6.11. VERY HEAVY PRECIPITATION OVER LAND: ESTIMATES BASED ON A NEW GLOBAL DAILY PRECIPITATION DATA SET

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The National Climatic Data Center has recently completed a multi-year effort to compile in-situ historical daily data on the global scale. The result is a data set with approximately 60,000 stations, several thousand of which have records in excess of 75 years. Daily precipitation time series are available at almost each of these stations. We use this data set to construct the climatology of "very heavy" precipitation events (e.g., those above 100 mm per day or those among the 1% (or even 0.3%) of rainy days with the highest precipitation amount at each given station/season).[*]

An approach employed includes the assessment of "very heavy" precipitation events in statistical terms as estimates of regional frequencies of these rare events. Therefore, in order to reliably estimate these frequencies we restricted ourselves to regions where the data set contains an especially dense network of long-term stations. There we were able to track the changes in "very heavy" precipitation for most of the past century. Among these regions are the contiguous United States, Mexico, South Africa, India, most of Australia, the former USSR (except northern Siberia), eastern Brazil and southern Canada. A set of maps in Figure 1 describes the data set used for each country and region (except Canada).

During a recent (summer 2001) expansion of the U.S. digitized daily data archive into the pre-1948 period, the data of ~ 10,000 U.S. stations have been "rescued" (i.e., digitized) and then incorporated into the national digital archive. Figure 2 shows a dramatic increase in our present ability to cover the entire 20th century with daily data over the entire contiguous U.S. Several months ago, the present spatial resolution was limited mainly to the Midwest. Therefore, we are repeating all our analyses on the century-long "heavy" and "very heavy" precipitation trends for the contiguous United States (first presented in Groisman et al. 1991a,b) in a hope to get a crispier pattern of these trends.

The pattern of trends in "very heavy" precipitation over all these countries will be presented at the conference. We shall show two types of diagrams: (a)Time series of the frequency of heaviest daily precipitation events (e.g., similar to those in Fig.3) and bar-chart trend diagrams similar to those first suggested by Karl and Knight (1998) [e.g., those shown in Fig. 4 for Mexico and in Groisman et al. (2001a) for the contiguous United States].

