



Assessment of Suspended Sediment Concentration of the Chilika Lake from NOAA-19 AVHRR Data

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A comprehensive analysis of sediment dynamics in the Chilika Lake have been carried out using in-situ observation and NOAA-19 AVHRR satellite data. The objective of the study was to monitor and analyze the spatiotemporal variability of suspended sediment concentration (SSC) and associated environmental forcing parameter in the Chilika Lake. Advanced Very High Radiometric Resolution (AVHRR) surface reflectance cloud free data was used to develop a SSC retrieval algorithm. AVHRR daily 1 km surface reflectance (NOAA-19) products were chosen, as it is atmospherically corrected and freely available, thus making them widely applicable for frequent monitoring of SSC. Three variants of Miller and McKee (2004) TSS model were recalibrated to establish the relationship between in-situ SSC and surface reflectance value in band 1 (R_{rs} at $0.63 \mu m$). A significant relationship ($R^2 = 0.73$) was obtained between in-situ SSC and AVHRR R_{rs} ($0.63 \mu m$) using a polynomial model. The other two models, linear and exponential showed comparatively low R^2 values i.e. 0.71 and 0.68 respectively. Accuracy of the models were assessed by comparing the in-situ measured SSC with AVHRR derived SSC. Based on R^2 values, validation analysis (RMSE = 21.36 mg/L) the polynomial model was found to be the best performing SSC model with an estimation range of 4.2 mg/L - 295 mg/L. The model was then implemented to derive pre and post-monsoon time-series SSC of Chilika Lake for the last 10 years (2009-2018). The seasonal and inter-sectoral variations in SSC distribution were observed in different sectors (northern, central, southern and outer channel) of the lake. It was found that the SSC variability is primarily driven by three factors: south-west monsoon effect (precipitation and runoff), wind-driven re-suspension of bottom and influx of river water into the lake. The relationship between AVHRR derived time-series SSC and meteorological parameters revealed that the variation of SSC in the northern sector is mainly correlated with precipitation and run-off during monsoon and post-monsoon season. Whereas, maximum amount of SSC found in southern sector is mainly due to wind induced re-suspension of bottom sediments. The analysis shows the significant impact of cyclone Phailin, which has the key role for rapid increase of SSC concentration in the lake in 2013. This is a comprehensive study to examine the long-term spatiotemporal variation of SSC of Chilika Lake during pre & post-monsoon season.

Keywords: NOAA-19 AVHRR, Phailin cyclone, Precipitation, Remote sensing reflectance, Run-off, Suspended sediment concentration