

Potential for early warning of Malaria in India using NOAA-AVHRR based vegetation health indices

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Malaria is still a major public health problem in India with about 1.82 million cases annually and 1000 deaths. As per World Health Organization (WHO) estimates, about 1.3 million Disability Adjusted Life Years (DALYs) are lost annually due to malaria in India. Central peninsular region of India is prone to malaria outbreaks. Meteorological parameters, changes in ecological conditions, development of resistance in mosquito vectors, development of resistance in *Plasmodium falciparum* parasite and lack of surveillance are the likely reasons of outbreaks. Based on satellite data and climatic factors, efforts have been made to develop Early Warning System (EWS) in Africa, but there is no headway in this regard in India. In order to find out the potential of NOAA satellite, AVHRR derived Vegetation Condition Index (VCI), Temperature Condition Index (TCI) and a cumulative indicator, Vegetation Health Index (VHI) were attempted to find out their potential for development of EWS. Studies were initiated by analysing epidemiological data of malaria vis-a-vis VCI, TCI and VHI from Bikaner and Jaisalmer districts of Rajasthan and Tumkur and Raichur districts of Karnataka. Correlation coefficients between VCI and monthly malaria cases for epidemic years were computed. Positive correlation (0.67) has been found with one-month lag between VCI and malaria incidence in respect of Tumkur while a negative correlation with TCI (-0.45) is observed. In Bikaner, VCI is found to be negatively related (-0.71) with malaria cases in epidemic year of 1994. Weekly satellite indicators from 36 to 39th week (i.e. September to November month) indicated maximum vegetation growth. The correlations between number of malaria cases departure from climatology (Dy) and estimated (EDy) have been found positive (0.60 for week 36 and 0.75 for week 39) in case of all the districts. Relationship between TCI and malaria incidence is found to be negative in most of the districts. Our results indicate that VCI may be used as a proxy for the development of EWS for malaria outbreaks.