Figure S1: Performance (R²) of the random forest (RF, two upper plots) and generalized additive models (GAM, two lower plots) in predicting VOD of different wavelengths on an 8-daily (first and third plot) and monthly data basis (second and fourth plot). The global model uses PFTs as predictors, contrary to the land cover-specific models, which were calibrated and applied only to the spatial extent of a certain dominant land cover class. 'Global model (land cover)' uses results of the global model, but filtered by dominant land cover class.

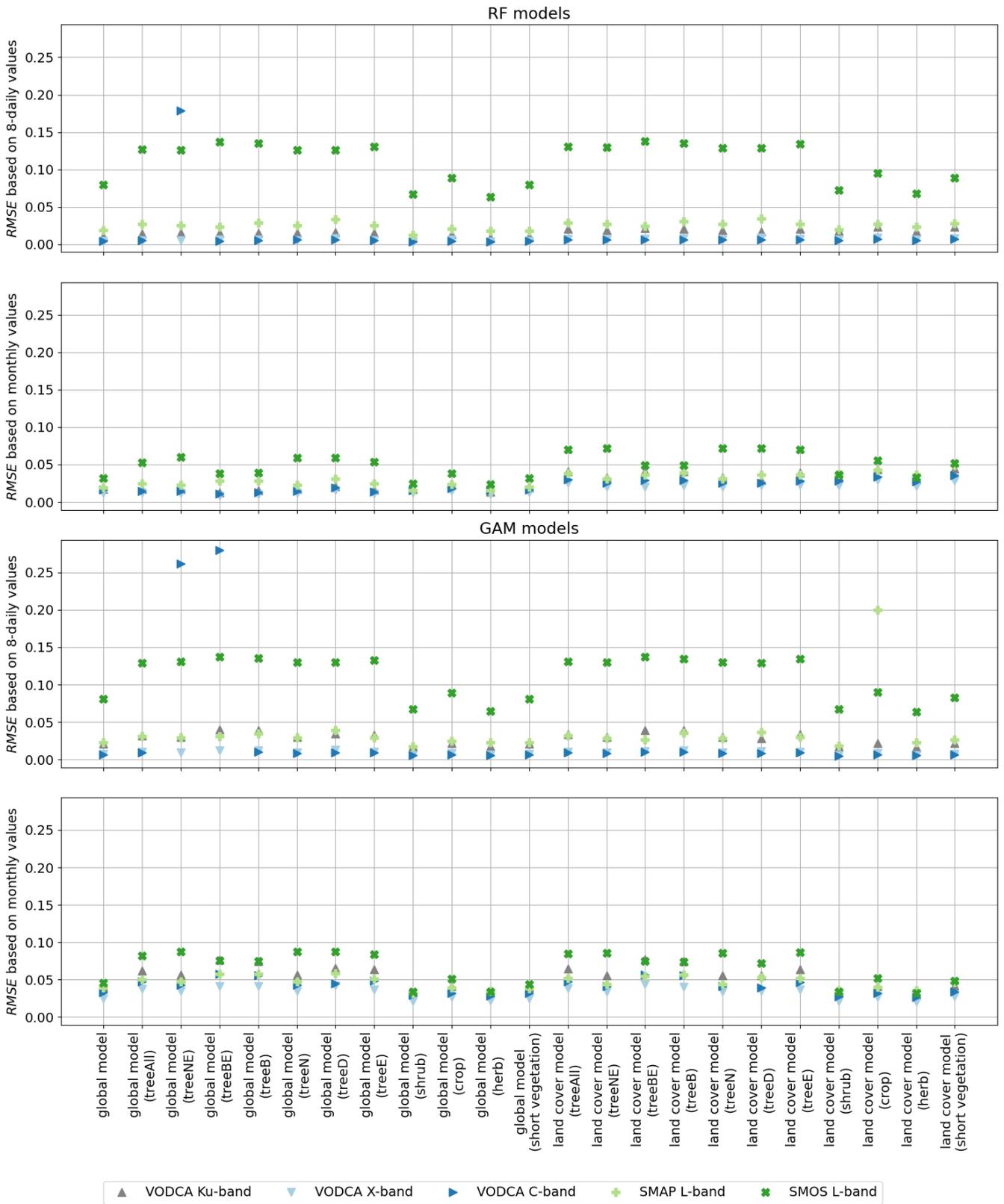
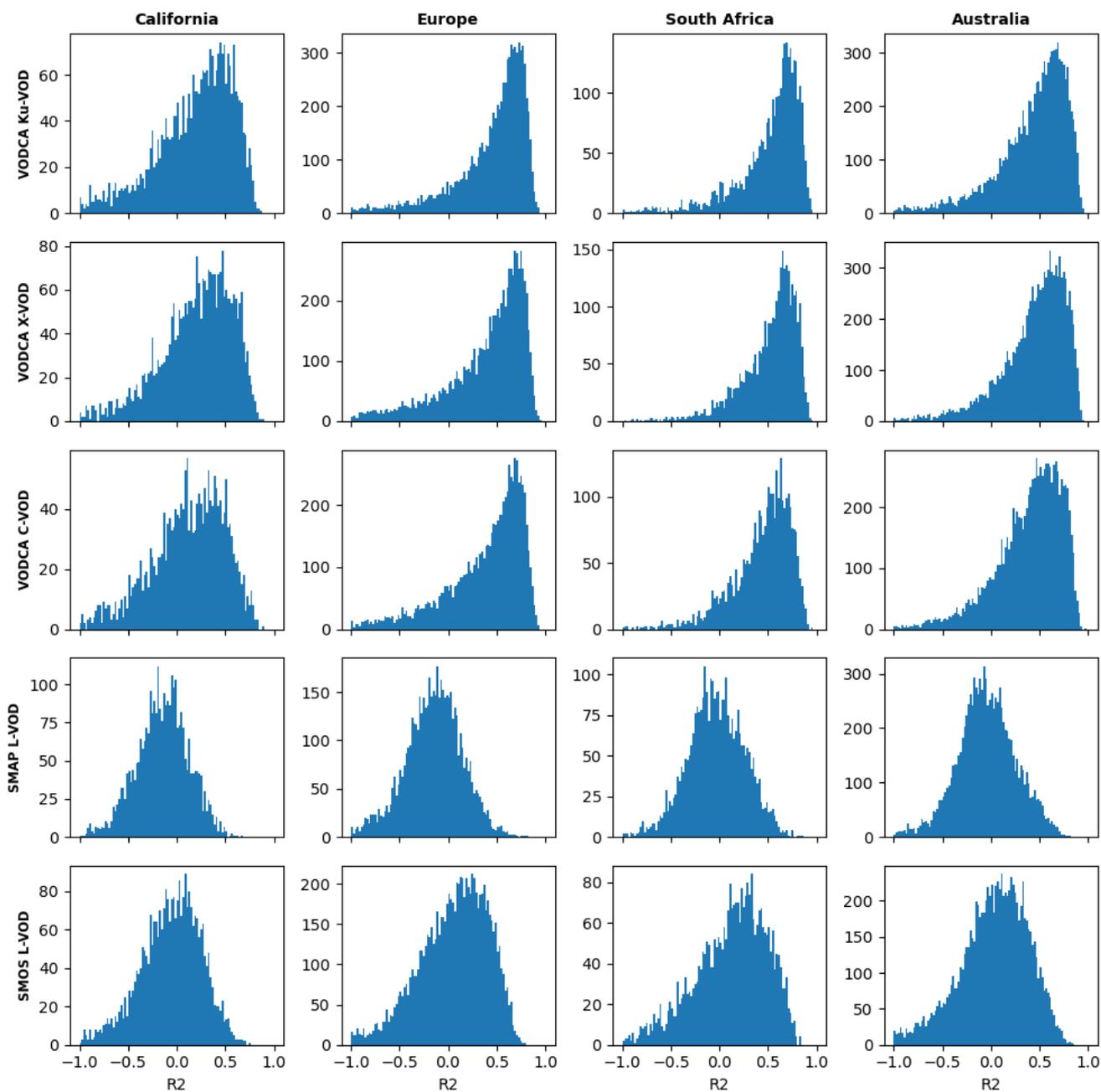



