Supplementary Information for "Outlet Glacier Seasonal Terminus Prediction Using Interpretable Machine Learning"

A Model results for all glaciers in study

We provide model output similar to Fig. 4 in the main text for the other 45 glaciers in this study. Figure captions are similar from figure to figure but we update the glacier name, GID, and the statistics of the model fit to the observations for each. Greenland basemaps used in Figures (a) accessed from Esri (2025).

Reference

Esri: World Imagery Basemap, https://server.arcgisonline.com/arcgis/rest/services/World_Imagery/MapServer, accessed via QGIS. Source imagery provided by Esri and contributors including Maxar, Earthstar Geographics, and the GIS User Community, 2025.

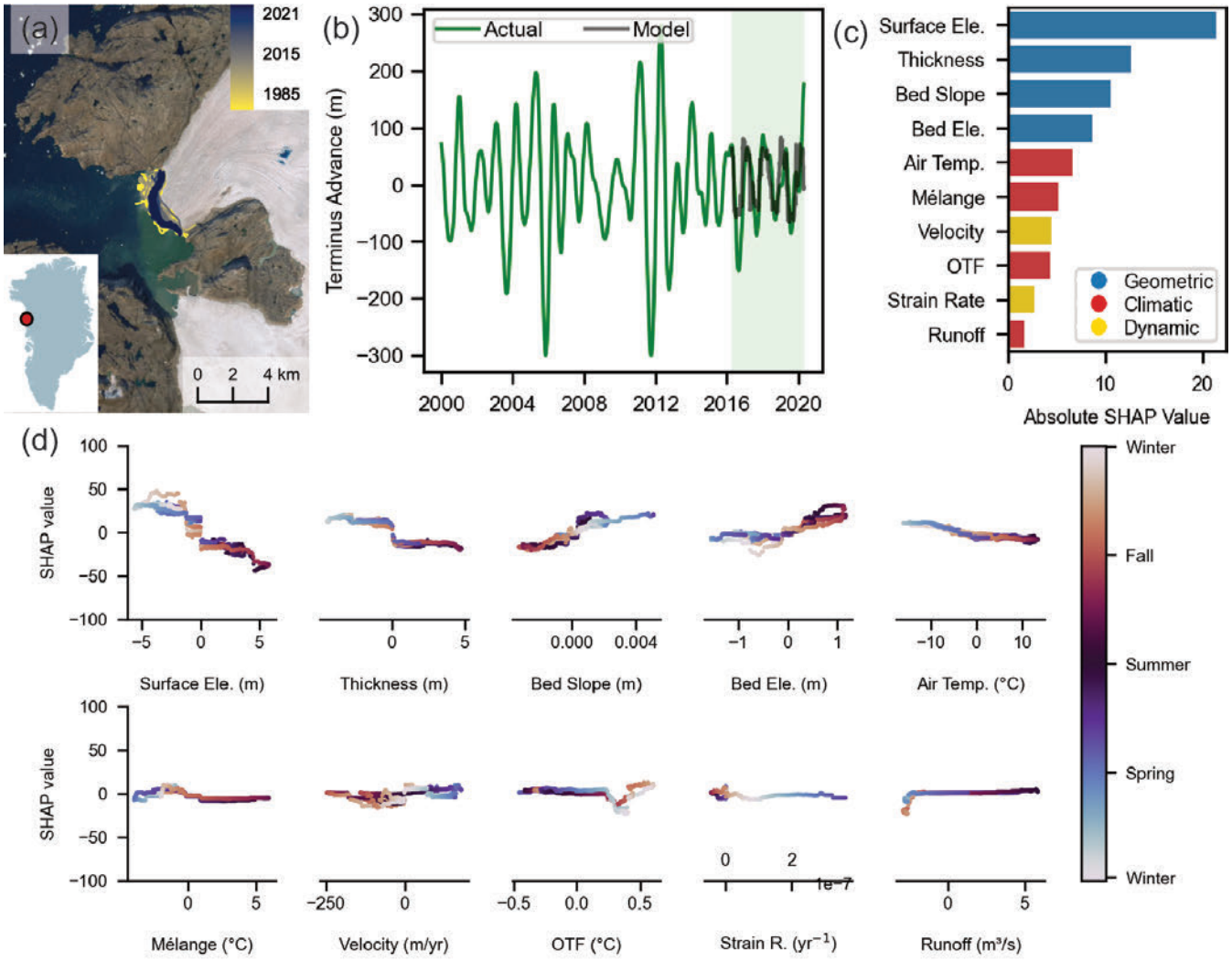

Figure S1. Model results for Nunatakassaap Sermia (Glacier ID 11). (a) Glacier location in Greenland and terminus traces colored by time. (b) Seasonal component of terminus change from 2000-2021 (green) with model prediction from Experiment 1 (black). (c) Absolute values of SHapley Additive exPlanations (SHAP) scores for each input variable, ranking variables by prediction importance. Variables are colored by variable group as indicated in the legend. (d) Relationship plots showing the variability of feature importance over a year. Data points are colored by time of year. Error scores for this model are NRMSE: 0.096; Spearman; 0.885; R^2: 0.783; offset: 2.5 weeks. Greenland basemaps used in Figures (a) accessed from Esri (2025). Greenland basemap used in Figure (a) accessed from Esri (2025).

