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The saptio-temporal distribution of lightning over the southern Levant and its relation to the regional synoptic systems

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The saptio-temporal distribution of lightning flashes over the southern Levant is derived from data obtained from the Lightning Positioning and Tracking System (LPATS) operated by the Israeli Electrical Company (IEC). The system has an aerial coverage in a range of $\sim$ 500 Km around central Israel, including the southeastern Mediterranean Sea, Israel, Lebanon, western Syria and Jordan and the eastern part of Sinai Peninsula and the Red Sea. The study period includes 4 years.

The spatial distribution of lightning flash density indicated the highest concentration over the sea, and is attributed to the contribution of sensible and latent heat fluxes. Other centers of high flash density appear along the coastal plain, expressing the friction effect of the coastline, and along orographic barriers, especially in northern Israel.

The intra-annual distribution shows a complete absence of lightning in the eastern Mediterranean during the summer (JJA) which is due to the persistent existence of the subtropical high above the region. The vast majority of the lightning activity occurs during 7 months between October and April. Even though over 65% of the rainfall is obtained in the winter months (DJF) only 35% of the lightning is obtained in the winter and October is the richest month, with 40% of total annual number of lightning flashes. This is attributed mostly to tropical intrusions, i.e. Red Sea Trough (RST), which is characterized by high static instability.

Cyprus lows are the synoptic system contributing the vast majority, >80%, of the rainfall in Israel, but only 42% of the lightning, whereas the RST, a minor contributor of rainfall, shares 48% of the lightning. However, during the winter 66% of the lightning flashes are associated with Cyprus lows and 25% with RST while during the autumn months the ratio is reversed: only 27% are associated with Cyprus lows and the majority (63%) occurs during RST. It was found that over 80% of the days defined as Cyprus lows were associated with lightning, indicating the instability associated with these cyclones over the region. During the RST, even though it is characterized by different weather conditions, 60% of the days were associated with lightning.

The spatial distribution of lightning is further studied for positive and negative cloud-to-ground flashes separately. Positive lightning, being <10% of their total number, are concentrated eastward over the coast and inland compared to the negative flashes. This may be explained by the enhanced inclination of the thunder-cloud due to their encounter with the coastline, leading to a "tilted dipole" which is manifested in a larger percentage of positive flashes. Similar results are found in the west coast of Japan in the winter season.