Global Vegetation Phenology Parameters From MODIS VI 5-year Time Series

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Introduction

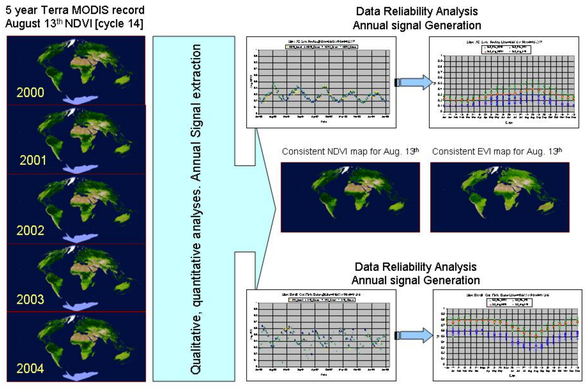
- Global and Regional phenology is important in ecosystem simulation models and coupled biosphere/atmosphere models
- Phenology metrics are directly used, or regulate, the timing and length of the growing season in large-scale BGC models.
- BGC and Climate models would greatly benefit from high quality high resolution phenology parameter maps
- Recent development in remote sensing data reliability, qualitative QA analysis, and most importantly the successful EOS MODIS mission is making available for the first time a very high fidelity stable time series
- Phenology maps at 1km resolution will be a great asset to climate change related studies, the study of earth vegetation dynamics, and to the modeling community

Objectives

- Assess the potential of extracting global vegetation dynamic metrics (phenology parameters) using the 1km MODIS VI product 5-year record
- Establish the accuracy of these parameters and any potential global applications
- Evaluate the differences between the NDVI and EVI based results

Data and Methodology

- We used the global 1km MODIS VI product times series 5 year record (Feb. 00' to Feb 05').
- This 5-year record was processed using a QA reliability index to eliminate clouds, aerosol, shadow, viewing extremes effects*
- This 5-year record was processed into an average year, representing an annual global seasonality. 23 consistent, cloud free, aerosol free, small view angle, and gap filled cycles were generated (16-day cycles)
- This average year was used to drive the phenology parameter extraction algorithm



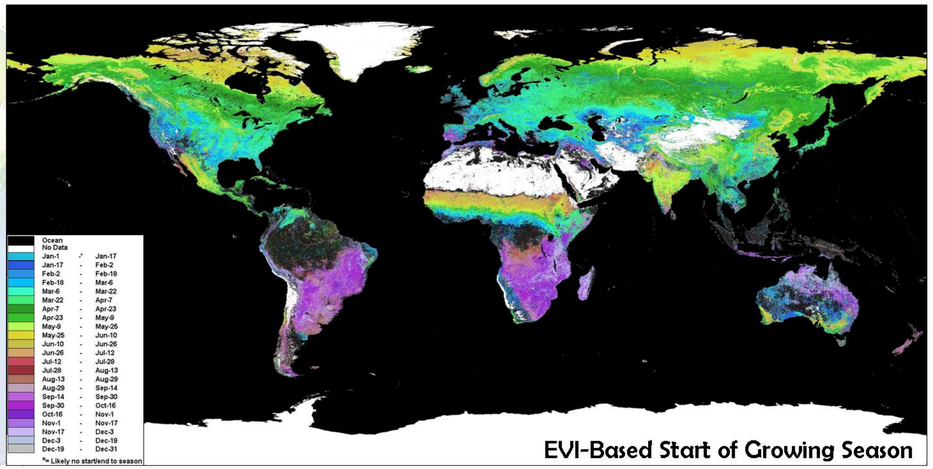
Phenology parameter extraction

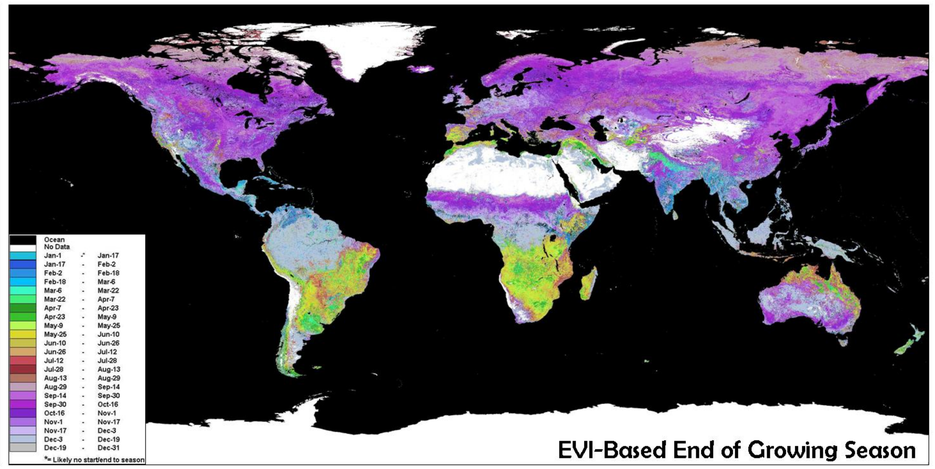
A new phenology metrics' extraction algorithm was developed based on a modified White & Reed method.