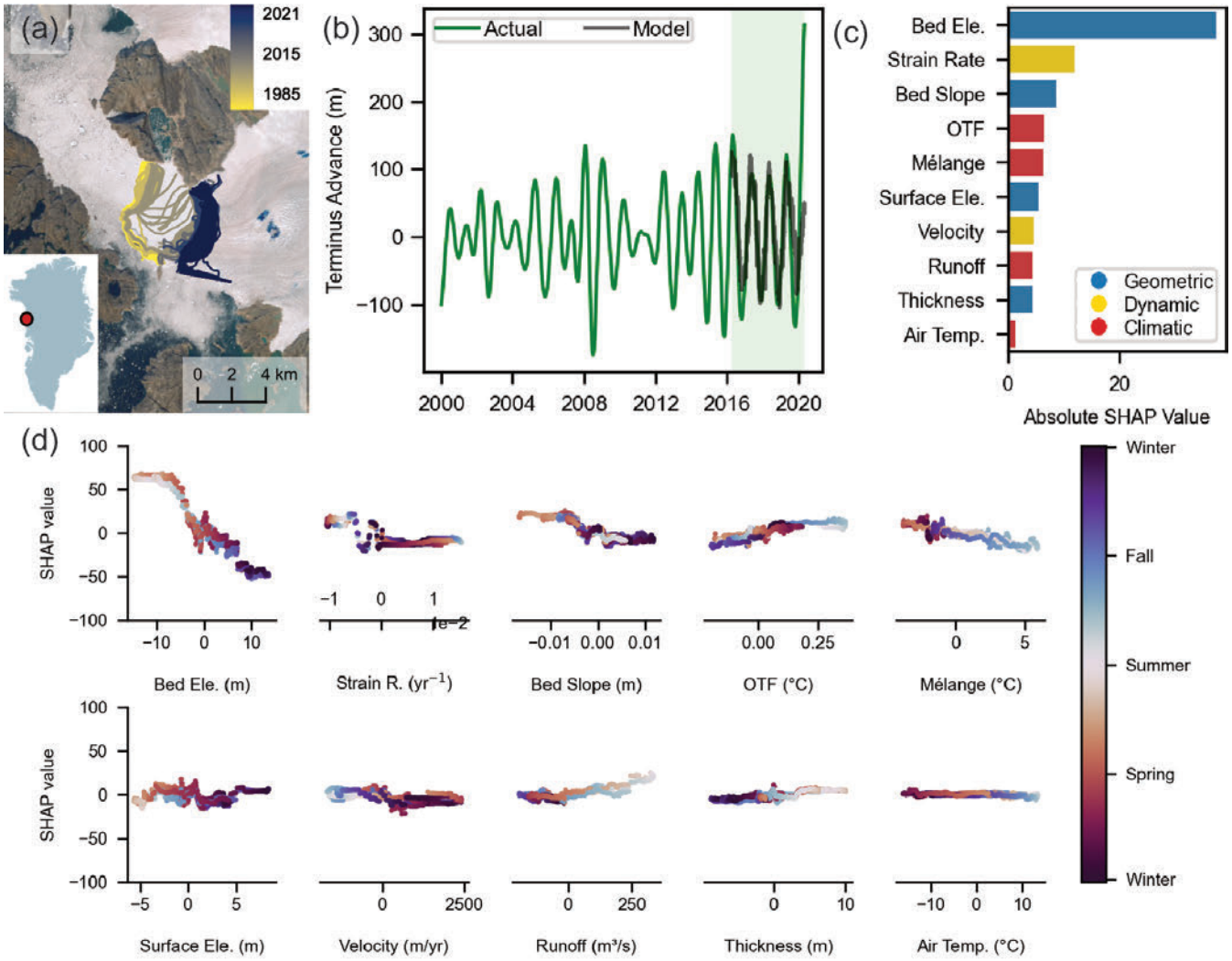

Figure S2. Same as for Fig. S1 but for Kakivfaat Sermiat (GID 14). Error scores for this model are NRMSE: 0.112; Spearman; 0.739; R^2: 0.437; offset: 0.6 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

