Rooting Depth and Plant Hydraulic Resistance Proxy Products

Product description

The rooting depth (Z_r) and plant hydraulic resistance (R_{plant}) proxy products are developed based on the daily microwave vegetation optical depth (VOD) from AMSR-E and AMSR2 (Du et al., 2017) over 2002-2011. The R_{plant} is the reciprocal of the plant hydraulic conductance (K_{plant}, $R_{plant} = 1/K_{plant}$). The two products are static, and are at a spatial resolution of 0.25-degree, and the desert area is masked out (i.e., no data). The spatial pattern of the Z_r proxy is compared against other available Z_r products in Figure 1, and that of the R_{plant} proxy is presented in Figure 2. Note that both the Z_r and R_{plant} proxy are just surrogates of the rooting depth and plant hydraulic resistance, respectively, rather than actual values. Therefore, they may not match *in-situ* observations well (could be at different magnitudes), but they overall preserve the spatial variations across the globe.

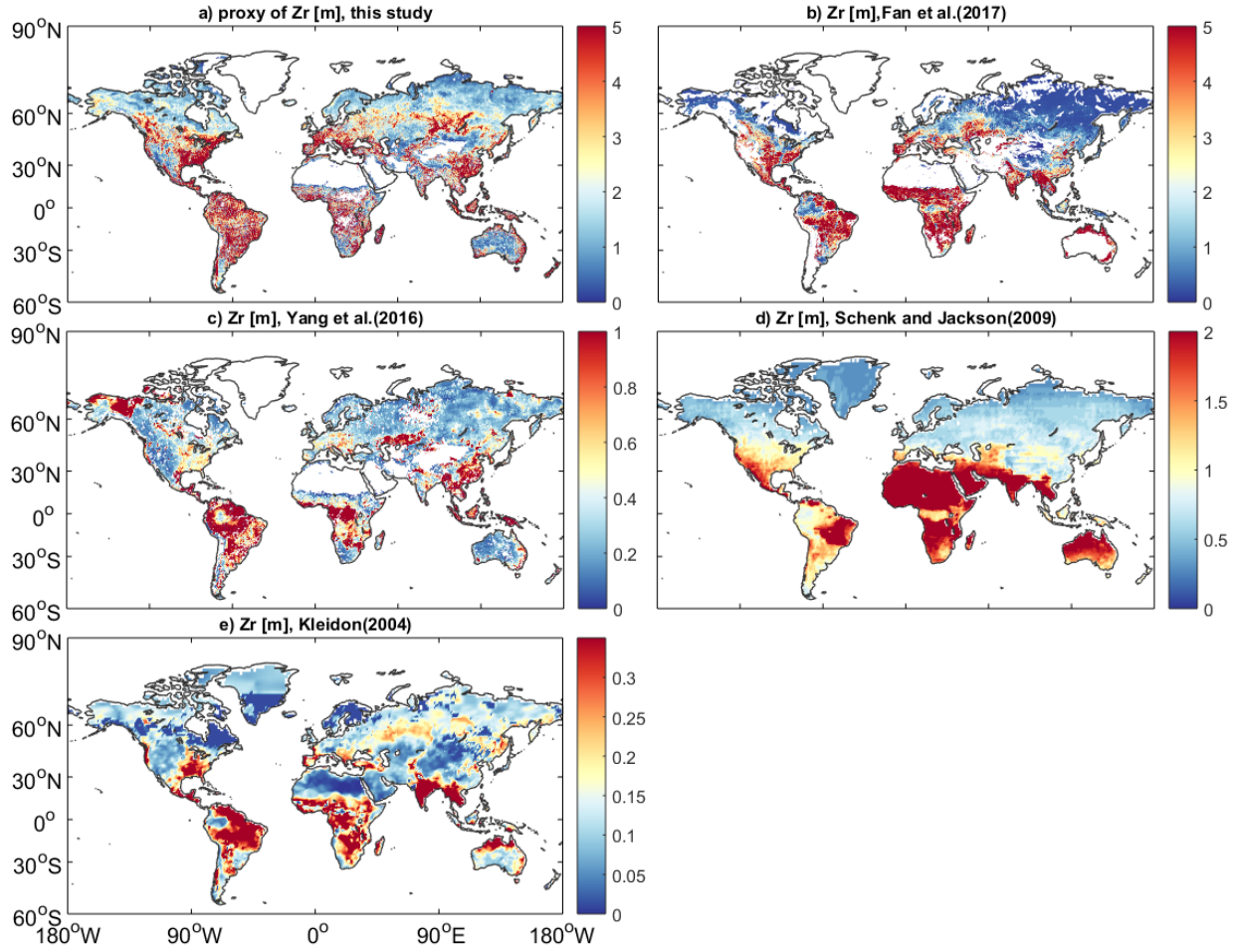

Figure 1 Spatial variations of rooting depth (Z_r) from different sources: a) proxy of Z_r derived from this study assuming linear relationship between soil water content and soil water potential; b) effective Z_r from Fan et al. (2017); c) effective Z_r from Yang et al. (2016); d) soil depth containing 95% of all roots (Schenk and Jackson, 2009); and e) hydrological depth of rooting zone in mm H_2O of plant-available water inferred from assimilation of satellite-derived absorbed photosynthetically active radiation (Kleidon, 2004).

