Analysis of the relationship between climate and NDVI variability at global scales

Fan-Wei Zeng (fanwei.zeng@nasa.gov)1,2, G. James Collatz3, Jorge Pinzon1,2, Alvaro Ivanoff1,3


1. Introduction: interannual variability in modeled (CASA) C flux is in part caused by interannual variability in NDVI (FPAR) (Fig. 1).

2. Justification: Is interannual variability in NDVI explained by climate? Here we examine the sensitivity of NDVI to interannual variability in precipitation and temperature.

3. Data: Table 1. Data sets used.

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Spatial (°)</th>
<th>Temporal</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIMMS 3g NDVI</td>
<td>0.05</td>
<td>Semi-monthly</td>
<td>1981-2010</td>
</tr>
<tr>
<td>GPCP precipitation</td>
<td>2.5</td>
<td>Monthly</td>
<td>1979-2009</td>
</tr>
<tr>
<td>CRU climatology</td>
<td>0.5</td>
<td>Monthly</td>
<td>1961-1990 (base)</td>
</tr>
<tr>
<td>GISS temperature anomaly</td>
<td>2</td>
<td>Monthly</td>
<td>1880-2010</td>
</tr>
</tbody>
</table>

• Data sets used: long record; global coverage; consistent with data sets of higher quality (Fig. 2); Use of TRMM precipitation (40°N-40°S, 0.25°, semimonthly, 1998-2010) gives the same result.

4. Methods:
4.1. Conducted Pearson’s correlation analyses at pixel level with varying lags (of NDVI response to climate) on:
- 1982-2009 NDVI – precipitation anomaly time series (monthly, 11×11);
- 1982-2010 NDVI – temperature anomaly time series (monthly, 0.5°×0.5°);
4.2. Accounted for first-order temporal autocorrelation following Dawdy and Matalas (1964). Only significant correlation coefficients (r values with corrected p values <0.05, two-tailed t-test) are shown.

5. Results:
5.1. NDVI – precipitation anomaly correlations:

- Strongest for 1-month preceding precipitation;
- Significant in 36% of land pixels;
- Positive in arid and semiarid areas where grasslands and shrublands are the dominant land cover types.

6. Conclusion:
• This study confirms a mechanism producing variability in modeled NPP:
  - NDVI (FPAR) interannual variability is strongly driven by climate;
  - The climate driven variability in NDVI (FPAR) can lead to much larger fluctuation in NPP vs. the NPP computed from FPAR climatology (Fig. 8).