CLASSIFICATION OF VEGETATION TYPE USING SPECTRAL INVARIANT PARAMETERS

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1. ABSTRACT

Global changes in vegetation characteristics are an indication of the effects of human interaction and natural disturbances due to climate change. The most notable changes are occurring in species composition. These changes impact the radiation regime in the canopy as well as effect the habitat for animal species. It is important to understand what impact these will have and where these changes will occur. A classification of forest types has been produced based on the scattering characteristics within the forest canopy. The scattering processes are described by the spectral invariants of the radiative transfer theory. The spectral invariants, recollision and escape probabilities, explain the effect that canopy structural hierarchy has on the bidirectional reflectance factor (BRF). The objective of the research is to extract variables of structure such as forest type composition from products of the spectral invariants. The spectral invariants allow for information about the hierarchical arrangement of a landscape. The recollision probability is the probability that a photon that has been intercepted by a phytoelement will recollide inside the canopy (hierarchical level) again.

The recollision probability gives you information about the complexity of the arrangement of structure in a vegetated pixel. The escape probability is the probability that a photon, which has been intercepted by a phytoelement will escape the canopy (hierarchical level). The escape probability is sensitive to the dominant geometrical shape (described by the aspect ratio) of the scale of the vegetation at which measurements are taken. The spectral invariant parameters can be retrieved from measured spectral data and has been retrieved from hyperspectral data such as AVIRIS. The potential to separate forest type using spectral invariant parameters is evident. Previous [1] and current research shows that given the ability of spectral invariants to categorize landscapes based on hierarchical levels, forest types can be separated. Here we show that the recollision probability can delineate between needleleaf and broadleaf forest types given the same effective LAI. Since the recollision probability tells about the multiple scattering in the canopy, we have found that the recollision probability is sensitive to hierarchal levels of canopy structure. Given the fact that needle leafs have 1 more hierarchal level (needles within the shoot as apposed to a flat leaf) there is more scattering within a needleleaf than a broadleaf forest for the same effective LAI allowing for separation between forest types. Promising results were attained yielding a high level of confidence by simply applying a threshold of escape probability in the nadir direction calculated from AVIRIS hyperspectral data. The results are shown for AVIRIS campaigns in the Northeast region of the US flown in August of 2003.

The methodology has shown promise in agriculture as well, using ESA's multi-angular hyperspectral sensor, CHRIS-Proba. The result indicates that using the same methodology, crops show that canopy structure effect the BRF and thus we can separate crop types with different hierarchical levels (corn, alfalfa, beans… etc.,). The results are shown for Proba/CHRIS data over Barrax test site, situated within La Mancha Autonomous Community about 20 km from Albacete, Spain (30°3'N, 2° 6' W). Field LAI measurements were taken simultaneously as part of the SPARC July, 2004 campaign.These guidelines include complete descriptions of the fonts, spacing, and related information for producing your abstracts. it is suggested to follow them and if you have any questions, direct them to Conference Management Services: Phone +1-979-846-6800 or Fax +1-979-846-6900 or email: papers@igarss08.org.

2. REFERENCES

[1] Rautiainen, M., and Stenberg, P. (2005). Application of photon recollision probability in coniferous canopy reflectance model. Remote Sensing of Environment, 96, 98–107.