

产流积水法测量坡地降雨入渗动态过程及其精度估计

Dynamics of soil infiltrability of sloped lands under rainfall conditions measured with runoff-ponding method and the accuracy estimations

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中文摘要:

坡地土壤的降雨入渗性能对于水文过程、土壤侵蚀、水资源相关方面的研究和实践非常重要。产流积水法采用由实验得到的数据,分析了不同坡位土壤入渗率及累积入渗量随降雨时间的变化过程。结果表明不同坡位入渗过程曲线反映了坡面径流到达前后,实际入渗率从降雨强度控制阶段跃升到入渗性能控制阶段,并最终趋于稳定入渗率的全过程。入渗区不同坡位的累积入渗量从坡顶至坡底逐渐减少,而且径流在坡面上推进速度越快不同坡位上的累积入渗量差值越小。通过理论分析,确定了观测径流推进距离误差所引起的测量结果的误差。用水量平衡原理对产流积水法实验结果进行精度估计,并提出了由实测入渗率求入渗水量的解析方法,并将此与实际降雨量进行比较,间接地估计了测量结果的精度。结果表明,产流积水法测量坡地降雨/径流入渗性能具有很高的精度。

英文摘要:

The soil infiltrability of sloped lands is of great importance to such studies and practices as hydrological process, soil erosion and water resources. The Runoff-Ponding Method is capable to the complete soil infiltrability process of sloped lands under rainfall conditions, which conceptually well represent the real processes of soil infiltrability and has not been possible with the traditional methods. In this study, the experimental data were used to illustrate the temporal functions of soil infiltration rates and cumulative infiltrations. The result indicated that the infiltration rates at slope locations well represented the transition of infiltration process from rainfall-controlled to infiltrability-controlled and eventually to steady infiltration stages. The cumulative infiltration volumes gradually reduced from the top to the lower slope locations, with lowered difference in infiltrated amount along the slope under faster runoff advances on the surface. Theoretical analysis was made to determine the error in measured infiltration rate as affected by the error in measured distance of the runoff advance. Water balance was used to estimate the overall measurement accuracy. An analytical integration method was advanced to compute the cumulative infiltration which in turn was used to indirectly estimate the measurement accuracy of the method. The results indicate a very high accuracy of the method for infiltrability measurement. This study will supply a reference basis for this method to be used in researches such as hydrology, soil erosion as well as water resources.

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