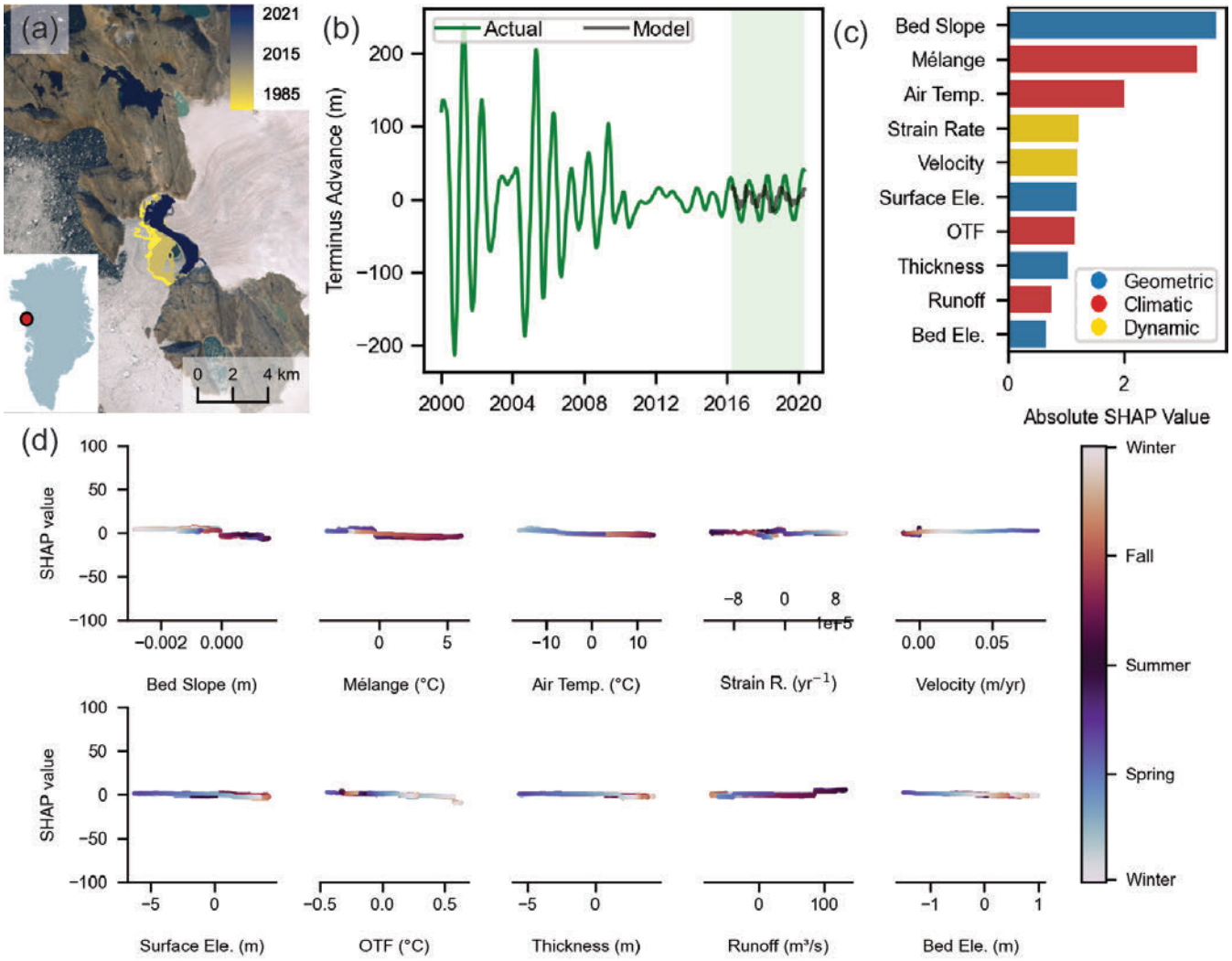

Figure S3. Same as for Fig. S1 but for Qeqertarsuup Sermia (GID 15). Error scores for this model are NRMSE: 0.221; Spearman; 0.545; R^2: 0.250; offset: 10.7 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

