Satellite Imgery in the fight against Malaria

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The analysis of multi-temporal data is a critical issue in the field of remote sensing and presents a constant challenge. The approach used here relies primarily on utilizing a method commonly used in statistics and signal processing: Empirical Orthogonal Function (EOF) analysis.

Normalized Difference Vegetation Index (NDVI) and Rainfall Estimate (RFE) satellite images pertaining to the Sub-Saharan Africa region were obtained. The NDVI images are derived from the Advanced Very High Resolution Radiometer (AVHRR) on the United States National Oceanic and Atmospheric Administration (NOAA) polar orbiting satellites, spanning from January 1999 to December 2004. The region of interest is restricted to the Limpopo Province (Northern Province) of South Africa.

EOF analyses of the space-time-intensity series of dekadal mean NDVI values was performed. They reveal that NDVI can be accurately approximated by its principal component time series and contains a near sinusoidal oscillation pattern. Peak greenness (essentially what NDVI measures) seasons last approximately 8 weeks. This oscillation period is very similar to that of Malaria cases reported in the same period, but lags behind by 4 dekads (about 40 days). EOF analysis of RFE isatellite imagery is carried out as well. Correlation analyses indicate that both Malaria and greenness appear to be dependant on rainfall, the onset of their seasonal 'highs' always following an arrival of rain. There is a greater delay to the arrival of a 'peak' of a greenness season compared to that of a Malaria season once the rains have arrived.

EOF analysis enables us to be able to easily compare climatic and environmental variables with Malaria cases, in a visually straightforward manner.

The ability to predict incidence of Malaria from remotely sensed data using intelligent-system techniques is also presented.