Figure S2: Performance (RMSE) of the random forest (RF, two upper plots) and generalized additive models (GAM, two lower plots) in predicting VOD of different wavelengths on an 8-daily (first and third plot) and monthly data basis (second and fourth plot). The global model uses PFTs as predictors, contrary to the land cover-specific models, which were calibrated and applied only to the spatial extent of a certain dominant land cover class. 'Global model (land cover)' uses results of the global model, but filtered by dominant land cover class.

15   **Figure S3: Histograms of the performance (R^2 in the figure noted as R2) of the global random forest model based on monthly values per pixel (i.e. of the time series per pixel) for the four regions (columns) and VOD dataset (rows)**

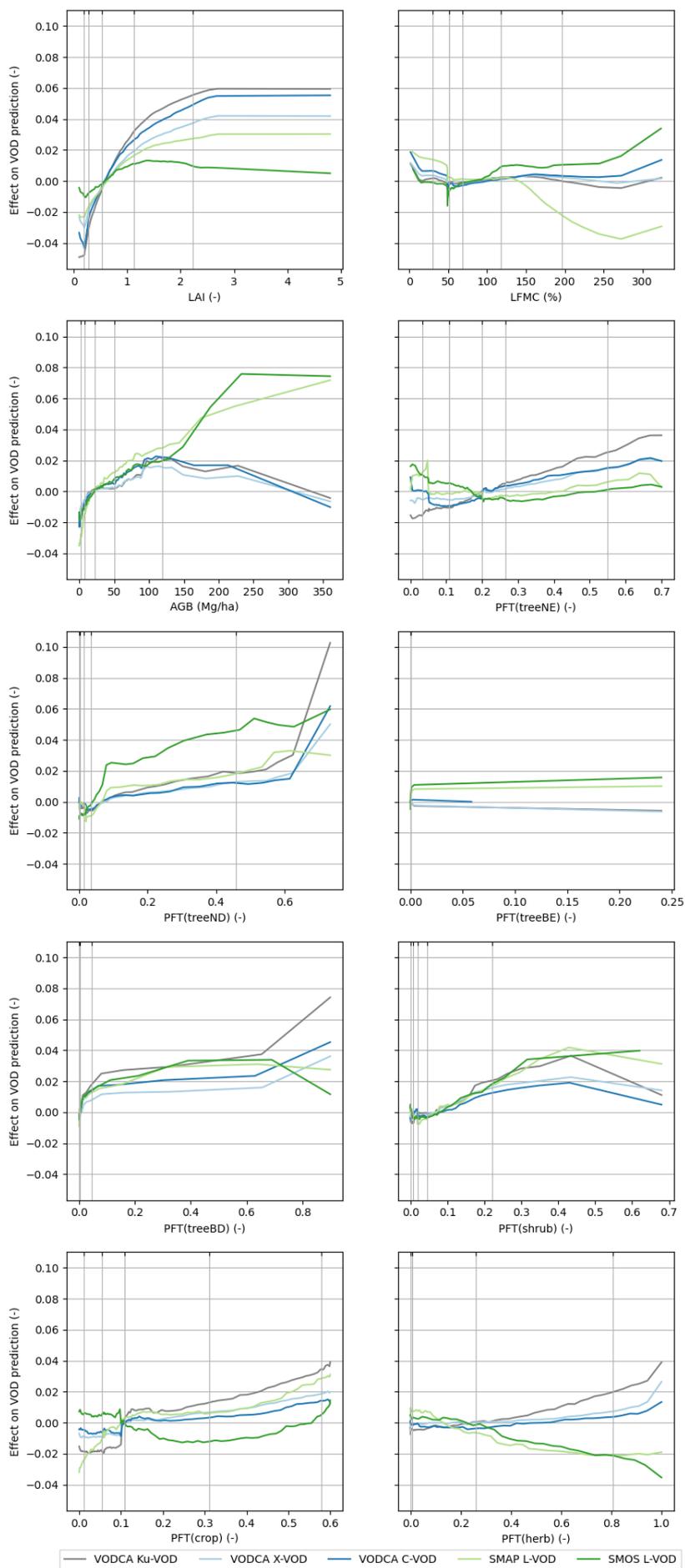



Figure S4: ALE plots of normalised VOD to ecosystem properties based on the global monthly RF model for all predictors with PFT = plant functional type, N = needleleaf, B = broadleaf, E = evergreen, D = deciduous. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.