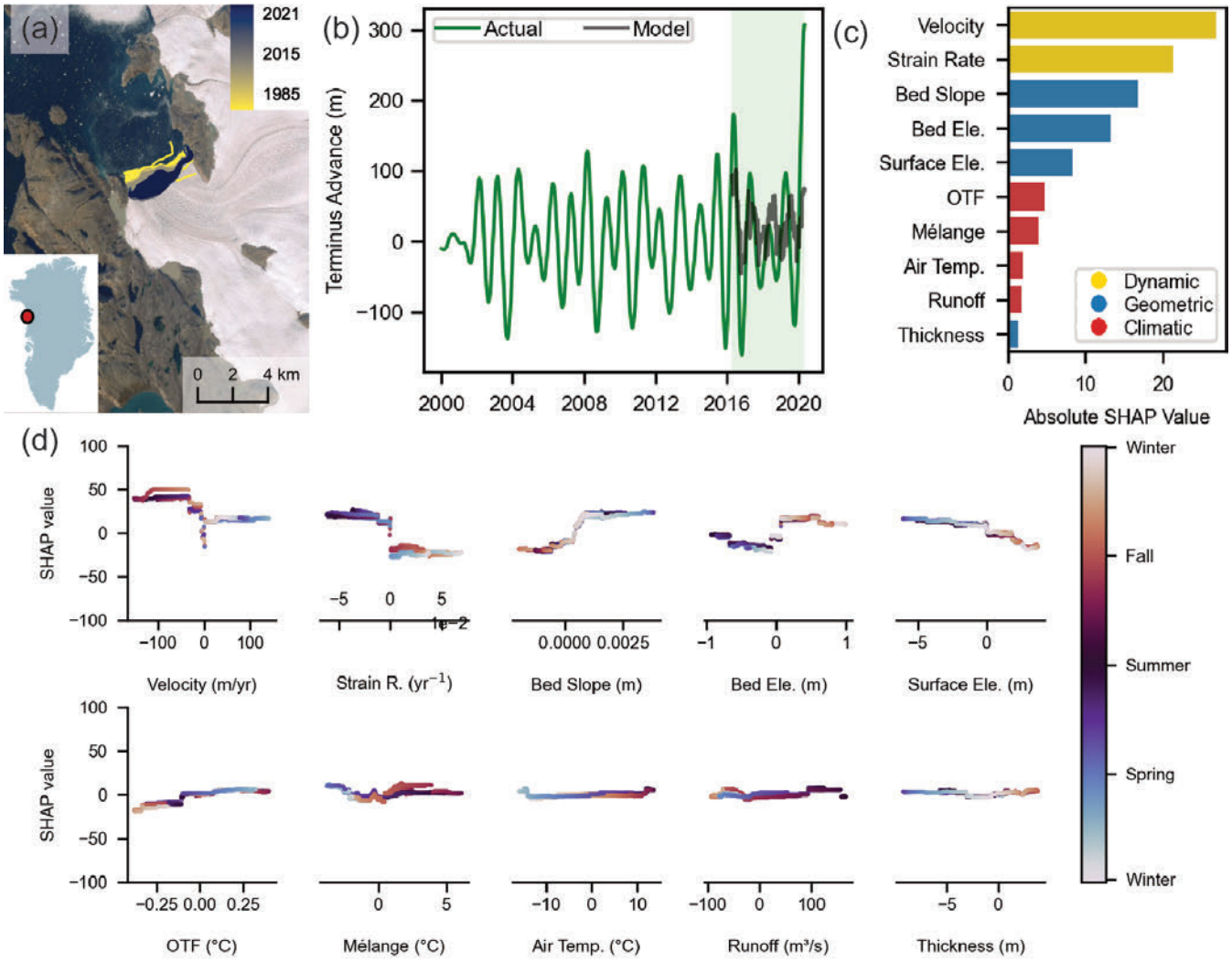

Figure S4. Same as for Fig. S1 but for Ussing Bræer (GID 16). Error scores for this model are NRMSE: 0.152; Spearman; 0.452; R^2: 0.068; offset: 13.1 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

