Abstract

Tawfiq M Khatab

Characteristics of Meteorological Conditions in Alexandria, with an Approach to Weather Forecasting

Lengthy weather records of Alexandria (1985 – 2008) were utilized to first investigate the main characteristics of meteorological conditions in the last few decades in Alexandria. The mean of the entire data set for each weather element gave: dry temperature (20.55°C), atmospheric pressure (1014.4 mb), prominent wind direction (north northwest), wind speed (6.12 knots), relative humidity (69.2%). The mode of cloud cover and horizontal visibility was zero and 10 kilometers respectively. Analyzing hourly records during the period of study proved that there is a 1.4% occurrence of mist fog, 0.5% occurrence of precipitation and 1.7% occurrence of sand rising and storms of all hours. Analysis of variance using the monthly means of weather elements classified the climate of Alexandria into two main significant seasons cool and warm season. The cool season starts from October to March with a mean air temperature of 16°C, higher atmospheric pressure, lower relative humidity, more clouds with chances for precipitation, lower horizontal visibility due to occurrences of fog and mist and prevailing winds from the north northwest to north northeast directions with 16% occurrences of gale winds (more than 21 knots) of all hours. The warm season starts from April to September with mean air temperature of 25°C, lower atmospheric pressure, higher relative humidity, clear skies with no chance of precipitation, better horizontal visibility and prevailing winds from the north northwest and north directions with 7% of gale winds of all hours. Correlation analysis verified that: dry air temperature was inversely correlated to atmospheric pressure (-0.6), wind speed was negatively correlated with atmospheric pressure (-0.1), precipitation was positively correlated (0.1) to cloud cover but negatively correlated (-0.1) with dry temperature, relative humidity was positively correlated (0.1) to dry temperature but negatively correlated (-0.2) to wind speed and fog was positively correlated to relative humidity. These findings are in agreement with previous studies and general laws of physics and meteorology. Linear and quadratic regression analyses were conducted to investigate long term trend climatic changes. The linear regression model provided better fit rather than quadratic models as it gave 0.24 as the explained variance in annual mean dry temperature, atmospheric pressure, and wind speed, 0.71 and 0.76 as the explained variance in cloud cover and visibility respectively. Long term trend investigation from 1985 to 2008 utilizing linear regression analysis proved that during this period there was a 0.89°C increase in dry temperature, 1.18 mb decrease in atmospheric pressure, 2.42 knots increase in wind speed, 2.8% decrease in relative humidity, and 253 meter decrease in visibility. During 1985-1999 prevailing wind direction was north northwest 27% of the time, while during 2000-2008 prevailing wind directions were north northwest (21%) and north (19%) of that recorded period. These findings are generally in good agreement with IPPC (2007) which stated that 11 of the 12 warmest years occurred during the period 1970-2007 causing an average global temperature increase by 0.55°C at northern latitudes more than southern latitudes and over land more than over oceans. Findings also agree with recent previous research in Alexandria. A prototype system of artificial intelligence was built up using case-based reasoning (CBR) technology to provide short range weather forecasts. To validate the weather forecasting system, observations were retrieved from 1985-2007 that matched observations from 2008 with a mean similarity of 83%. The system provided six hour forecasts and gave mean similarity of 71% of actual observations. The six day forecasts provided by the system had a m