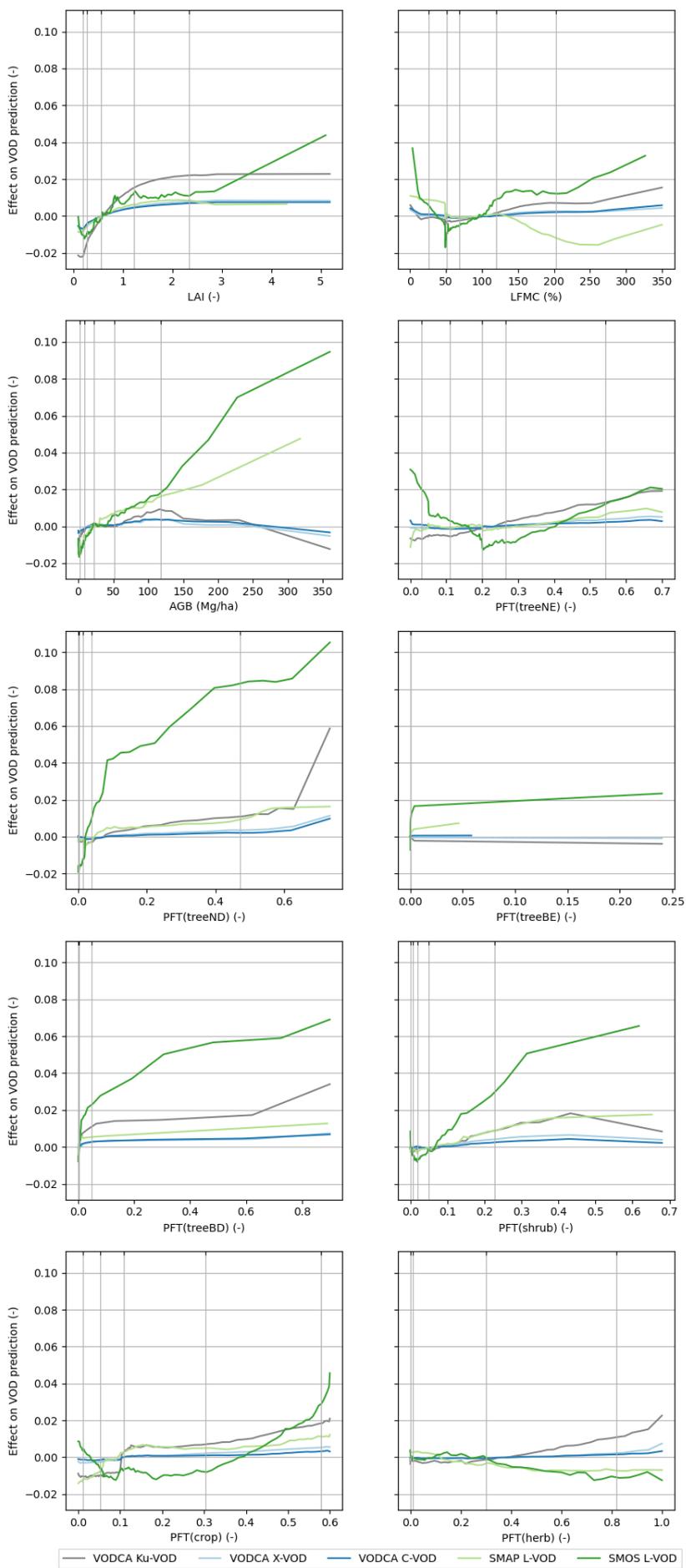



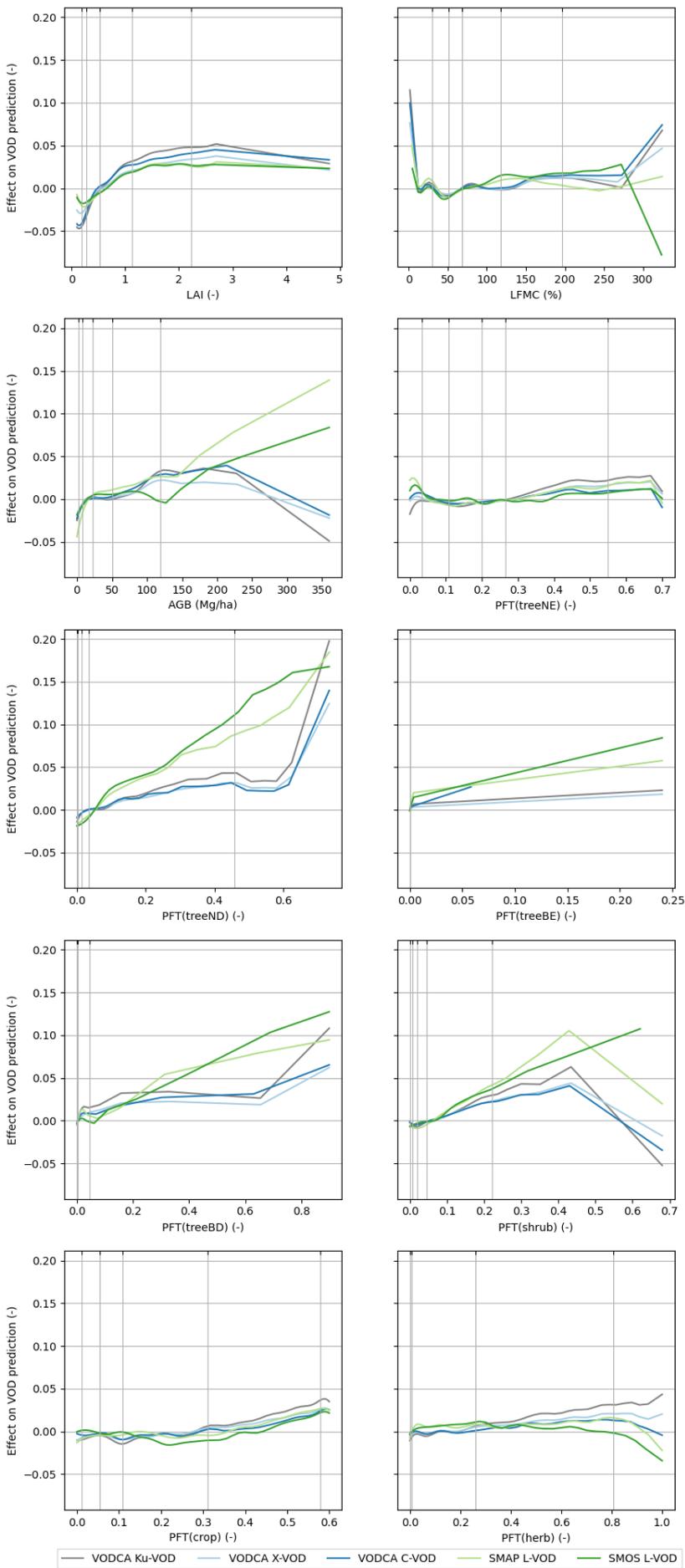
Figure S5:ALE plots of normalised VOD to ecosystem properties based on the global 8-daily RF model for all predictors with PFT = plant functional type, N = needleleaf, B = broadleaf, E = evergreen, D = deciduous. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.

