Variation of a Lightning NO_x Indicator for National Climate Assessment

Lightning and Climate

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During the past couple of years, an analysis tool was developed by the NASA Marshall Space Flight Center (MSFC) for the National Climate Assessment (NCA) program. The tool monitors and examines changes in lightning characteristics over the conterminous US (CONUS) on a continual basis. In this study, we have expanded the capability of the tool so that it can compute a new climate assessment variable that is called the Lightning NO_x Indicator (LNI). Nitrogen oxides (NO_x = NO + NO_2) are known to indirectly influence our climate, and lightning NO_x is the most important source of NO_x in the upper troposphere (particularly in the tropics). The LNI is derived using Lightning Imaging Sensor (LIS) data and is computed by summing up the product of flash area x flash brightness over all flashes that occur in a particular region and period. Therefore, it is suggested that the LNI is a proxy to lightning NO_x production. Specifically, larger flash areas are consistent with longer channel length and/or more energetic channels, and hence more NO_x production. Brighter flashes are consistent with more energetic channels, and hence more NO_x production. The location of the flash within the thundercloud and the optical scattering characteristics of the thundercloud are of course complicating factors. We analyze LIS data for the years 2003-2013 and provide geographical plots of the time-evolution of the LNI in order to determine if there are any significant changes or trends between like seasons, or from year to year.