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Global assessment of subnational drought impact based on the Geocoded Disasters dataset and land reanalysis

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S1 Sensitivity of drought cluster centroids map to the size of drought clusters

Upscaled map of the drought cluster centroids was generated using four thresholds of the size of drought clusters: 10,000 km^2, 50,000 km^2, 100,000 km^2, and 500,000 km^2, shown in Fig. S1. The drought clusters were generated from the third layer's soil moisture. In the results part, we showed the case of (c) 100,000 km^2. Drought-prone areas identified by drought indices are not well consistent with those found in GDIS (Fig. 6) if the size of drought clusters is too large or too small. In the case of (a) 10,000 km^2, there are many more drought-prone areas than those found in GDIS such as western China and Thailand. Although (b) 50,000 km^2 case shows a similar trend of drought-prone areas with (c) 100,000 km^2, the drought-prone area in northern China is relatively small. In the case of (d) 500,000 km^2, drought-prone areas in northern China and western India which are found in (c) 100,000 km^2 are less outstanding.

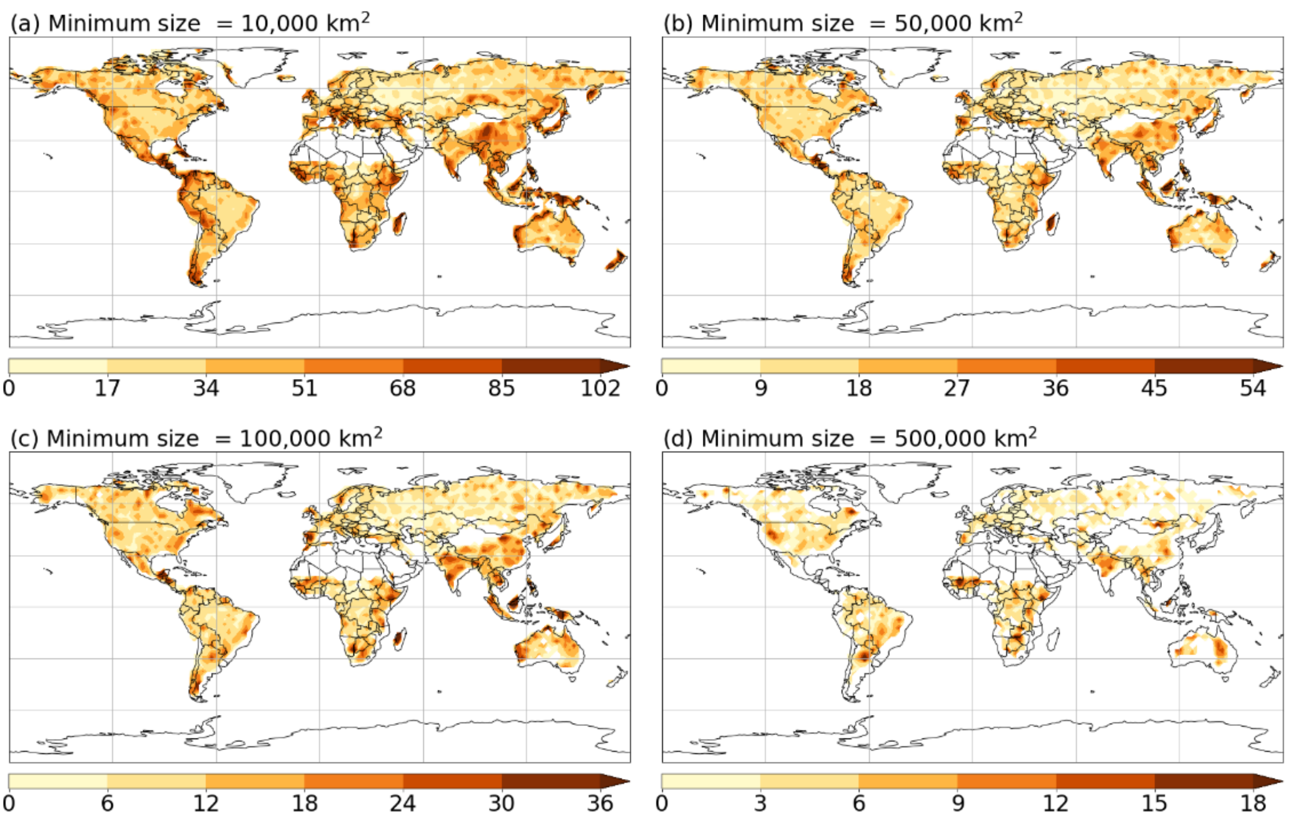

Figure S1: Sensitivity of drought cluster centroids map to the size of drought clusters. (a) 10,000 km^2, (b) 50,000 km^2, (c) 100,000 km^2, and (d) 500,000 km^2.