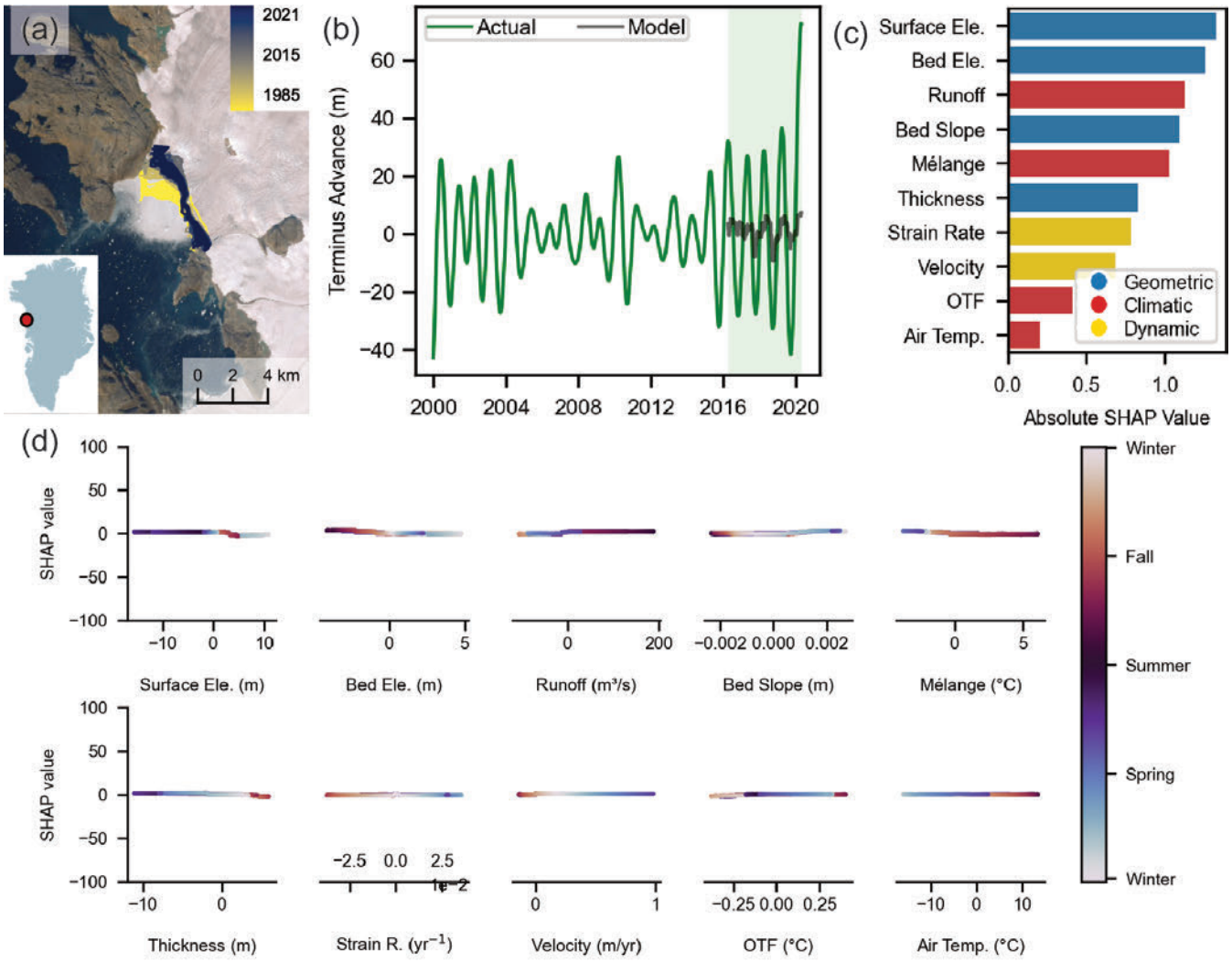

Figure S5. Same as for Fig. S1 but for Ussing Brær N (GID 17). Error scores for this model are NRMSE: 0.194; Spearman; 0.152; R^2: 0.019; offset: 20.2 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

