1. MOTIVATION

- Flash droughts, flood potential and fire potential are a few of the nowcasting hydrologic challenges for forecasters and decision makers
- Current soil moisture analysis products are not high enough resolution or timely enough for forecasters to use in nowcasting environment
- Relative soil moisture products do not put current analysis into a climatological context
- Objective: Develop a real-time, high-resolution soil moisture index product the provides climatological context for to aid decision makers with the following features:
  - sub-county spatial resolution
  - produced daily; available same day
  - displayable in forecaster decision support tools to enable overlay of other variables (e.g., forecast precipitation, lightning, etc.)

2. LAND INFORMATION SYSTEM (LIS) CLIMATOLOGY

- SPoRT runs the Noah Land Surface Model (LSM) in uncoupled/analysis mode to produce real-time, daily land surface output
- These real-time, daily runs are then compared to a 30+ year climatology (1 January 1981 to 31 December 2013)
  - CONUS domain at 0.03° deg resolution (~3 km)
  - IGBP/MODIS 20-class land use, STATSGO 16-class soil
  - MODIS/FPAR 30-sec resolution monthly GVF climatology (Wang et al. 2014; Barlage, personal communication)
  - Atmospheric forcing: NARR-based NLDAS-2 hourly data
  - 30+ year spin-up (1979-2010), then re-run for 1979-2013 (only >1981 used in climatology) to ensure deep soil equilibrium
  - Output soil fields once daily
- Histograms of the 33-year climatology are created for all grid points in each county in the conterminous United States (CONUS; Fig. 1)
- Each percentile is matched to a U.S. Drought Monitor category using technique developed in Xia et al. (2013)

3. PERCENTILE PRODUCT

- Each grid point in the real-time, daily LIS-Noah run is compared to its daily county histogram to create gridded percentile product
- Generally good comparison east of the Rockies; challenges in western U.S. (Fig. 2)
- LIS-Noah also highlights TS Erin impacts over Texas and Oklahoma
- Available in AWIPS 2 for select SEUS NWS WFOs

4. COMPARISON TO USDM

- USDM shapefiles were rasterized and mapped to the LIS-Noah grid for statistical comparison
- Generally captures the overall magnitude of total drought area (Fig. 3)
- Captures major droughts (SEUS in 2007; SGP in 2011 and 2012)
- SEUS is noisier given the more frequent and scattered nature of precipitation

5. FUTURE WORK

- Northwest is not as well represented because factors defining drought are driven by groundwater and snowmelt
- Best overall statistics in SEUS domain
- Bias depicts overall under-representation of lower drought categories and slight over-representation of higher drought categories (Table 1)
- Correlations are highest for lower drought categories and SEUS/SGP; correlations diminish for higher drought categories and NWUS region (Table 2)

REFERENCES


Table 1. Difference in mean area (LIS-Noah minus USDM) for each region from June 2006 to Sept. 2015

<table>
<thead>
<tr>
<th>Region</th>
<th>Bias</th>
<th>D0</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
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</thead>
<tbody>
<tr>
<td>SEUS</td>
<td>-4.1</td>
<td>2.1</td>
<td>0.2</td>
<td>0.7</td>
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<tr>
<td>SGP</td>
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<td>-6.6</td>
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<td>-4.5</td>
<td>1.4</td>
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Table 2. Pearson’s correlation for each region from June 2006 to Sept. 2015

<table>
<thead>
<tr>
<th>Region</th>
<th>Correlation</th>
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<th>D2</th>
<th>D3</th>
<th>D4</th>
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</thead>
<tbody>
<tr>
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<td>0.87</td>
<td>0.85</td>
<td>0.83</td>
<td>0.72</td>
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<tr>
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<td>0.90</td>
<td>0.88</td>
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<tr>
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<td>0.68</td>
<td>0.53</td>
<td>0.38</td>
<td>0.12</td>
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Figure 1. Histogram for Madison County, AL for 21 August. Vertical colored lines denote each USDM category (yellow/red) and reverse categorization for flooding (green/blues). Dashed line represented average countywide soil moisture for 21 August 2007.

Figure 2. Qualitative comparison between LIS-Noah percentile product (left) and USDM (right) for 21 August 2007. Blue boxes denote validation regions shown in Fig. 3 and Tables 1 and 2.

Figure 3. Time series of bulk area comparison between LIS-Noah (top row) and USDM (bottom row) for three geographical areas shown in Fig. 2 from June 2006 through June 2015.

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