Analysis of topographic effects on global surface BRDF/Albedo

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Abstract

Analysis of topographic effects on global surface BRDF/Albedo Shengbiao Wu1,2 Jianguang Wen1,2 1Institute of Remote Sensing and Digital Earth, CAS, Beijing, 100101, China 2University of Chinese Academy of Sciences, Beijing, 100049, China Abstract: Rugged terrain significantly impacts surface reflectance anisotropy as it incurs variations in the illumination and viewing geometry, as well as the incoming irradiance. An accurate knowledge of such variation is crucial to improve the understanding land surface process and Earth's surface radiation budget. To analyze the topographic effects on global-scale surface BRDF/Albedo, the 500 m moderate resolution imaging spectroradiometer (MODIS) daily global BRDF/Albedo Model Parameter (MCD43A1, collection 6) and MCD43A3 Albedo products, 30 m resolution Advanced Spaceborne Thermal Emission and Reflection Radiometer Global Digital Elevation (ASTER GDEM, version 2), and 500 m MODIS Land Cover Type product (MCD12Q1, collection 6) from 2000-2016 were used. The topographic characteristic (e.g., slope, aspect, sky view factor) that extracted from ASTER GDEM datasets were used to statistic surface BRDF/Albedo of different land cover types under different topography conditions. The primarily results in Figure 1-3 show that surface BRF/Albedo is significantly decreased with the mean slope angles due to the increased topographic shadow. As the mean slope increases from 0° to 60°, the maximum value of grassland red (near-infrared: NIR) BRF decreases from 0.15 (0.35) to 0.10 (0.20), evergreen broadleaf red (NIR) BRF decrease from 0.04(0.45) to 0.03(0.40). Moreover, the grassland average shortwave black-sky (white-sky) albedo decreases from 0.17 (0.18) to 0.12 (0.14), and the evergreen broadleaf average shortwave black-sky (white-sky) albedo decreases from 0.13 (0.15) to 0.11 (0.13). Fig. 1. Topographic effects on grassland BRF of h26v05 and h26v06 on DOY 245, 2016. (a) 0°-10°. (b). 10°-20°. (c). 20°-30°. (d). 30°-40°. (e). 40°-50°. (f). [?]50deg Fig. 2. Topographic effects on evergreen broadleaf forest BRF of h26v05 and h26v06 on DOY 245, 2016. (a) 0deg-10deg. (b). 10deg-20deg. (c). 20deg-30deg. (d). 30deg-40deg. (e). 40deg-50deg. (f). 50deg Fig. 3. Topographic effects on black-sky and white-sky albedos of grassland and evergreen broadleaf forest of h26v05 and h26v06 on DOY 245, 2016

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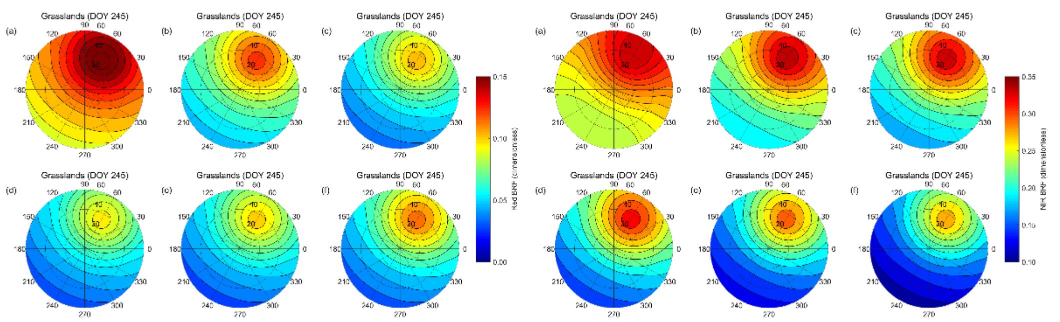
Abstract:

Rugged terrain significantly impacts surface reflectance anisotropy as it incurs variations in the illumination and viewing geometry, as well as the incoming irradiance. An accurate knowledge of such variation is crucial to improve the understanding land surface process and Earth's surface radiation budget. To analyze the topographic effects on global-scale surface BRDF/Albedo, the 500 m moderate resolution imaging spectroradiometer (MODIS) daily global BRDF/Albedo Model Parameter (MCD43A1, collection 6) and MCD43A3 Albedo products, 30 m resolution Advanced Spaceborne Thermal Emission and Reflection Radiometer Global Digital Elevation (ASTER GDEM, version 2), and 500 m MODIS Land Cover Type product (MCD12Q1, collection 6) from 2000-2016 were used. The topographic characteristic (e.g., slope, aspect, sky view factor) that extracted from ASTER GDEM datasets were used to statistic surface BRDF/Albedo of different land cover types under different topography conditions. The primarily results in Figure 1-3 show that surface BRF/Albedo is significantly decreased with the mean slope angles due to the increased topographic shadow. As the mean slope increases from 0° to 60°, the maximum value of grassland red (near-infrared: NIR) BRF decreases from 0.15 (0.35) to 0.10 (0.20), evergreen broadleaf red (NIR) BRF decrease from 0.04(0.45) to 0.03(0.40). Moreover, the grassland average shortwave black-sky (white-sky) albedo decreases from 0.17 (0.18) to 0.12 (0.14), and the evergreen broadleaf average shortwave black-sky (white-sky) albedo decreases from 0.13 (0.15) to 0.11 (0.13).