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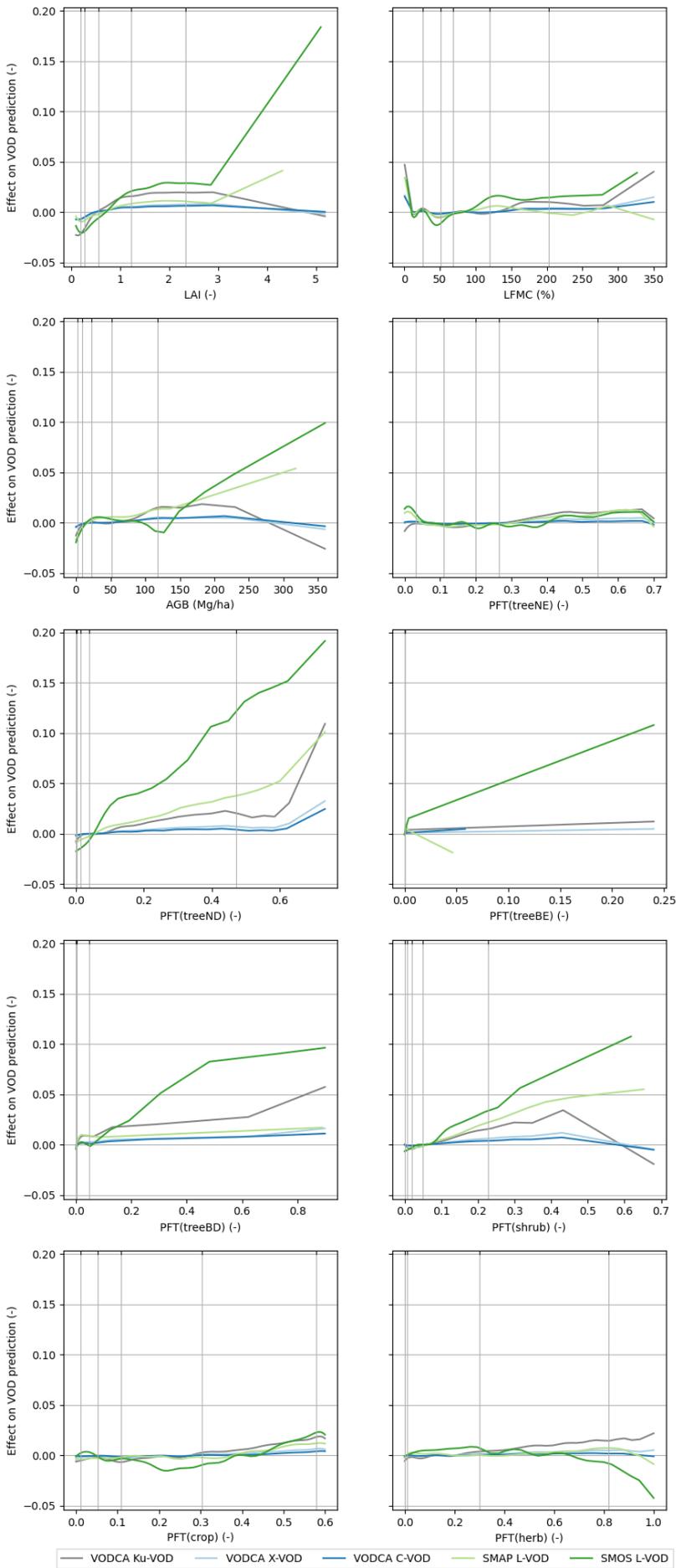
Figure S6: ALE plots of normalised VOD to ecosystem properties based on the global monthly GAM model for all predictors with PFT = plant functional type, N = needleleaf, B = broadleaf, E = evergreen, D = deciduous. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.

30 **Figure S7: ALE plots of normalised VOD to ecosystem properties based on the global 8-daily GAM model for all predictors with PFT = plant functional type, N = needleleaf, B = broadleaf, E = evergreen, D = deciduous. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.**

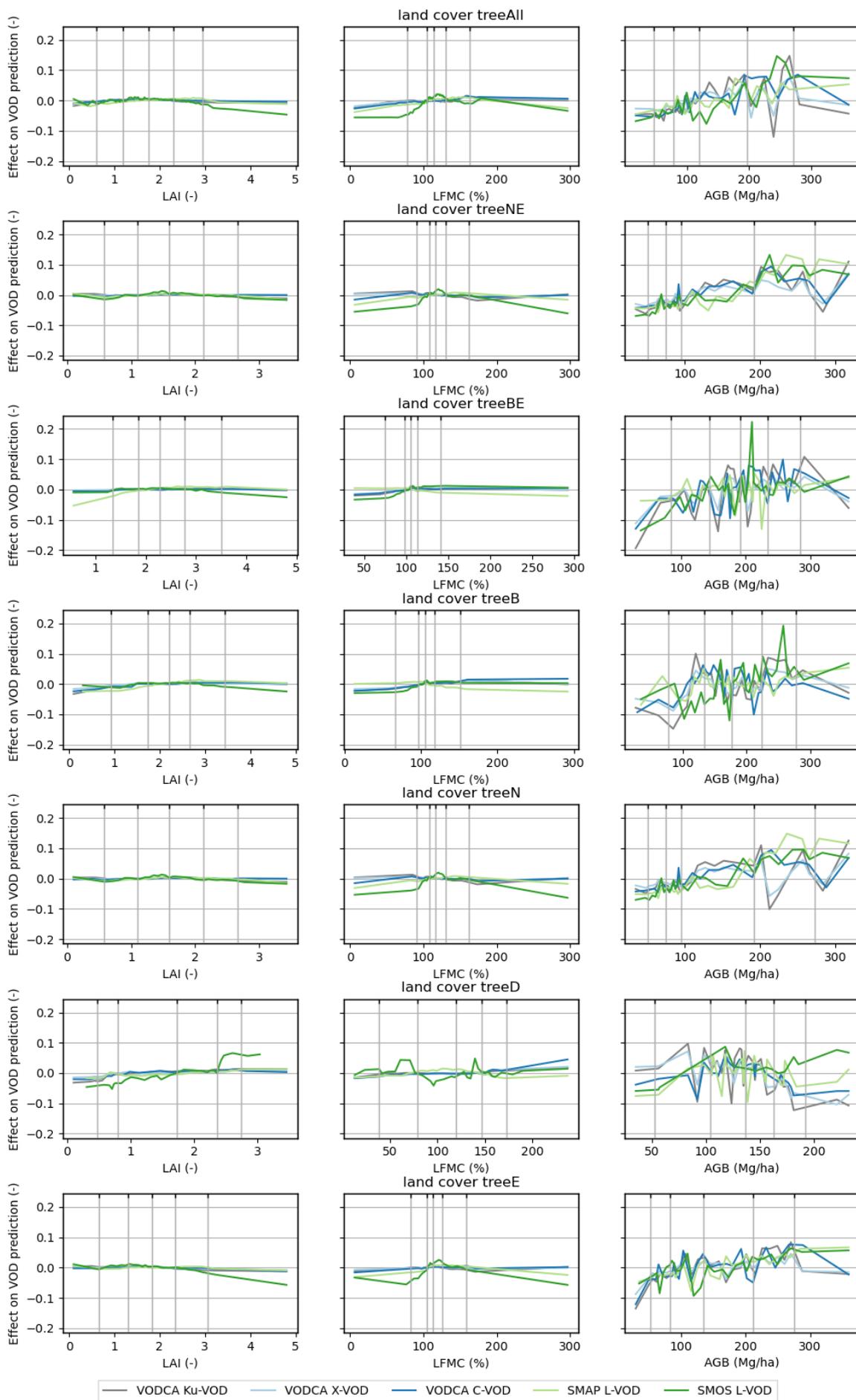



Figure S8: ALE plots of normalised VOD to ecosystem properties based on the land cover-specific monthly RF models for tree land covers. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.

