

(Updated on 03-Jul-2015)

OCM2 NDVI Filtered Product: Version-01

FOR BHUVAN NOEDA

SDAPSA

NATIONAL REMOTE SENSING CENTRE

Introduction

Fortnightly OCM2 NDVI/VF products are being generated operationally from NRSC since Jan-2012. To maximize the occurrence of clear sky pixels, NDVI products are generated for a 15 day period using maximum NDVI compositing technique. The products are delivered at a spatial resolution of 1080mts in Geotiff format with geographic projection. Spurious data still remain in case of Persistent cloud or other atmospheric effects during the compositing period.

As NDVI time series are cyclical and smooth in nature, It is assumed that sudden changes in the NDVI is not due to sudden changes in the target pixel and is assumed to be from atmosphere, clouds etc. So besides the operational NDVI/VF Products, a special processing based on both FASIR (Fourier adjustment of NDVI time series) and Cubic Spline methods to estimate and adjust the pixels contaminated by cloud in NDVI time series was carried out and all the data sets since 2012 were processed using this technique.

Methodology:

The Fourier Adjusted model works well for vegetation which follows a cyclical pattern. Each vegetative pixel was fit by the following equation:

$$\hat{Y}_i = \sum_{j=1}^m a_j \cos[(j - 1)\phi_i] + b_j \sin[(j - 1)\phi_i]$$

Where $\phi_i = 2\pi(i - 1)/n$ and a_j and b_j are Fourier Coefficients.

The variable n represents the number of data points, in our case it is 72 (no. of fortnights in 3 years) and m represents the number of harmonics.

To provide more robustness, a weighted approach (Sellers et al [1]) was also incorporated. Weights were added according to their distances from the fitted curve

2) For the features which are not following a sinusoidal cyclical pattern, in order to deliver a composite that models non-vegetative pixels too, a new algorithm was devised which would identify them and model them using a simple cubic spline.

File Naming Convention

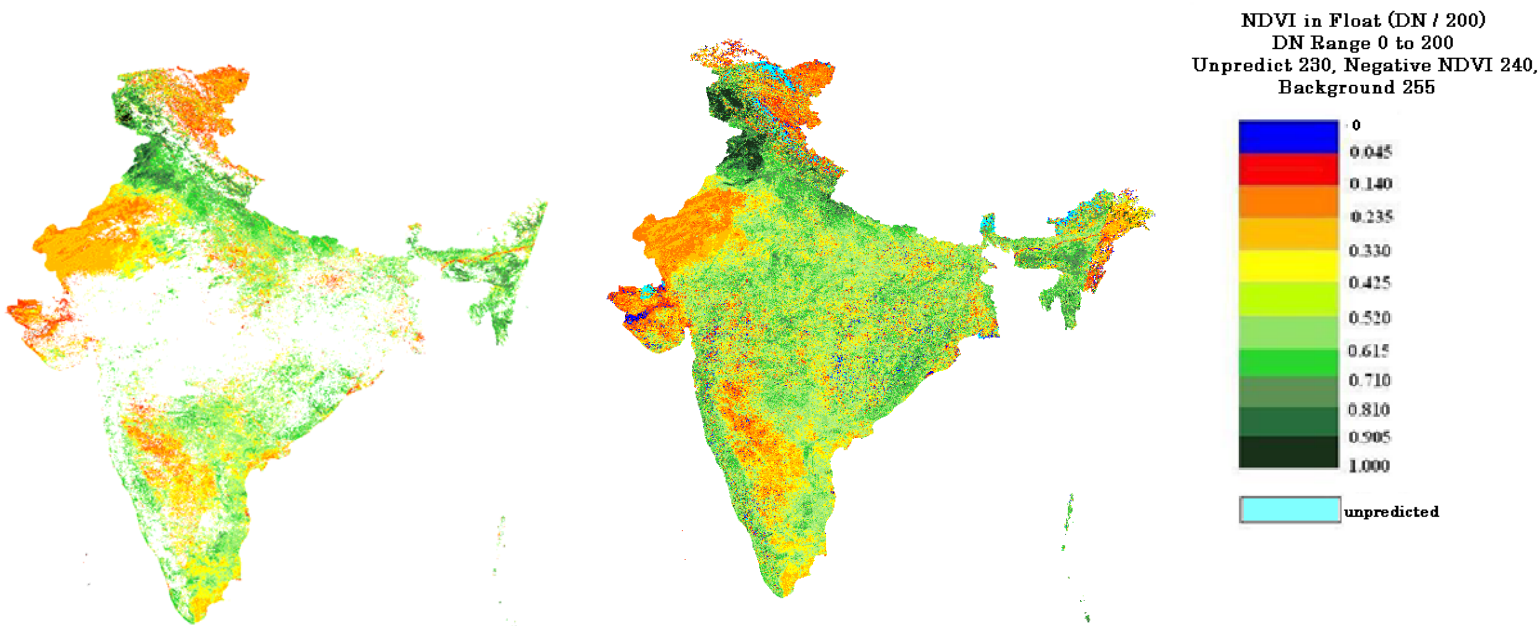
ocm2_ndvi_01to15_apr2012_v02_01.tif	: Original Fortnightly Product
ocm2_ndvi_filt_01to15_apr2012_v01_01.tif	: Filtered Fortnightly Product

