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A revised calculation of Dst, general interpretations, and a map of low-latitude, storm-time magnetic disturbance: 1958 – 2007

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Abstract. A new version of the storm-time Dst disturbance index is calculated using the original hourly magnetic-observatory data from the four standard observatories and collected over the years 1958 – 2007. The calculation method amounts to a refinement of that first used by *Sugiura* [1964], and which is now used by the Kyoto World Data Center for routine calculation of Dst. The most important methodological difference concerns the removal of solar-quiet (Sq) variation. Each 50-year observatory time series is band-stop filtered in the frequency domain – removal of specific Fourier amplitudes corresponding to stationary, periodic variation driven by the Earth's rotation, the Moon's orbit, the Earth's orbit around the Sun, and their mutual coupling. The resulting non-stationary, disturbance time series ($Dist$) from each observatory is weighted by site geomagnetic latitude, and he time series from all the observatories are then averaged together to give what we call $Dst^{5807-4SH}$. Comparisons are made with the standard Kyoto Dst, and various biases, especially for residual Sq, are identified in the Kyoto Dst. Analysis is made of magnetic disturbance corresponding to positive Dst values, mostly storm sudden commencements, and negative Dst, mostly corresponding to subsequent storm main and recovery phases. Individual observatory time series are analyzed for possible site-specific, induced magnetotelluric signals. A global, Dst-scalable map is constructed of a standing, asymmetric pattern in local-time disturbance. Greatest (least) average disturbance is found to be dusk (dawn) centered, a result that might be interpreted in terms of a persistent, storm-time partial ring current. Still, the local-time disturbance map presented here challenges some conventional ideas about the magnetosphere and magnetic storms. The disturbance index $Dst^{5807-4SH}$ time series is made freely available for space physics and solid-Earth applications.