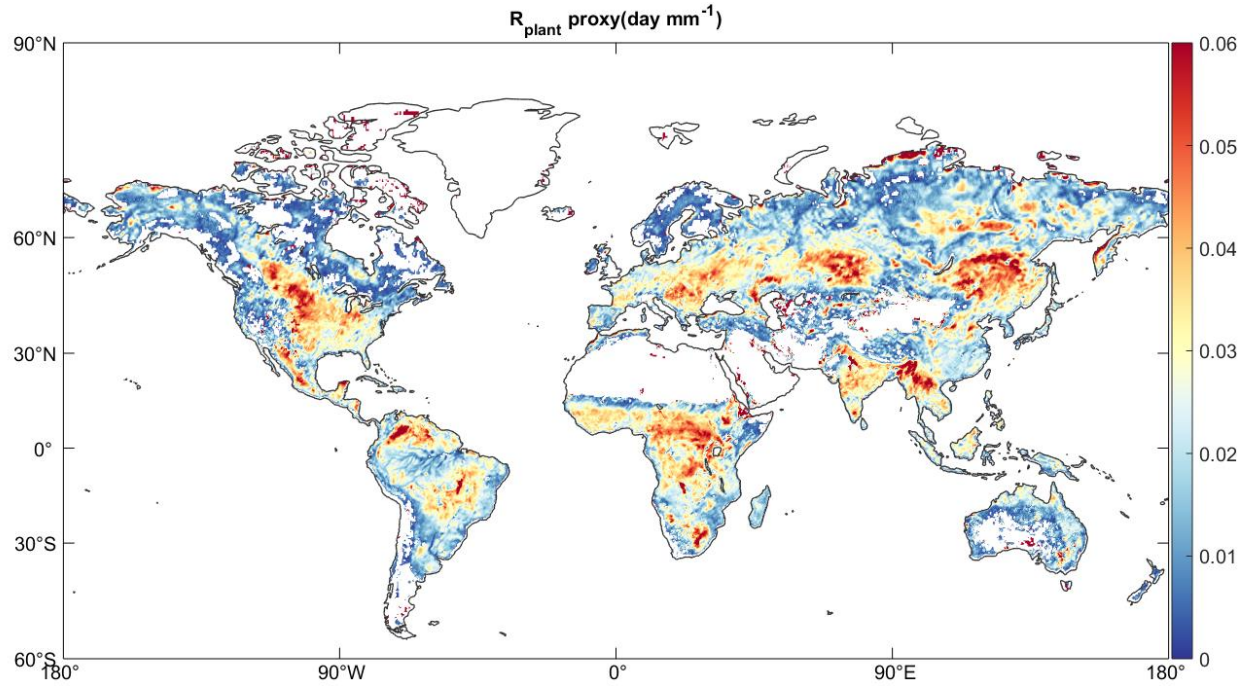

Figure 2 Spatial pattern of R_{plant} proxy.

File Format

This products are provided in the format of Matlab data files. It includes three files:

1) Z_r.mat, which contains the rooting depth proxy data (m).
2) R_{plant}.mat, which contains the plant hydraulic resistance proxy data (day mm^{-1}).
3) latlon.mat, which contains the corresponding coordinates, where the first and second column represents latitude and longitude, respectively.

Acknowledgement

This research is supported by the Modeling, Analysis, Predictions and Projections (MAPP) program of NOAA NA17OAR4310127 and NASA NNH17ZDA00IN-THP to P.G. and A.G.K., A.G.K was also partially supported by NASA Terrestrial Ecology award 80NSSC18K0715 through the New Investigator Program.

Data Usage and Citation

The rooting depth and plant hydraulic resistance proxy products are freely available for any non-commercial application. Redistribution of these data without prior permission from the developers is prohibited. Developers request to be contacted and invited to collaborate in any research study that uses the products here so they can provide guidance as they have the best knowledge of the products.

Users are asked to cite the following publication when using these products:

Liu, Y., Konings, A.G., Kennedy, D., and Gentine, P., Global coordination in plant physiological and rooting strategies in response to water stress, *Global Biogeochemical Cycles*., in review.

Contact

All questions related to the rooting depth and plant resistance proxy products should be directed to the developer Dr. Yaling Liu (cauliuyaling@gmail.com) or the research group lead Prof. Pierre Gentine (pg2328@columbia.edu).

References

Du, J., Kimball, J. S., Jones, L. A., Kim, Y., Glassy, J. M., & Watts, J. D. (2017), A global satellite environmental data record derived from AMSR-E and AMSR2 microwave Earth observations, *Earth System Science Data*, 9, 791.

Fan, Y., Miguez-Macho, G., Jobbágy, E. G., Jackson, R. B., & Otero-Casal, C. (2017), Hydrologic regulation of plant rooting depth, *Proceedings of the National Academy of Sciences*, 201712381.

Kleidon, A. (2004), Global datasets of rooting zone depth inferred from inverse methods, *Journal of Climate*, *17*(13), 2714-2722.

Schenk, H., Jackson, R., Hall, F., Collatz, G., Meeson, B., Los, S., Brown De Colstoun, E., & Landis, D. (2009), Islscp ii ecosystem rooting depths, *ORNL DAAC*.

Yang, Y., Donohue, R. J., & McVicar, T. R. (2016), Global estimation of effective plant rooting depth: Implications for hydrological modeling, *Water Resources Research*, *52*(10), 8260-8276.