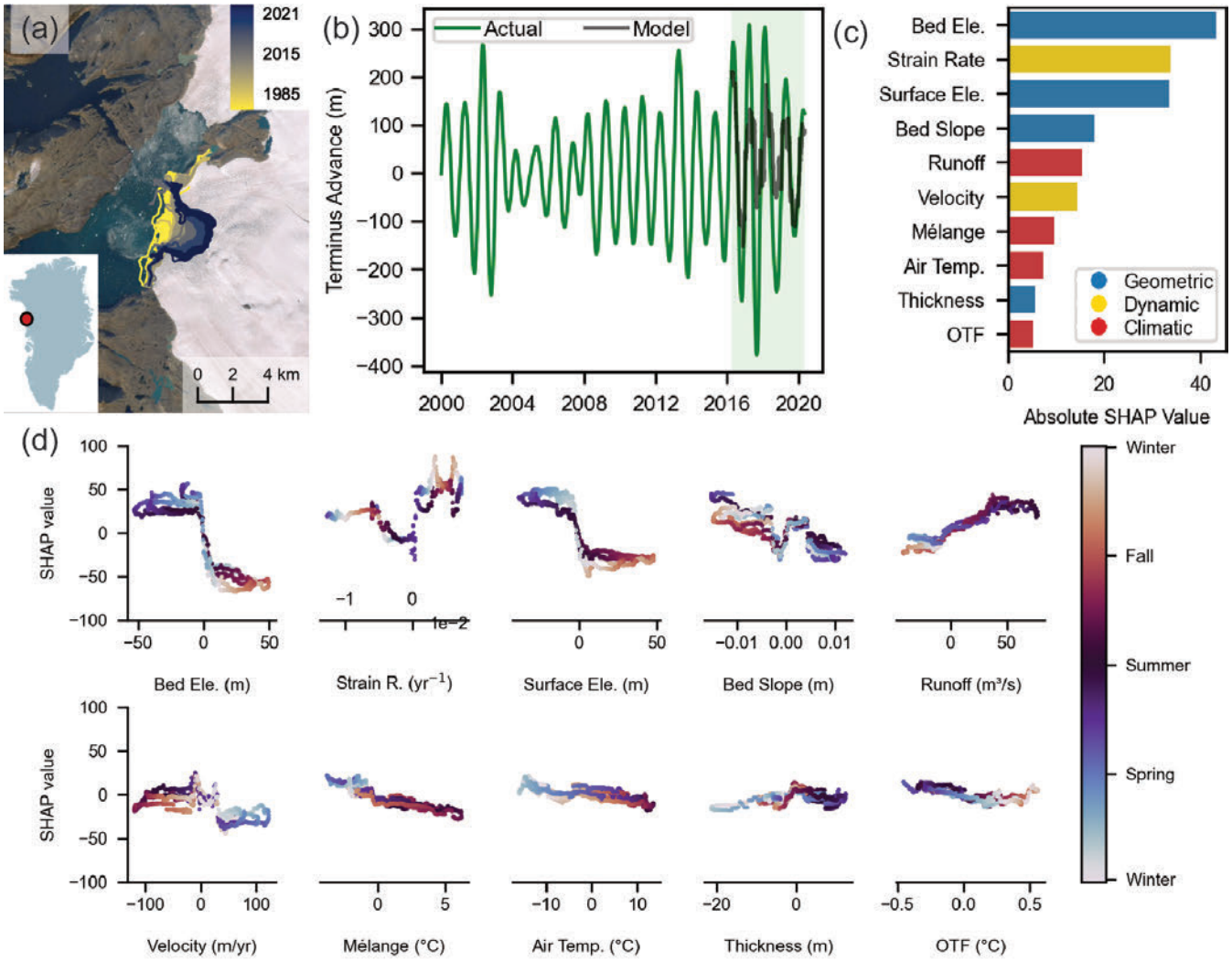

Figure S6. Same as for Fig. S1 but for Cornell Gletscher (GID 18). Error scores for this model are NRMSE: 0.164; Spearman; 0.767; R^2: 0.437; offset: 7.0 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