S2 Sensitivity of drought cluster centroids map to upscaled resolution

Upscaled map of the drought cluster centroids was generated using four resolutions of the grid cells within which we count the centroids: 0.25° (original), 1.25°, 2.5°, and 5°, shown in Fig. S2. The drought clusters were generated from the third layer's soil moisture. In the results part, we showed the case of 2.5°. Counting centroids with original resolution (a) does not provide regional trends, because the plots are scattered sparsely. Therefore, by counting the number of centroids within a certain larger area (but still small enough to be meaningful compared with GDIS spatial resolution), we can observe the areas that experience frequent hydro-meteorological droughts. Regional trends start to emerge from 1.25°, and 5° is slightly larger than the GDIS resolution. Therefore, 2.5° was chosen.

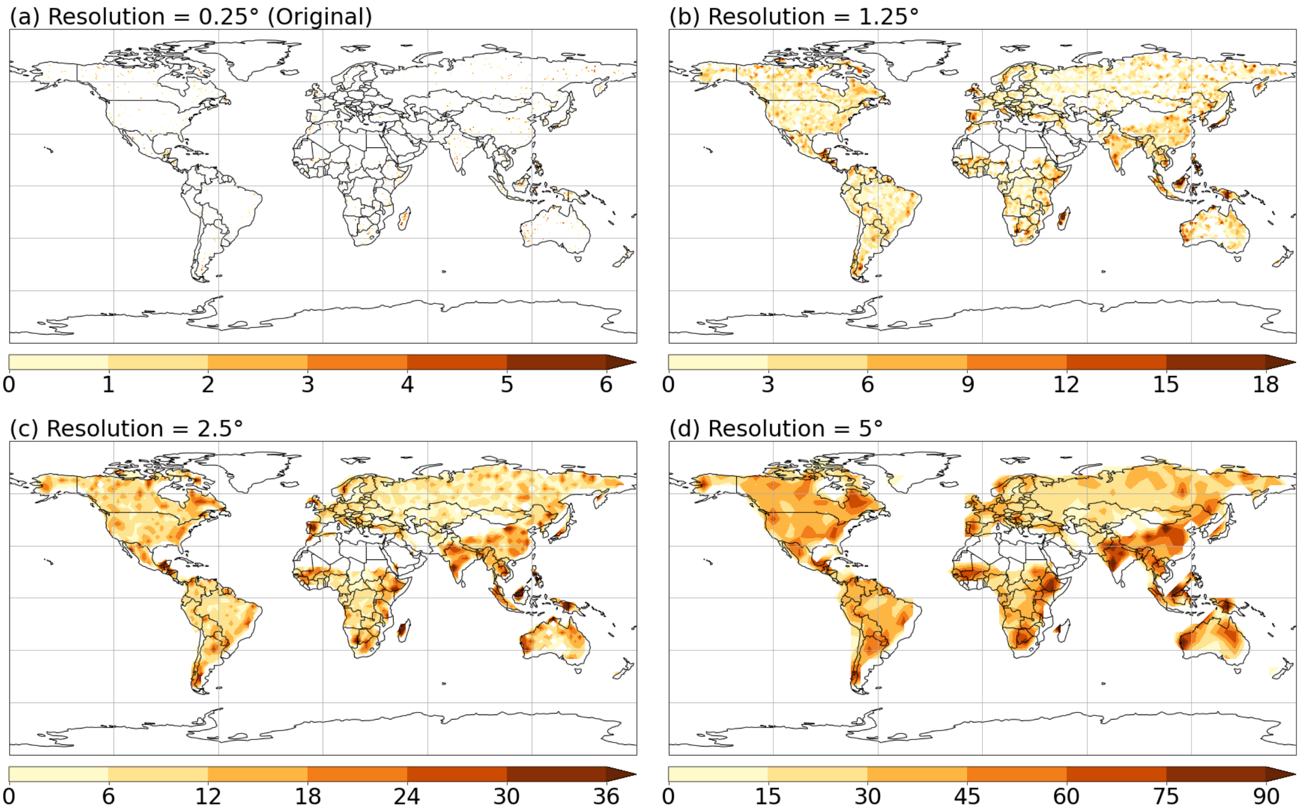

Figure S2: Sensitivity of drought cluster centroids map to upscaled resolution. (a) 0.25°, (b) 1.25°, (c) 2.5°, and (d) 5°.

