Effects of Drought on Leaf Area Index over Texas

GISWR 2012 Term Project Proposal (Ling Huang)

Background

Leaf Area Index (LAI), usually defined as one half the total leaf area per unit ground area, is a critical parameter controlling many biological and physical processes associated with vegetation. It is a key input to many climate and ecological models. For instance, regional LAI data is utilized to generate biogenic emission, which is subsequently imported to atmospheric models and produces regional ozone concentrations. Various global or regional LAI products have been produced based on different remote sensing data with different LAI retrieval algorithms, such as MODIS by NASA, ECOLIMAP by CNRM and so on. Among them, MODIS (Moderate Resolution Imaging Spectroradiometer) provides the most continuous and latest global LAI data (Kappas and Propastin, 2012) and has been extensively validated against in situ measurements and other satellite-derived LAI products (Garrigues et al., 2008). On the other hand, Texas has suffered a severe drought in 2011. The effects of drought on the distribution of LAI values has not been much studied (Caccamo et al., 2011).

Objective

The goals of this term project is using ArcGIS to post-process raw MODIS LAI data and generate time series of LAI map over Texas for 2010 (relatively wet) and 2011 (extremely dry and warm). The effects of drought on the distributions of LAI will be investigated by comparing the two LAI maps visually and calculating LAI statistics using ArcGIS and ENVI.

Project Update

Tasks Completed

1. LAI post-process model

An ArcGIS model was built to post-process MODIS LAI data from May 1st to Sep 30th for year 2010 and year 2011. This generates Texas LAI maps with applied quality control. Figure 1 is a snap shot of the model builder and Figure 2 shows the final LAI maps on the following four days: May 1st 2010, Sep 30th 2010, May 1st 2011 and Sep 30th 2011.

Figure 1 Snap shot of LAI post-process model
2. Statistical distributions of LAI changes

The changes of LAI distribution between a wet year and a drought year were investigated. Figure 3 compares the LAI distribution on May 1st 2010 and 2011.

Figure 2 Processed LAI maps over Texas on four days

Figure 3 LAI distribution on May 1st 2010 and 2011
3. Spatial distributions of LAI changes

The LAI changes caused by drought were also examined spatially by ArcGIS. Figure 4 shows an example of spatial change.

Figure 4 Spatial distribution of LAI change on May 1st and Sep 30th
**Tasks to be done**

1. Create time series LAI map over Texas from May to September for 2010 and 2011, respectively.

2. Investigate more the statistics of LAI distribution changes caused by drought. For example, the mean LAI over Texas, or mean LAI over eastern Texas and West Texas.

3. Investigate the LAI changes in different land cover.

**References and Datasets**


MODIS: [http://reverb.echo.nasa.gov/reverb/](http://reverb.echo.nasa.gov/reverb/#utf8=%E2%9C%93&spatial_map=satellite&spatial_type=rectangle)
ENVI tutorial: [http://cliveg.bu.edu/courses/estonia/modis-lab-07-08-analyses.pdf](http://cliveg.bu.edu/courses/estonia/modis-lab-07-08-analyses.pdf)

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