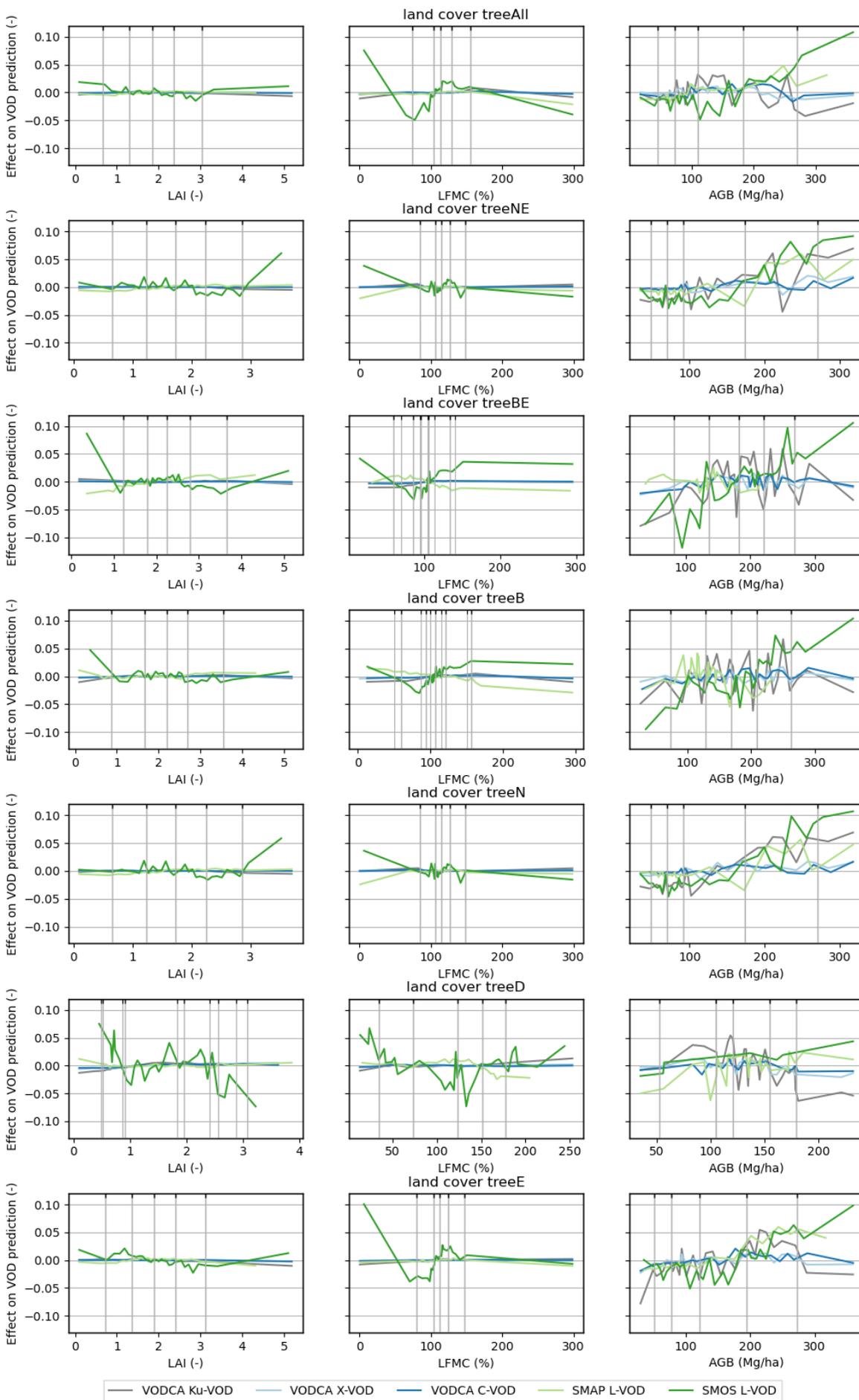



Figure S9: ALE plots of normalised VOD to ecosystem properties based on the land cover-specific 8-daily RF models for tree land covers. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.

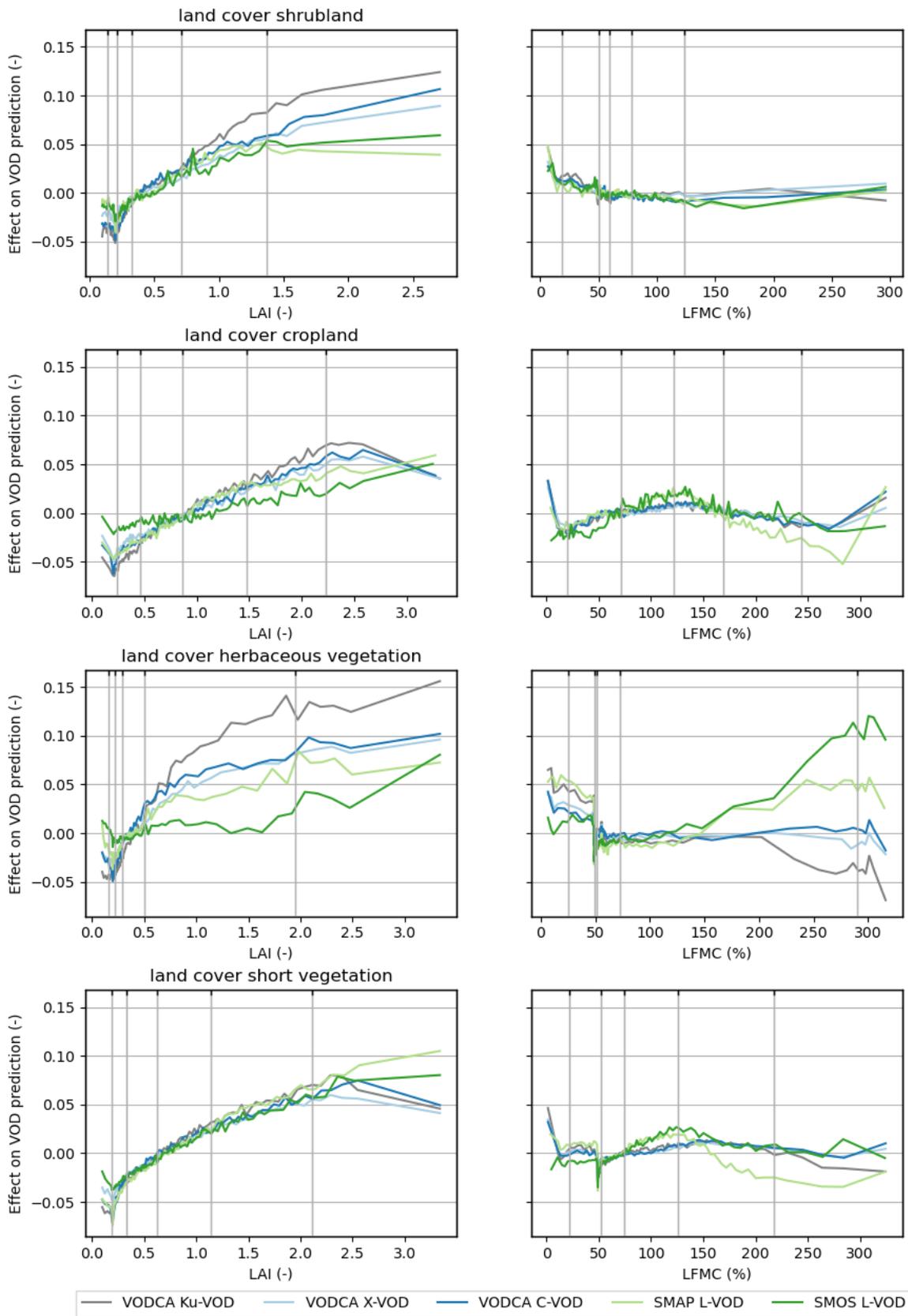



Figure S10: ALE plots of normalised VOD to ecosystem properties based on the land cover-specific monthly RF models for short vegetation land covers. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.

