Temporal Sensitivity of Satellite-Based Remote Sensing Products to Rainfall Pulse Events in Dryland Ecosystems

Andrew L. Neal1, Shirley A. Kurc2, Paul D. Brooks1

1Department of Hydrology and Water Resources, University of Arizona, Tucson.
2School of Natural Resources and the Environment, University of Arizona, Tucson.

Introduction

Dryland ecosystems are spatially extant (over 30% of the land surface is arid or semi-arid) and exhibit spatial heterogeneity and temporal variability with regard to land surface interactions. The need for improved up- and downscaling for improved analysis is critical. Thus, improving the ability to scale between flux tower and remote sensing data will lead to deeper understanding of that variability in the way ecosystems respond to precipitation events. This information will aid management decisions by clearly describing that response and relating it to global daily measurements made by satellite remote sensors.

Here, we consider the timing of ecosystem response to rainfall events in dryland ecosystems as related to remote sensing data. This timing is assessed by analyzing the time scale of exponential drydown at several flux tower sites in the southwest. Timing and magnitude of carbon release (respiration) and uptake (photosynthesis) is also included.

Flux Measurement Sites

Summary data for Ameriflux sites used in this study

Event-level example for summer storms at Sevilleta Grassland Site

Large, low frequency storms account for a large proportion of total rainfall.
These events strongly influence soil moisture availability for vegetation.

Large, rare storms generate response in mean soil moisture along the soil profile.

Soil moisture at all depths is more sensitive to large storms (>8mm) than small storms (<1-8mm).

Event-level example for summer storms at Sevilleta Grassland Site

Grasslands will have a stronger response in release and uptake of carbon - greater magnitudes of NEE+ and NEE-.
All sites will have weak linkages between carbon, soil moisture and remote sensing data during non-summer months - NDVI and carbon flux are decoupled

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