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研究论文

利用不同分辨率卫星影像的NDVI数据估算叶面积指数(LAI)——以岷江上游为例

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摘要 短周期的低分辨率遥感数据为大面积估算LAI及季节动态和物候趋势提供了有利工具，但基于高分辨率LAI的遥感估算模型在低分辨率遥感数据上应用有很大的不确定性。研究利用LAI-2000冠层分析仪与跟踪辐射和冠层结构测量仪(TRAC)，测定了岷江上游流域范围内490块野外调查样地（50m×50m样方）的LAI数据，结合同期较高精度卫星数据（TM）建立了不同植被类型的LAI-NDVI算法，在经过传感器的相对校正后，将这种算法应用到同期分辨率较低的MODIS数据和SPOT VEGETATION数据上。结果表明，30m 分辨率的TM LAI的均值为4.53,250m MODIS LAI的均值为3.55,1000m VGT LAI的均值为4.20,随着栅格分辨率的降低，总体标准差有增加的趋势，并且LAI值也有不同程度的低估，其中MODIS LAI值被低估约22%。但利用TM LAI数据验证MODIS 和VGT LAI数据后发现，250m的MODIS数据预测误差在30%左右,1000m的SPOT数据预测误差则高达50%，空间重采样分析表明，栅格分辨率的降低是导致预测误差扩大的主要原因，而这也是岷江流域植被分布破碎化的体现。

关键词 叶面积指数；岷江上游；归一化植被指数；TM；MODIS

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Derivation and validation of leaf area indes maps using NDVI data of different resolution satellite imageries

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Abstract Leaf area index(LAI) is an important vegetation structural parameter for quantitative analysis of many ecological and hydrological processes related to vegetation dynamics as well as phenological trends.Short Revisit period and coarse or medium-resolution satellite imageries(e.g.SPOT/VEGETATION and MODIS) demonstrate great potential in exploring large scale leaf area index(LAI),but the reliability is still unclear when LAI algorithms based on high-resolution satellite imageries applied to coarse-resolution imageries.Totally 490 plot-LAIs(50m×50m) were measured by using Tracing Radiation and Architecture of Canopies(TRAC) and LAI-2000 instruments in the upstream catchment of Minjiang river in SW China.Landsat Thematic Mapper(TM) scenes at 30m-resolution were used to calculate Normalized Difference Vegetation Index(NDVI) and locate ground sites.Seven land cover-specific NDVI-LAI converting algorithm were constructed by regression analysis.MOD NDVI products at 250m-resolution and 1000m resolution SPOT/VEGETATION NDVI were used to produce coarse-resolution LAI data.Since regions of the spectrum among the different sensors are not exactly the same,a mutual calibration among the sensors was first performed before they were used for TM LAI algorithms,and the acquisition date of TM data,VEGETATION and MOD NDVI data were constrained in the same month,i.e.July 2002,field measurements were carried out from 2002 to 2004 with the matching dates.The mean LA

I of the catchment derived from TM,MODIS and VEGETATION imageries are 4.53,3.55 an d 4.20 respectively.MODIS LAI,VEGETATION LAI images and those in the matching TM sce nes were compared,TM LAI map is much better correlated to MODIS LAI than to VEGETATI ON LAI.With the decreasing of the spatial resolution,the LAI was likely to be underestimated,i n particular,MODIS LAI was underestimated by 22%.It is possible to use MODIS 250m-resolut ion imagery to map LAI distribution with acceptable error of approximately 30%,but 1000m-reso lution VEGETATION imagery causes considerable error of 50%.Comparisons of LAI values o f different-resolution resampled from TM 30m pixels indicate that it is major cause of scaling error s when aggregate map from high-resolution to coarse-resolution.We speculate that it is a likely res ult of landscape fragmentation of this area.

Key words leaf area index _ upstream of minjiang catchment _ normalized diffe rence vegetation index _ TM _ MODIS

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