S3 Drought-prone areas in different soil layers

The locations of drought-prone areas are almost the same when drought clusters are generated by soil moisture in different soil layers, shown in Fig. S3. The drought-prone areas are most distinguishable from their surroundings and corresponded best with GDIS drought-prone areas (Fig. 6) in the third layer case. Drought clusters generated from shallow layer's soil moisture disperse and the border are relatively unclear from their surroundings. As we mention in the discussion part, the serious socio-economic events such as those listed in GDIS, especially those in drought-prone areas, are the events that were caused by the soil moisture deficit not only on the surface layer but also down to the root.

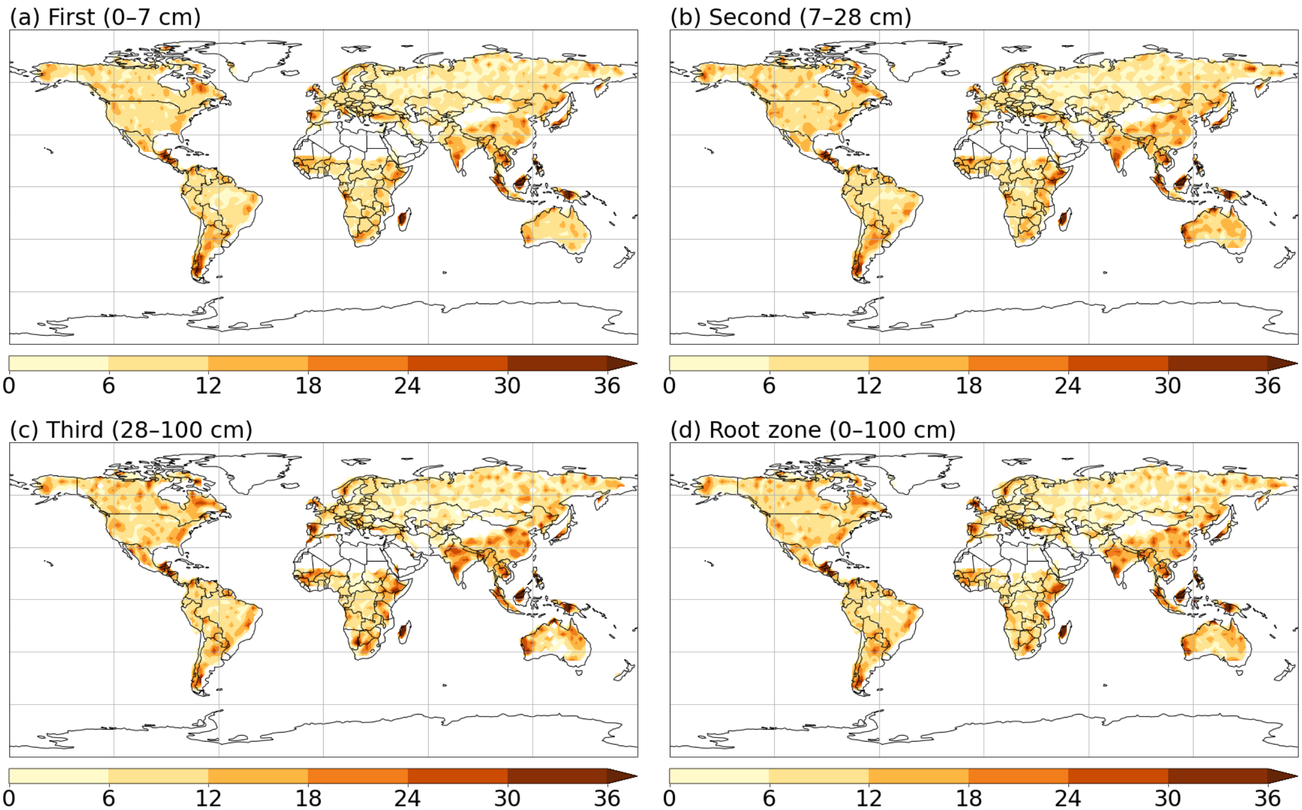

Figure S3: The number of drought cluster centroids based on ERA5-Land in different soil layers. (a) First layer, (b) Second layer, (c) Third layer, and (d) Root zone layer.