and cause severe socio-economic impact in the affected regions. Tropical cyclones as one of this damaging phenomenon have been intensively focused. Meteorologists have done so many attempts to simulate this phenomenon and to be able to do on time prediction, because on time prediction of such event can highly decrease the cost of its disturbance. Since tropical cyclone could affect south coast area of IRAN, so investigation has a high degree of benefit for this area. In spite of its importance, little research has been conducted to base on various meteorological parameters during this phenomenon and most of researches have been focused on storm surges. Hence this research has been done to investigate on a case study of tropical cyclone (TC) to provide enough knowledge about the characteristics and space-time variation of meteorological parameter during that. So Haiyan tropical cyclone as the strongest TC occurred in 3-11 November 2013 has been selected which spent most of its life time over Peace Ocean and moved west ward and to the higher latitude. To reach the defined purpose, two kind of meteorological parameters have been analyzed, synoptic and dynamical ones.

For the above aim, three sets of data have been used (1) reanalysis data including GFS, FNL and ECMWF with the resolutions of 0.5, 1 and 0.75 degree in latitude and longitude, respectively, (2) TRRM satellite data with 0.25 degree resolution in latitude and longitude and (3) observational data from Japan Meteorology Agency (JMA). In addition, sea level height data from 5 surface stations

in Philippine were used.

In this research dynamical parameters calculated or extracted from data base were helicity, potential vorticity (PV), convective available potential energy (CAPE) and relative vorticity. In addition synoptic parameters, calculated or extracted from data base, consist of potential temperature, geopotential height at various pressure levels, wind vector over surface and pressure levels, sea surface temperature (SST), mean sea level pressure (MSLP), relative humidity, precipitation, temperature and geopotential height at tropopause level and sea level height. Pattern of all parameters have been plotted by Fortran 90 coding and NCL software. Moreover, value of most of parameters have been calculated and analyzed in the eye and eye wall of Haiyan. Results indicated that using values in the nearest point to the eye location produce less inaccuracy compare with using various interpolation methods.

Finally, in this research at least 11 synoptic parameters and 4 dynamical parameters have been calculated or extracted from data-base and were analyzed during Haiyan TC. Achieved results indicated that all analyzed parameters from both upper- and lower levels of atmosphere had been intensified to the extreme corresponding values. Also it can be concluded that not only lower-levels forcings affected Haiyan tropical cyclone but also those from upper-levels influenced that. Accompanying of these two kinds of forcings led to the intensification to category 5 for the Haiyan tropical cyclone. Our obtained knowledge of meteorological parameters (at core, eyewall and environment location) together with their trends prepared sufficient knowledge for validation of numerical models operation in simulation of this phenomenon.