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Global patterns of lightning properties derived by LIS

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The Lightning Imaging Sensor LIS aboard the TRMM satellite provides unmatched empirical data of the global lightning distribution (up to 35 S/N) since end of 1997. Climatological flash rate densities derived from LIS are standard references, e.g. for flash rate parameterizations used in GCMs. It is known that flash characteristics are quite variable, and that various quantities (like the flash energy or the NO_x production per flash) vary considerably, statistically as well as systematically on regional and seasonal scales.

LIS provides information beyond flash counts, in particular radiance and flash footprint. Here we present an analysis of global patterns of various lightning properties derived from LIS, in relation to the number of flashes. These normalized flash characteristics show consistent spatial patterns of regions with “strong” versus regions with “weak” lightning. Most striking is a clear land-ocean contrast, with oceanic flashes being “stronger” than continental flashes. But also over continents, flash strength shows systematic variations. Highest continental values are found over the US, while values over South America and India are quite low. These regional variations cannot be simply parameterized as function of latitude.

Information on spatial patterns of mean flash “strength”, though rather qualitative up to now, is potentially a valuable input for improving empirical parameterizations based on flash counts (like precipitation or lightning NO_x). Further investigation is in progress to come to a more physical and quantitative understanding of the spatial patterns of the different LIS properties. In particular, it has to be checked how far they could be related to established lightning properties (like energy or the fraction of intra-cloud to cloud-to-ground flashes) or to meteorological quantities (like CAPE).