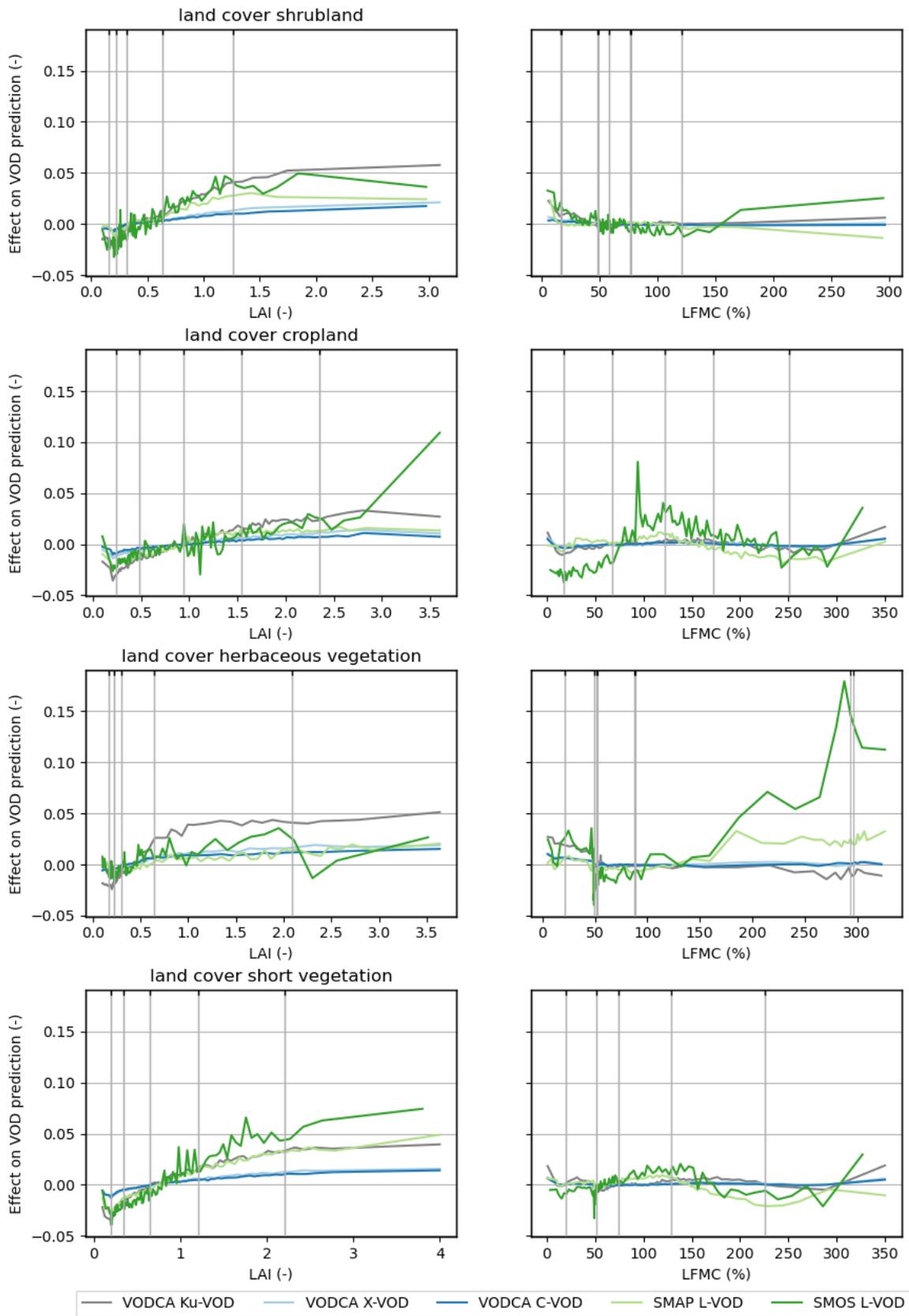



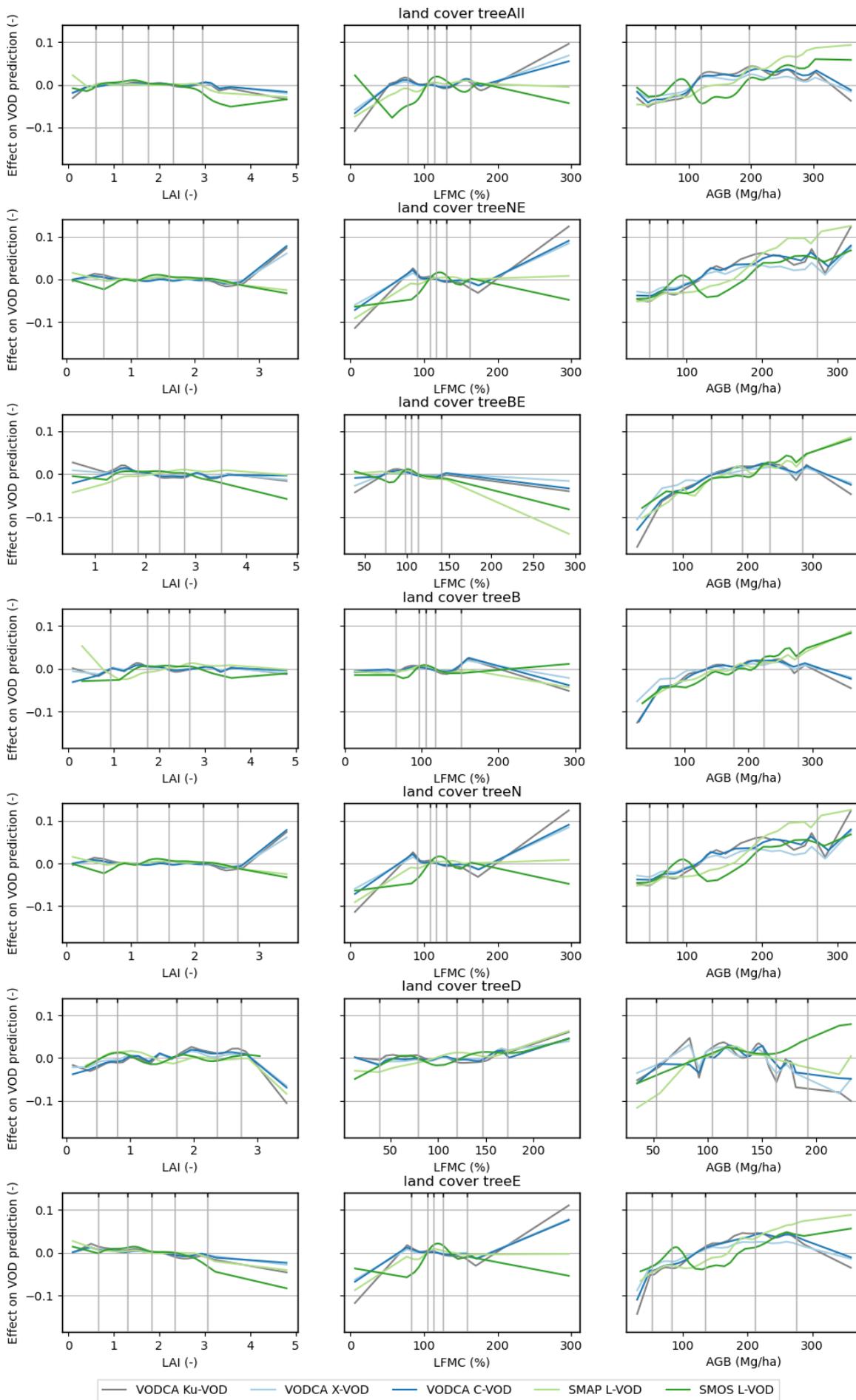
Figure S11: ALE plots of normalised VOD to ecosystem properties based on the land cover-specific 8-daily RF models for short vegetation land covers. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.

