An Introduction of USDA UV-B Radiation Monitoring Program and A Geometric UV-B Radiation Transfer Model Applied to Agricultural Vegetation Canopies

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Program Objectives

The USDA UV-B Radiation Monitoring Program is a program of the US Department of Agriculture's Cooperative State Research, Education and Extension Service (CSREES). The program was initiated in 1992, through a grant to Colorado State University, to provide information on the geographical distribution and temporal trends of UV-B radiation in the United States. This information is critical to the assessment of the potential impacts of increasing ultraviolet radiation levels on agricultural crops and forests. Specifically, the monitoring program provides information to the agricultural community and others about the climatological and geographical distribution of UV-B radiation.

The Climatological Network

The climatology of UV-B radiation is obtained from the USDA UV-B Radiation Monitoring Program. The program is designed to provide a database of high temporal and spatial resolution measurements to assess the potential impact of increasing UV-B radiation on agriculture. The network consists of 24 sites located in various regions across the United States, including agricultural areas and forested regions. The sites are selected to provide a comprehensive picture of UV-B radiation levels across the country.

Introduction

The most important wavelengths for assessment of potential plant damage due to increased UV-B radiation are in the UV-B region (290-320 nm). This region is characterized by its ability to penetrate into the plant canopy and has significant impact on plant growth and development.

The Theory of UV Radiation Transfer Model

The 3-D UVR model is an advanced model developed by the USDA UV-B Radiation Monitoring Program. The model uses a radiative transfer approach to simulate the distribution of UV-B radiation in the canopy. The model takes into account the physical and chemical properties of the canopy, including the leaf area index, plant density, and the reflectance properties of the canopy.

The Theory of UV Radiation Transfer Model

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Measurements

The accuracy of the 3-D UVR model in predicting the UV-B radiation on sunlit and shaded areas in agricultural canopies was evaluated using field measurements. The model predictions were compared with measured UV-B radiation levels in sunlit and shaded areas in the canopy.

Results and Discussion

The results of the study showed a good agreement between the model predictions and the measured UV-B radiation levels. The model was able to accurately predict the UV-B radiation levels in sunlit and shaded areas in the canopy.

Conclusions

A 3-Dimensional model was developed to predict the UV-B radiation levels in the canopy. The model was validated using field measurements in open canopies of different locations. The model predictions were in good agreement with the measured UV-B radiation levels in sunlit and shaded areas in the canopy.

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