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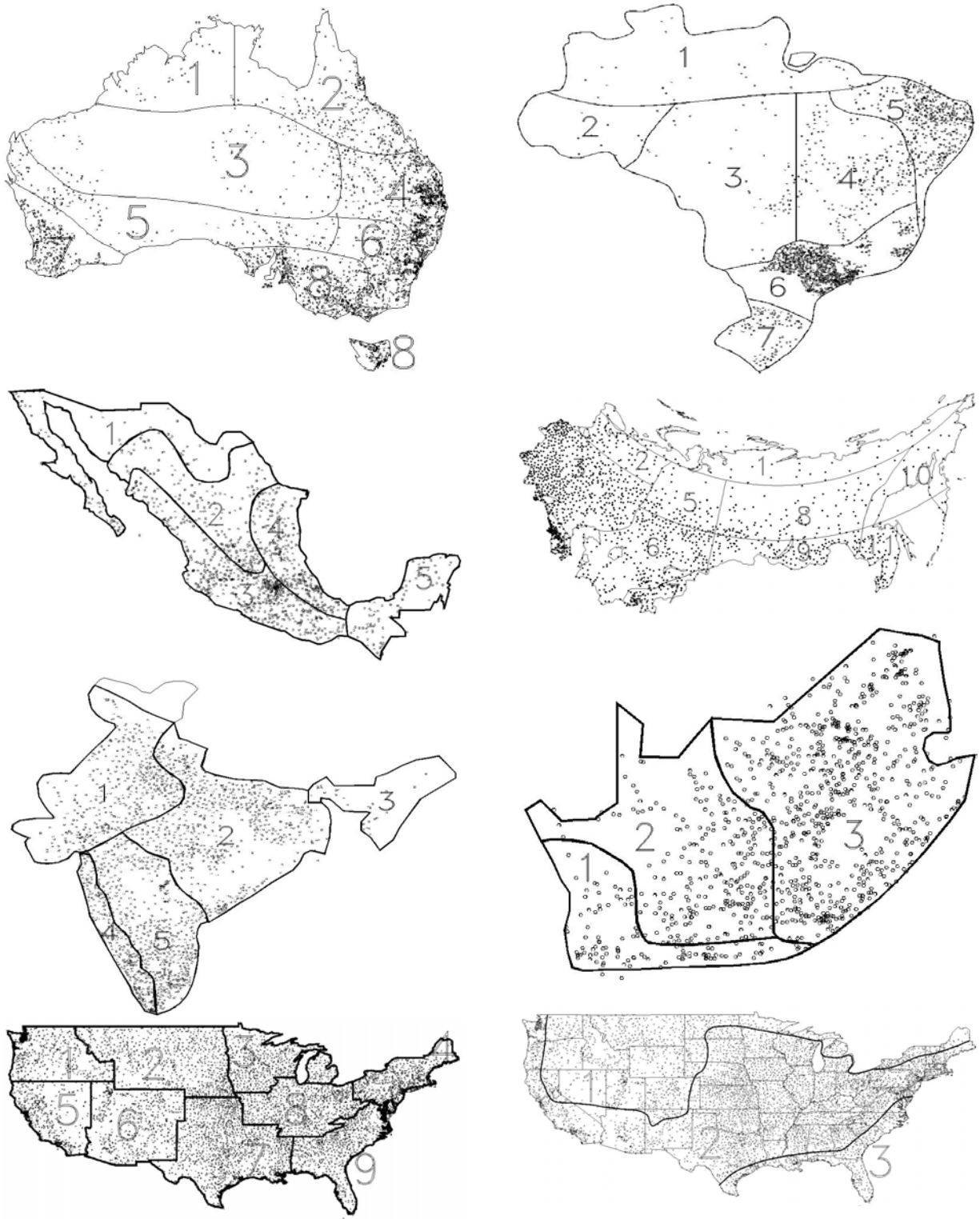

Figure 1. Long-term stations with at least 75% (83% for the U.S.) of the valid daily precipitation data during the reference period of the best spatial coverage (usually a 30-year-long period, but different for different countries) and regional partition employed in this study. Climatic zones and/or seasonal cycle of precipitation were used to partition Australia, Brazil, Mexico, the former Soviet Union, India, and South Africa. State-based and precipitation type partitions used in Groisman et al (1991a,b) were preserved for the contiguous United States.

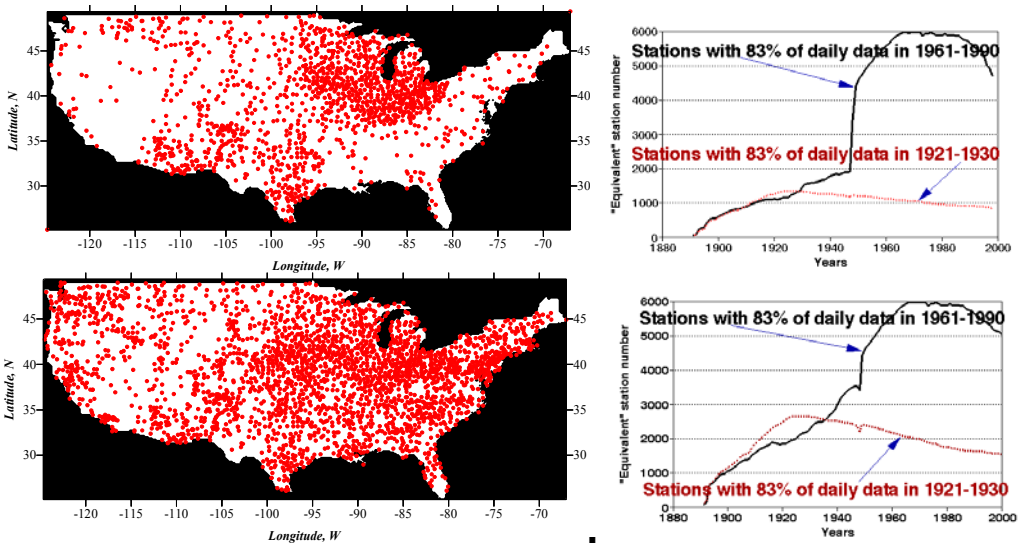

Figure 2. ***Top panel*****. Stations with at least 25 years of valid digitized daily precipitation in 1961-1990 that are still available 50% of the time during the 1921-1930 period and the data availability in long term daily precipitation time series at NCDC one year ago (Groisman et al 2001a,b).** ***Bottom panel*****. Same information, but as of August 15, 2001.**