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Figure S12: ALE plots of normalised VOD to ecosystem properties based on the land cover-specific monthly GAM models for tree land covers. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.
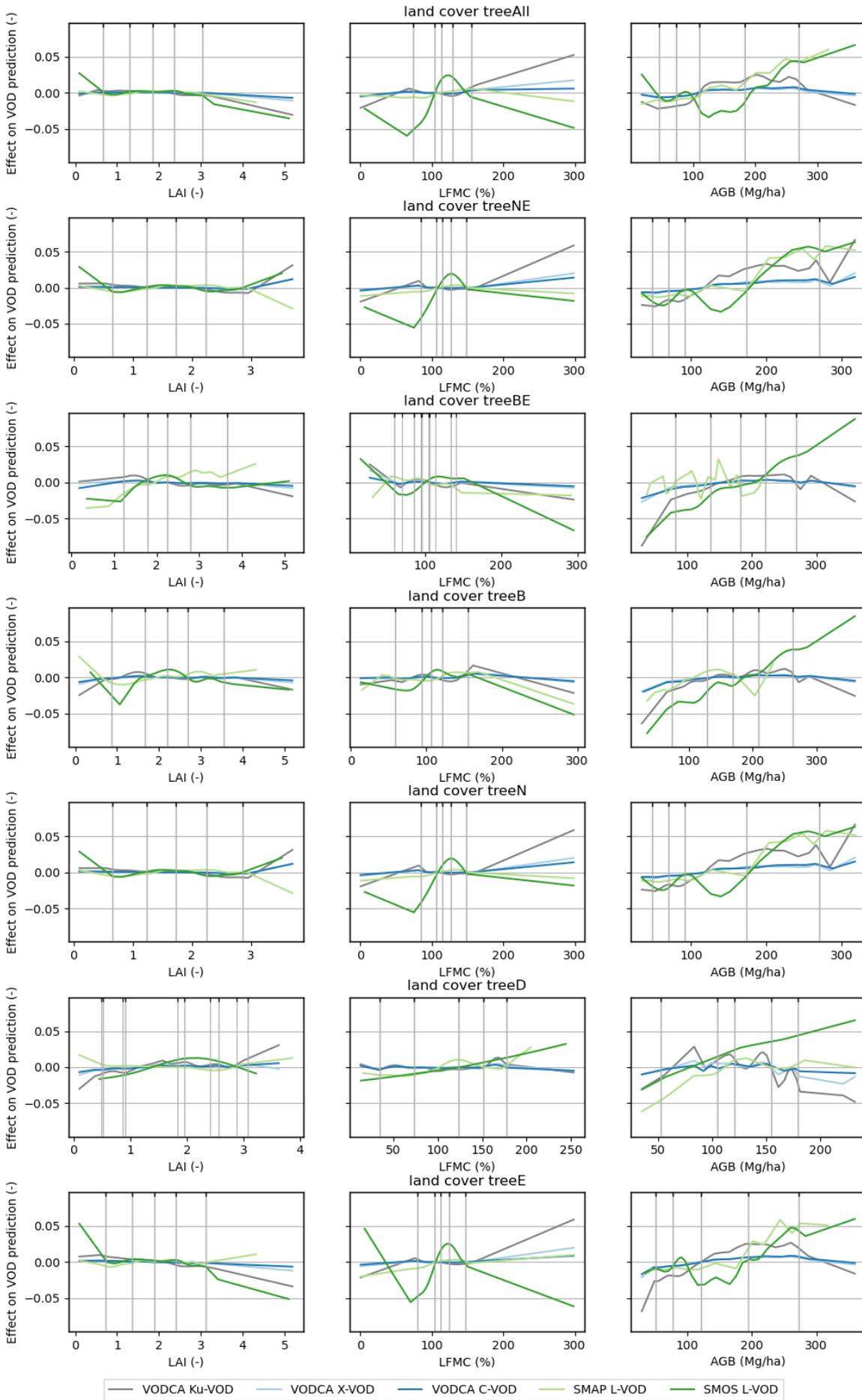
Figure S13: ALE plots of normalised VOD to ecosystem properties based on the land cover-specific 8-daily GAM models for tree land covers. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.

