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研究论文

植被叶面积指数遥感反演的尺度效应及空间变异性

陈健[1],倪绍祥[1,*]，李静静[2]，吴彤[1]

1.南京师范大学地理科学学院，南京 210097

2. 南京信息工程大学计算机科学与技术系，南京 210044

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摘要 遥感作为宏观生态学研究中数据获取的一种便捷手段，有助于把握较大尺度内生态学现象的特征。应用遥感数据反演*LAI*时，由于像元的异质性，不同尺度遥感数据之间的转换是遥感发展的一个重要问题。以河北省黄骅市为研究区，在利用TM和MODIS遥感数据对芦苇*LAI*反演误差产生原因进行分析的基础上，利用半变异函数对像元空间异质性进行了定量描述。发现NDVI算法的非线性带给*LAI*尺度转换的误差很小，而*LAI*的空间异质性则是引起*LAI*尺度效应的根本原因。并且当像元内空间异质性很大时半变异函数的基台值比纯像元要大得多，空间自相关的程度是引起LAI尺度转换误差的主要原因；反之，像元内空间异质性不大时，随机误差是引起*LAI*尺度转换误差的主要原因。当像元为纯像元时，由像元异质性引起的反演误差基本可以忽略。此外，研究区芦苇的空间相关有效尺度约为360m，超过此距离空间相关性则不复存在

关键词 叶面积指数；尺度效应；半变异函数；异质性

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Scaling effect and spatial variability in retrieval of vegetation LAI from remotely sensed data

CHEN Jian[1], NI Shao-Xiang[1,*] , LI Jing-Jing[2],WU Tong[1]

1.College of Geographical Science, Nanjing Normal University, Nanjing 210097, China; 2.Department of Computerscience & Technology, Nanjing University of Information Science & Technology , Nanjing 210044, China

Abstract As one kind of the means for data acquiring in macroscopic ecology, remote sensing has an ability to grasp features of the ecological phenomena on larger scale. In deriving Leaf Area Index (LAI) from remotely sensed data, the transformation of the remotely sensed data from one kind of resolution to another has become a significant problem because of the heterogeneity in pixel. In this paper, based on an analysis of the reasons for error appearing in LAI retrieval, the spatial heterogeneity in pixel was described by semivariogram. Taking the city of Huanghua in Hebei province as the study area and using TM and MODIS data, this paper explores the scaling effect in the retrieving reeds LAI. Firstly, the LAI image with 30m scale was retrieved from the TM image data based on the statistic model. Then, seven test plots were selected from the LAI image. Each plot is different in reeds coverage, and the smaller reeds coverage in pixel the lager heterogeneity within it. Following this step, the reeds LAI on the MODIS scale (990m by 990m) were obtained for the seven plots using the method of spatial transformation, and the reason for error appeared in the LAI retrieval was explored. Finally, the semivariogram model of reeds coverage was developed through the analysis on the semivariograms of these plots.The following conclusions were obtained from this study: (1) The scaling problem appeared in deriving the parameters on ground surface stems from not only the non-linearity of algorithm for normalized difference vegetation index (NDVI), but also the spatial heterogeneity within pixel. The variation in LAI error depends mainly on the degree of heterogeneity of ground surface. It was found that a small error (less than 0.08) is from the nonlinearity of the algorithm for NDVI and, however, the spatial heterogeneity of LAI is the fundamental factor for giving rise to the scaling effect in LAI. (2) In the study area, the spatial heterogeneity of reeds is caused by both the random element and the extent of spatial auto-correlation. These factors can be described by the parameters of semivariogram, i.e., nugg

et and sill. If the pixel is dominated by reeds in coverage the major reason causing the spatial hete rogeneity is the extent of spatial auto-correlation; and if the pixel is a mixed one in cover, the spati al heterogeneity resulted from random factor increases as reeds coverage decreases.(3) In a pur e pixel, little variation was found between the 30m and 60m scale, which means that the scaling pr oblem for pure pixels may be ignored. However, while the degree of heterogeneity within a pixel i ncreases the spatial heterogeneity in the pixel with larger scale may be somewhat hided compare d with the pixel with smaller scale.(4) Results also showed that valid spatial auto-correlation scal e of reeds in the study area is within 360m.

Key words Leaf Area Index (LAI) _ scaling effect _ semivariogram _ heterogenei ty

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通讯作者 倪绍祥 sxni@njnu.edu.cn