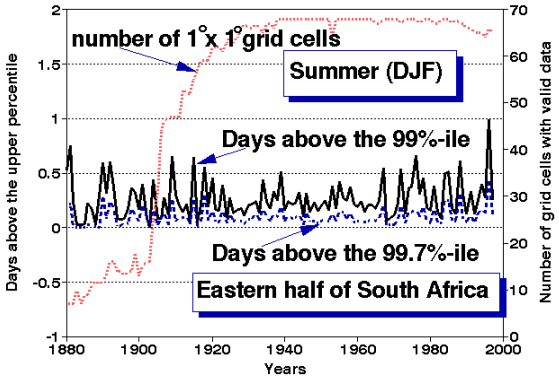

Figure 3. Variations in the number of summer (DJF) days above the 99%- and 99.7%-iles of the rainy days over the Eastern half of South Africa (region 3 in Figure 1) during the past century. The regional average values of the seasonal thresholds used for the DJF percentiles in this region are 68 mm and 89 mm and characterize 4 and 10 years return period for the one-day rain event respectively. Linear trends for the 1916-1997 period with the best data coverage for the frequency of the days above the 99%- and 99.7%-iles are 5.6%/10yrs and 7.0%/10yrs respectively (R^2 = 0.05 for both trends).

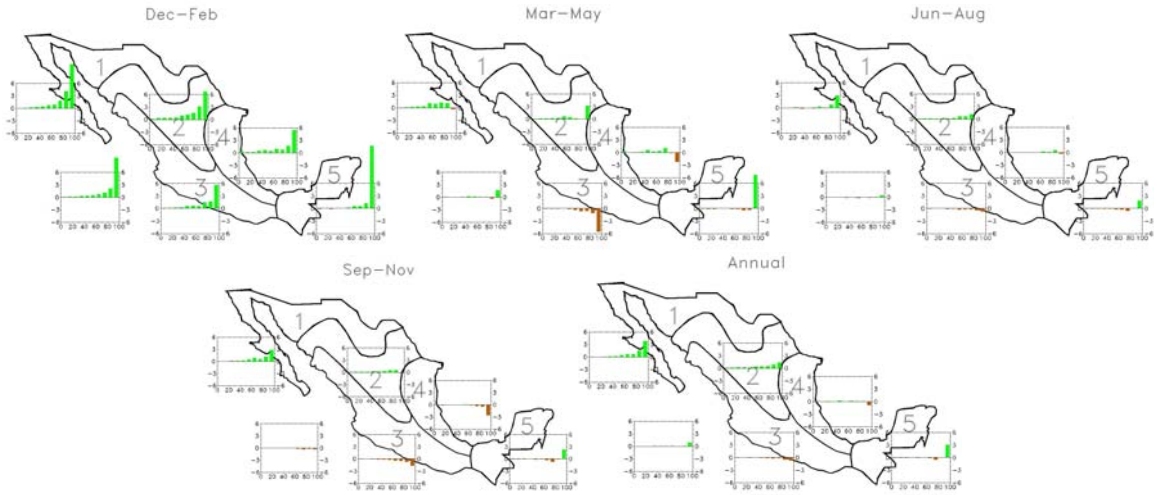

Figure 4. Contribution of various parts of daily precipitation distribution to the linear trend of the total precipitation over Mexico (%/10yrs) for the 1950-1994 period with the best data coverage. Trends are partitioned by 5-%-ile rainfall intensity classes (similar to that shown in Fig. 16 of Groisman et al. 1991a for the contiguous U.S.) and their sums across the classes provide a total regional/nationwide trend for a given season.