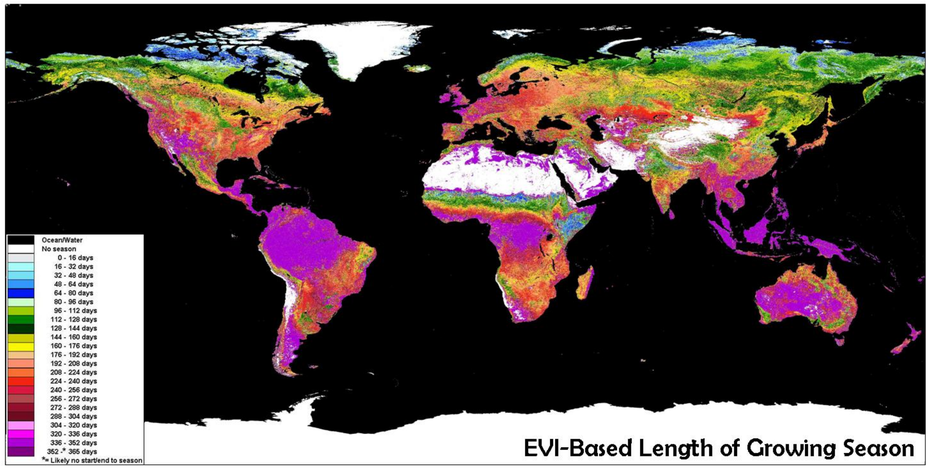
- Original method based on attainment of a 'half-maximum' VI level designed to predict the initial leaf expansion of dominant overstory species
- Modified to work with the new MODIS VI reliability index
- Accommodates double seasonality scenario
- Fully automated and completely based on the actual sensor data (no empirical smoothing, etc…)

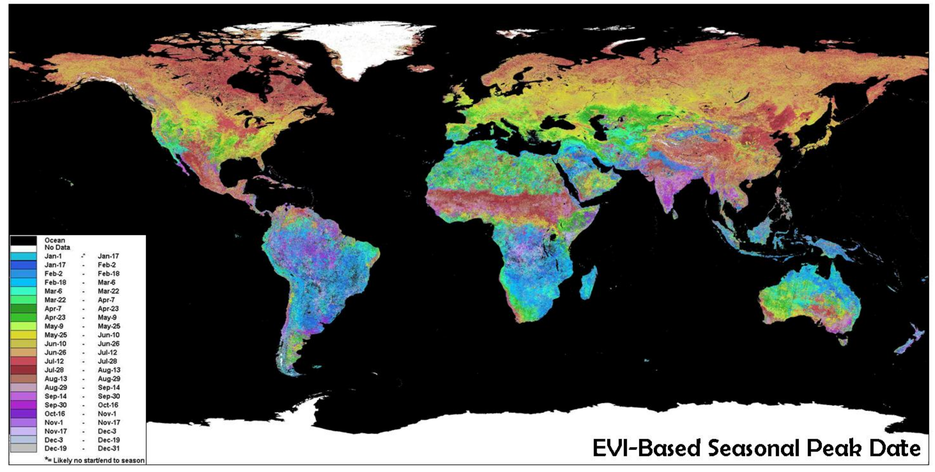
Results

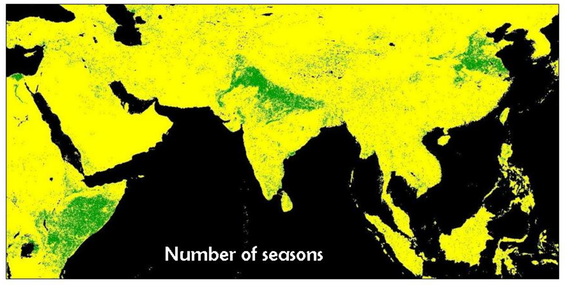
We achieved ten phenology parameters, extracted globally at 1km. With the exception of few pixels, every 1km location on earth was successfully processed. The parameters extracted included: Average VI signal for the growing season, Cumulative VI signal for the growing season, Green Up and Green Down Rates, Peak VI Signal date, Peak VI Signal, End of Growing Season, Start of Growing Season, Length of Growing Season, Number of Seasons. Examples are shown on the right.

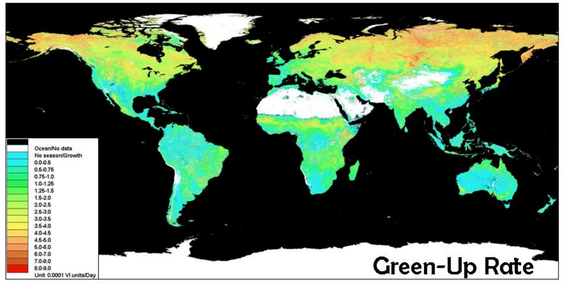


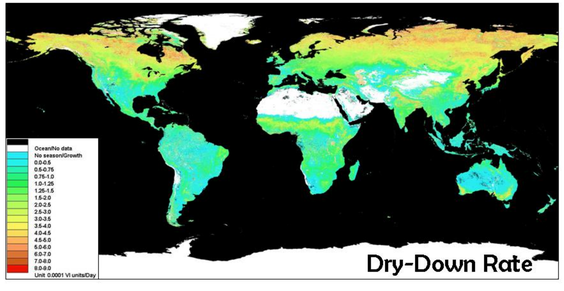












Conclusions

- Phenology was accurately derived using MODIS NDVI/EVI.
- The EVI based extraction performed better in areas of dense vegetation
- Other NDVI and EVI based phenology parameters were identical
- The new Phenology extraction algorithm was robust and spatially consistent
- The Location, elevation and biophysical characteristics of vegetation were accounted for accurately by using actual sensor data at 1km spatial resolution
- In combination with other biophysical parameters (LAI, fPAR, NPP, etc…) these phenology metrics can be used to drive various Carbon, Ecosystem productivity models at the unprecedented 1km resolution

* For more information on this reliability index look at the poster "*MODIS VI Product Reliability Index: Improving The Quality Of Time Series Data", By Didan Kamel and Huete Alfredo.*

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