

Lightning in Bangladesh: Hydrometeors and thermodynamics assessment of active and inactive lightning days

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Lightning is a natural phenomenon that occurs during thunderstorms by electrostatic discharge. Thunderstorms are created during the formation of cumulonimbus clouds in the presence of enough atmospheric instabilities, moisture, and strong updrafts. In recent years, Bangladesh has been experiencing an increased number of lightning casualties, causing a significant threat to human civilization. In this study, the top-ranked available 50 active and inactive lightning days (from GDL360 lightning data) were considered to evaluate the relationship between different thermodynamic parameters of active and inactive lightning days. For this purpose, the University of Wyoming's atmospheric-sounding data at Dhaka station (ID: 41923, latitude: 23.76 N, longitude: 90.38 E) has been used to calculate the thermodynamic parameters, and ERA5 data has also been used for hydrometeors profiles during the study period 2015-2020. The average value of the Showalter index indicates a moderately unstable condition prevails in the days during active lightning, whereas weak convection is possible on inactive days. The SWEAT index was found to be higher than 300 on the active days, which indicates the potential for the occurrence of severe thunderstorms. The averaged k index was larger on active days than inactive days, indicating an enhanced potential for the occurrence of thunderstorms with heavy rain. The average value of convective available potential energy was more than 1200 J/kg on the active days, indicating the air parcel has more potential to lift at a level of free convection than on the inactive days. The LCL and equivalent potential temperature are found to be higher on active lightning days. Precipitable water is one of the most used parameters that determine the amount of rainfall and influences the dynamical evolution of convective storms for weather forecasting and is found much greater value during active days. The co-existence of snow and ice was more intense on active days than inactive days at 500-200 hPa levels. This study showed significant differences in the thermodynamic parameters of the active and inactive days, which will be helpful for forecasting the most active days of lightning in Bangladesh.