

METEOROLOGICAL CONDITIONS ASSOCIATED WITH HEAVY RAIN EVENT OVER MUMBAI REGION, INDIA

H. N. Singh

S. D. Bansod

Nityanand Singh

Indian Institute of Tropical Meteorology

Dr. Homi Bhabha Road, Pashan, Pune - 411008

E-mail: narendra@tropmet.res.in

ABSTRACT

Mumbai, the most populated city and the commercial hub of India was hit by a torrential rain on July 26, 2005 causing human casualty of few hundreds with an unprecedented huge loss to the socio-economic sector. The synoptic situation over Mumbai was not that vigorous during this period, which means the main cause may be of some mesoscale processes embedded in the large-scale. This rainfall system had a long-lasting structure that brought a large quantity of rainfall to a small region. Extreme rainfall over a region is a major concern since it is associated with devastation of flood and associated natural calamities. The experiments showed the formation of a mesoscale vortex over Mumbai that appears to have enhanced the conditions for localized, heavy rainfall over Mumbai. The intense and heavy rainfall might have been triggered by the sprouting and persistence of the mid-tropospheric mesoscale vortices, in concern with the active monsoon conditions over the west coast of India. Most of the previous studies examined this event through model studies. None of the studies utilize the different dynamical/thermodynamical parameters in relation to heavy rainfall events over Mumbai and its adjoining area. Hence, in this study we explore this aspect using various meteorological fields. The main objectives of this study are (i) to understand the structure of the weather-system(s) that produce extremely heavy rainfall over and around Mumbai during July-August 2005; (ii) to know the genesis of the rain producing weather systems; and (iii) to determine the relationship between selected regional/local meteorological parameters and rainfall over and around Mumbai region. In this study, an attempt has been made to focus the possible role of meteorological conditions

over the domain (30°S - 50°N; 0°-180°E) in producing heavy rain spells in and around Mumbai region (17.5°-24.5°N, 71.5°-80.5°E) during July and August 2005. The various meteorological parameters such as pressure level geopotential height, pressure level temperature, zonal wind, meridonal wind and vertical wind velocity and Mean sea level pressure, surface air temperature from NCEP/NCAR reanalysis data set have been examined on daily scale. Daily data for outgoing longwave radiation (OLR) and precipitable water (PPW) from NOAA CPC have also been analyzed to see the deep convection and moisture content of the atmosphere. The simple correlation techniques have been used in this study to identify the relationship between various dynamical/thermodynamical parameters and extreme rainfall over and around Mumbai region. The study also compares the 1°x1° grid daily rainfall data from IMD and 3-hourly TRMM rain-rate over the Mumbai region. The circulation features over the global tropics influencing the occurrence of wet spells over and around Mumbai region have also been examined. The results show that the larger scale parameters are responsible for producing intense rainfall over and around Mumbai region. Mid-tropospheric (700 hPa to 200 hPa) temperature over Sub Tropical Indian Ocean High (STIOH; CC with Mumbai rainfall=0.65), North Pacific High (NPH; CC with Mumbai rainfall=0.75) and low level (below 600 hPa) temperature over West Tibet (CC with Mumbai rainfall=0.65) and Azores High (AH; CC with Mumbai rainfall=-0.52) seems to play a major role in producing the intense rainfall over Mumbai. Upper tropospheric (above 400 hPa) GPH over STIOH (CC with Mumbai rainfall=0.85), West Tibet and NPH (CC with Mumbai rainfall=0.68) seems to play a major role in producing the intense rainfall over Mumbai.