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## Supplemental Material

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How Land Surface Characteristics Influence the Development of Flash Drought through the Drivers of Soil Moisture and Vapor Pressure Deficit

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1 **Supplemental Material for “How land surface characteristics influence the**  
2 **development of flash drought through the drivers of soil moisture and vapor**  
3 **pressure deficit”**

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9 **1. Supplemental Figures**

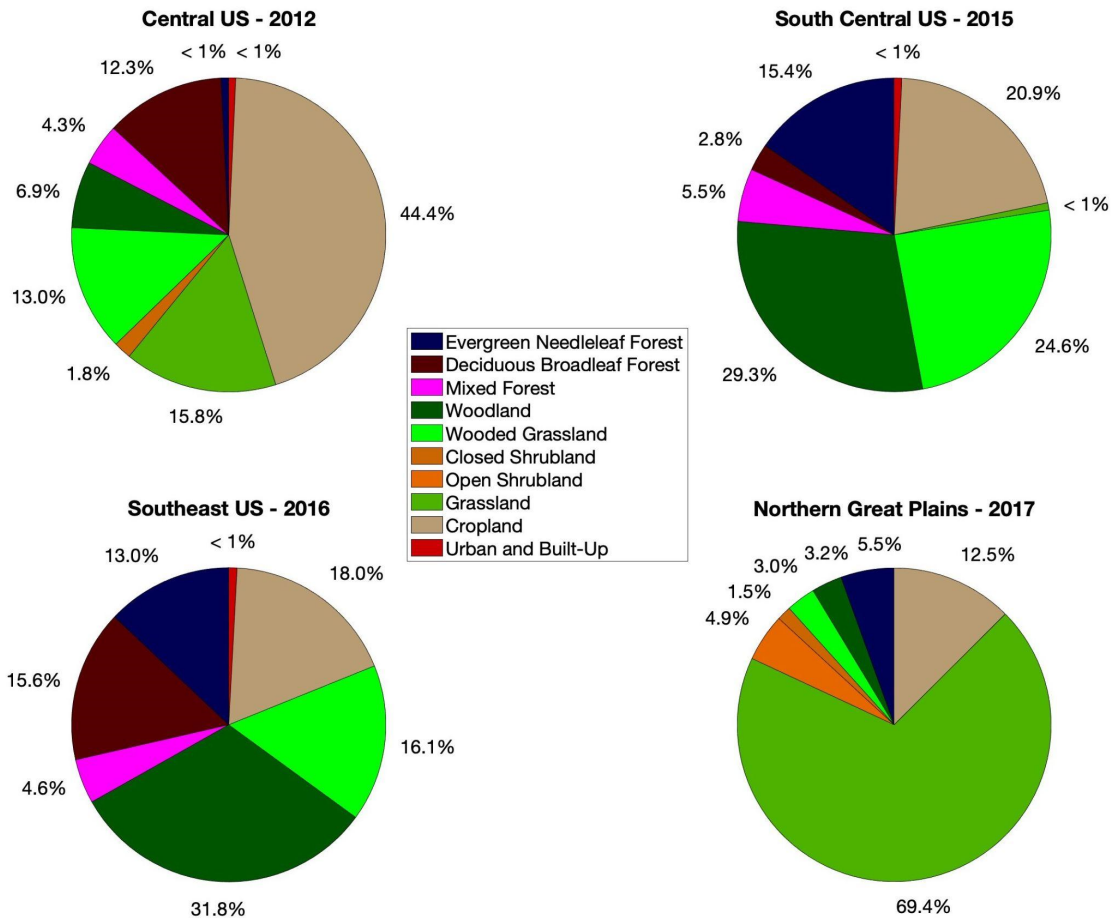
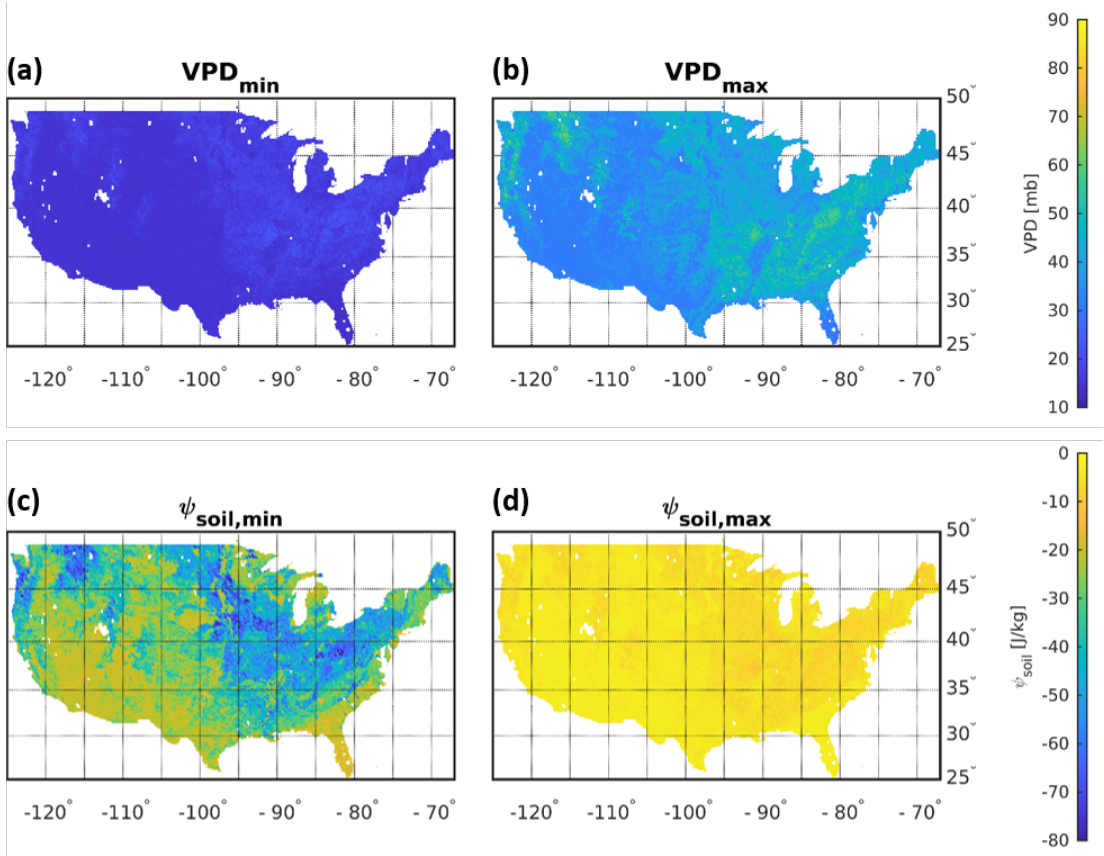
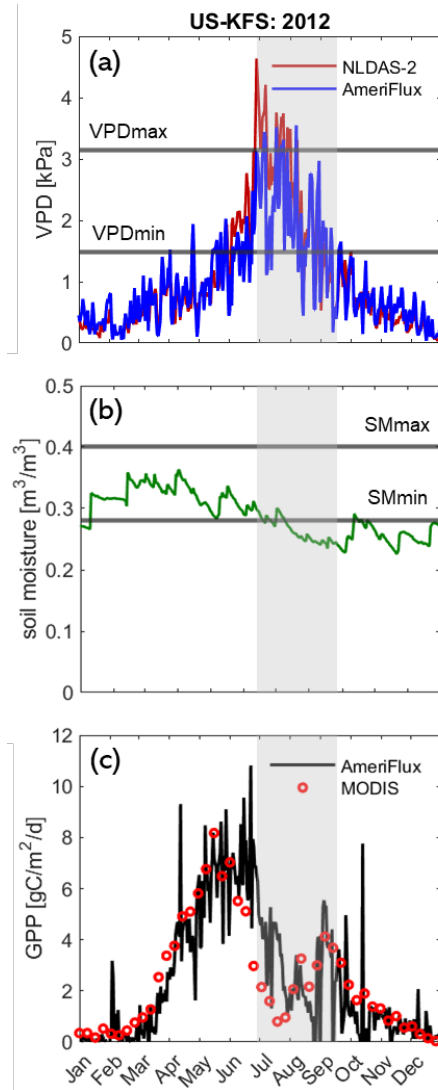