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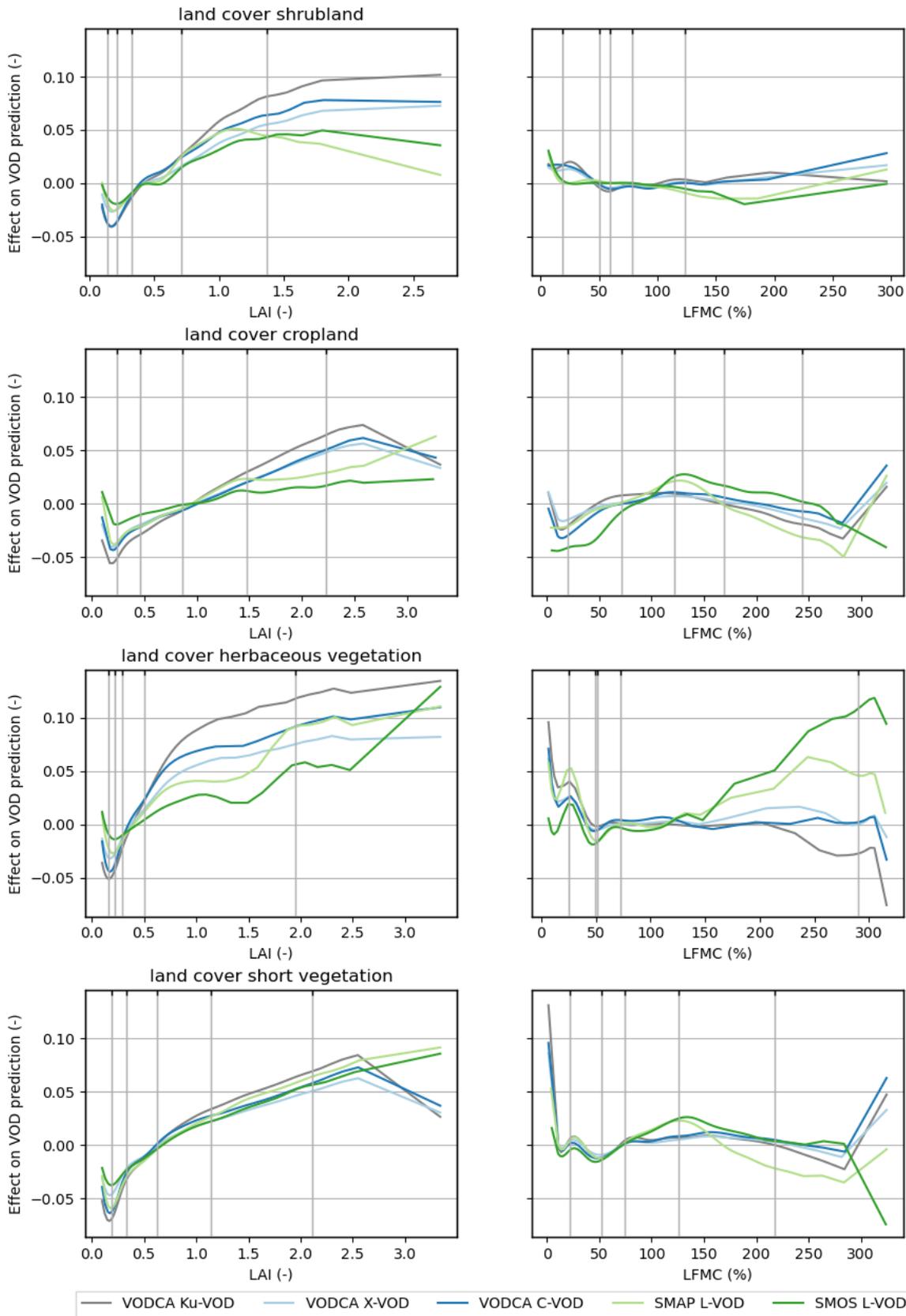


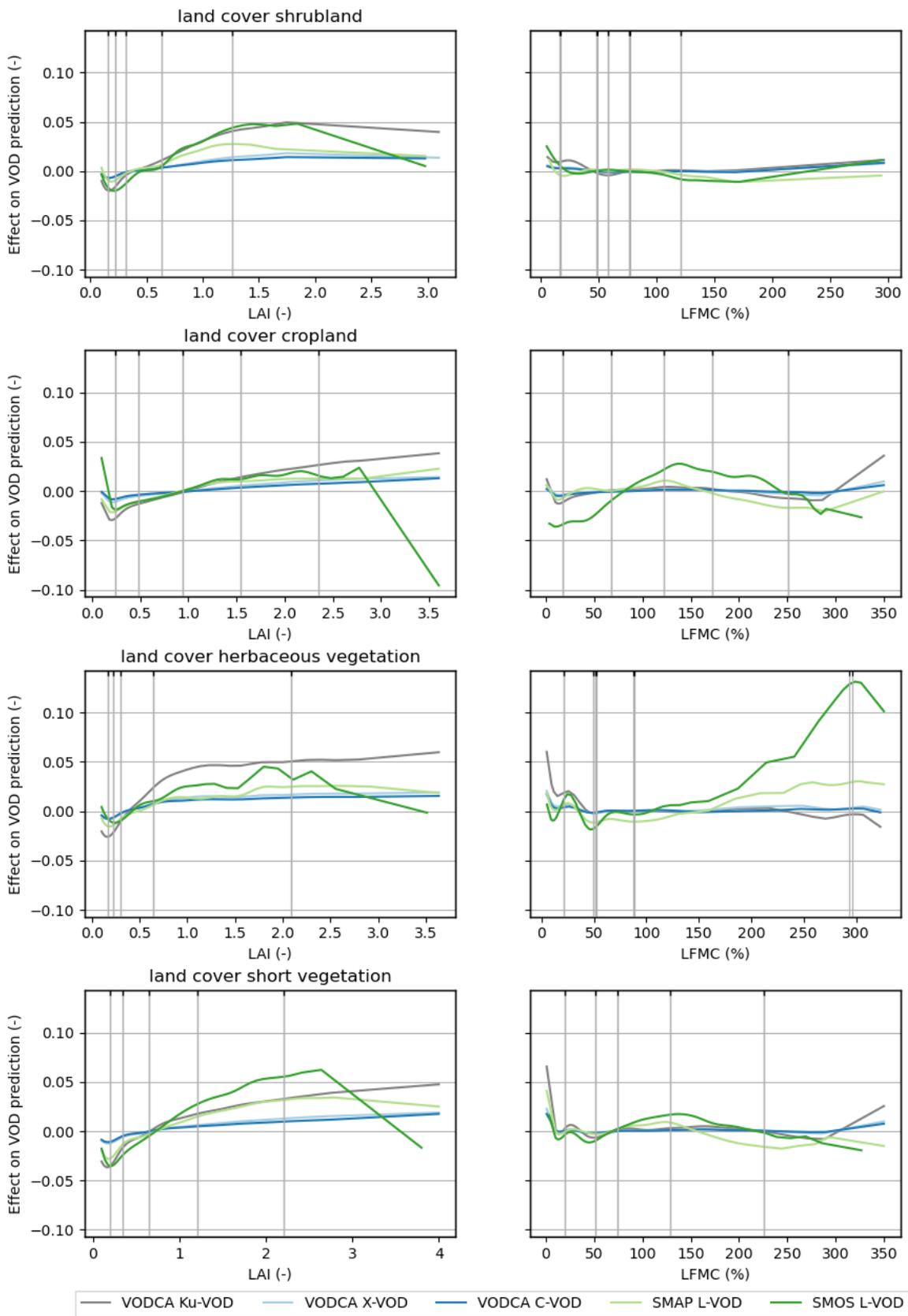
Figure S14: ALE plots of normalised VOD to ecosystem properties based on the land cover-specific monthly GAM models for short vegetation land covers. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.

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Figure S15: ALE plots of normalised VOD to ecosystem properties based on the land cover-specific 8-daily GAM models for short vegetation land covers. Vertical lines indicate the quantiles of the data sample size 0.05, 0.25, 0.5, 0.75 and 0.95, respectively.