Product Format specification:

- Image File Format : Geo TIFF
- Projection : Geographic coordinates (Lat., Long.)
- Datum : WGS-84
- Spatial Resolution : 1080m (0.01017 deg)
- Radiometric resolution : 8 bits per pixel
- Correction Level : precision corrected
- Number of bands : 1
- DN – NDVI conversion rule : $NDVI = (0.005 \times DN)$ (in float)
- Usable range of DN : 0 – 200
- Masked Label values : 230 (unpredicted value)
: 240 (NDVI less than 0)
- Image background : 255 (outside country boundary)

Results

All the pixels of fortnightly NDVI datasets from 2012 to 2014 were processed using the modified FASIR (FASIR + Spline) and new sets were generated . A significant improvement was observed in getting the pixels under the clouds over the original version. Following figure shows the original and filtered images



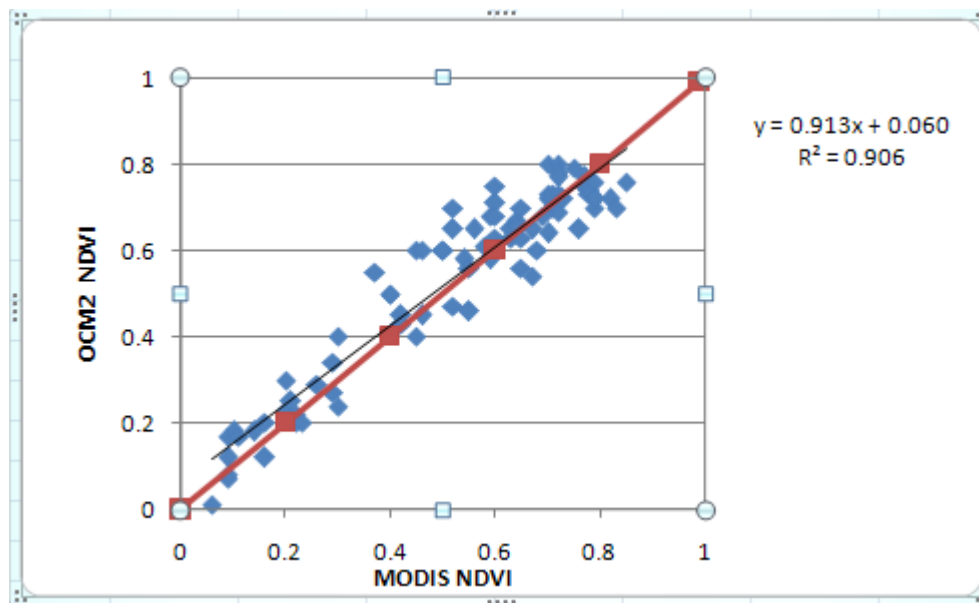
Original NDVI Image (Aug-2012)

Filtered NDVI Image (Aug-2012)

Cross Validation

A good overall correlation between Filtered and Original products was noticed (correlation ~ 90%). The root mean square error (RMSE) between these products is found to be 0.08, with an overall variation of the Filtered products with respect to Original NDVI data of about 8%.

Original data sets especially during monsoon period (Jul, Aug & Sep of 2012, 13, 14) could not be earlier generated due to persistent cloud all the time. Using these filtering technique those sets were also generated. Following plot shows the correlation between these sets with MODIS NDVI (MOD13A2) data.



Disclaimer

As each filtered NDVI product is modeled from long term NDVI time series, the filtered pixel value may differ from original value at some places.