FIG. 1. Proportions of land cover types across the four study regions.



10 FIG. 2. Maps of Growing Season Index (GSI) parameter estimates for (a) minimum VPD, (b) maximum VPD,  
 11 (c) minimum soil water potential, and (d) maximum soil water potential.



12 FIG. 3. Time series of: (a) VPD derived from NLDAS-2 (red line) and AmeriFlux (blue line), (b) root zone soil  
 13 moisture from SMERGE, and (c) gross primary productivity (GPP) from AmeriFlux (black line) and MODIS  
 14 MOD17A2HGF (red circle) for the Kansas Field Station (US-KFS) in 2012, when flash drought occurred in the  
 15 Central U.S. The horizontal gray lines mark the suboptimal range for photosynthesis determined by assimilating  
 16 MODIS FPAR/LAI data to a phenology forecasting model. Gray shading in highlights a period of drought  
 17 stress marked by crossing the VPDmax and SMmin thresholds simultaneously. Cross both thresholds results in  
 18 a significant drop off in productivity in (c).

19 **2. Supplemental Tables**

| Soil texture class | $\phi$ | $\psi_{ae}$ | $\lambda$ | $S_f$ |
|--------------------|--------|-------------|-----------|-------|
| Sand               | 0.395  | 12.1        | 0.694     | 4.95  |
| Loamy sand         | 0.410  | 9.0         | 0.553     | 6.13  |
| Sandy loam         | 0.435  | 21.8        | 0.378     | 11.01 |
| Silt loam          | 0.485  | 78.6        | 0.234     | 16.68 |
| Silt               | 0.485  | 78.6        | 0.234     | 16.68 |
| Loam               | 0.451  | 47.8        | 0.252     | 8.89  |
| Sandy clay loam    | 0.420  | 29.9        | 0.319     | 21.85 |
| Silty clay loam    | 0.477  | 35.6        | 0.177     | 27.30 |
| Clay loam          | 0.476  | 63.0        | 0.242     | 20.88 |
| Sandy clay         | 0.426  | 15.3        | 0.223     | 23.90 |
| Silty clay         | 0.492  | 49.0        | 0.150     | 29.22 |
| Clay               | 0.482  | 40.5        | 0.165     | 31.63 |

TABLE 1. Soil hydraulic parameters.

$\phi$  - porosity  
 $\psi_{ae}$  - air-entry pressure head  
 $\lambda$  - pore-size distribution,  $b = \frac{1}{\lambda}$   
 $S_f$  - wetting front suction head

20 **3. References**

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