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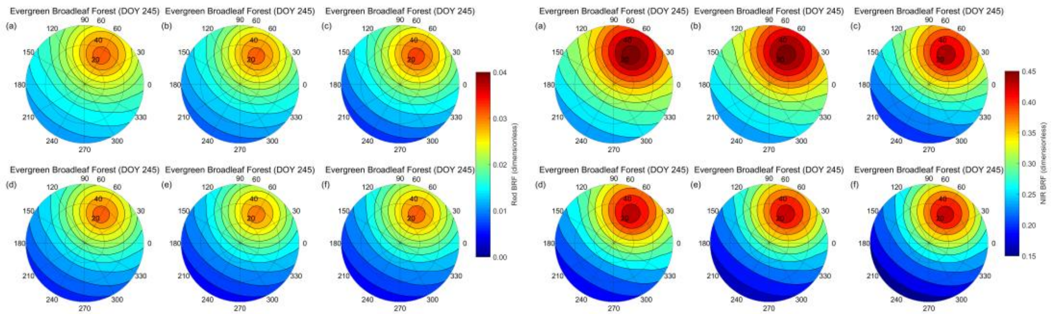

Fig. 2. Topographic effects on evergreen broadleaf forest BRF of h26v05 and h26v06 on DOY 245, 2016. (a) 0°-10°. (b). 10°-20°. (c). 20°-30°. (d). 30°-40°. (e). 40°-50°. (f). ≥50°

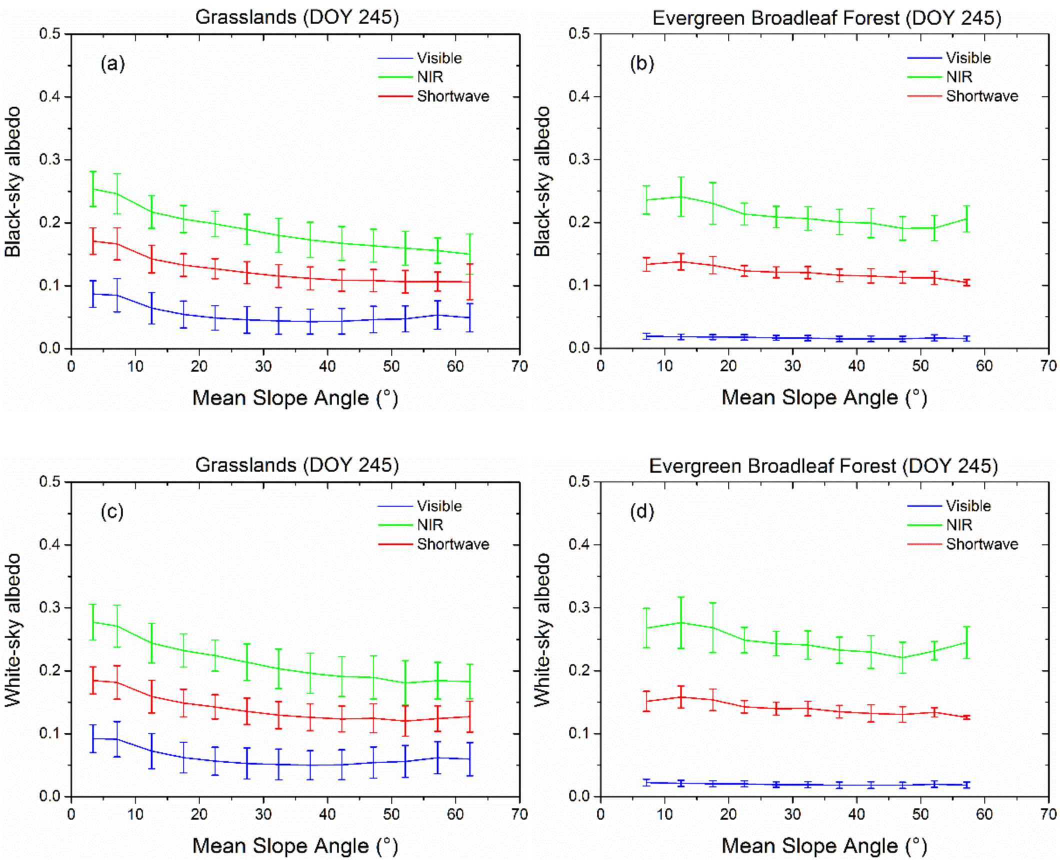

Fig. 3. Topographic effects on black-sky and white-sky albedos of grassland and evergreen broadleaf forest of h26v05 and h26v06 on DOY 245, 2016