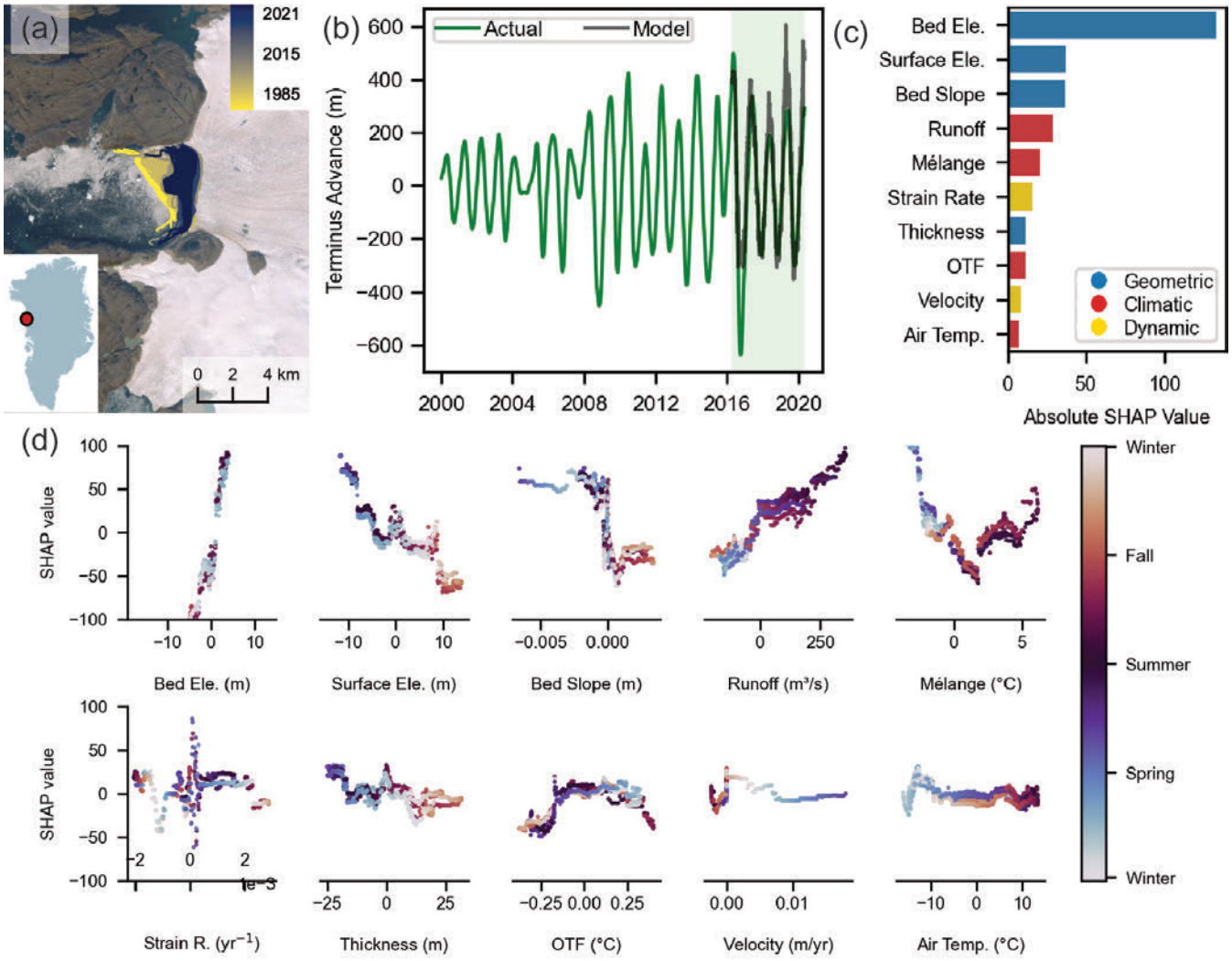

Figure S7. Same as for Fig. S1 but for Illullip Sermia (GID 20). Error scores for this model are NRMSE: 0.084; Spearman; 0.915; R^2: 0.759; offset: 3.9 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

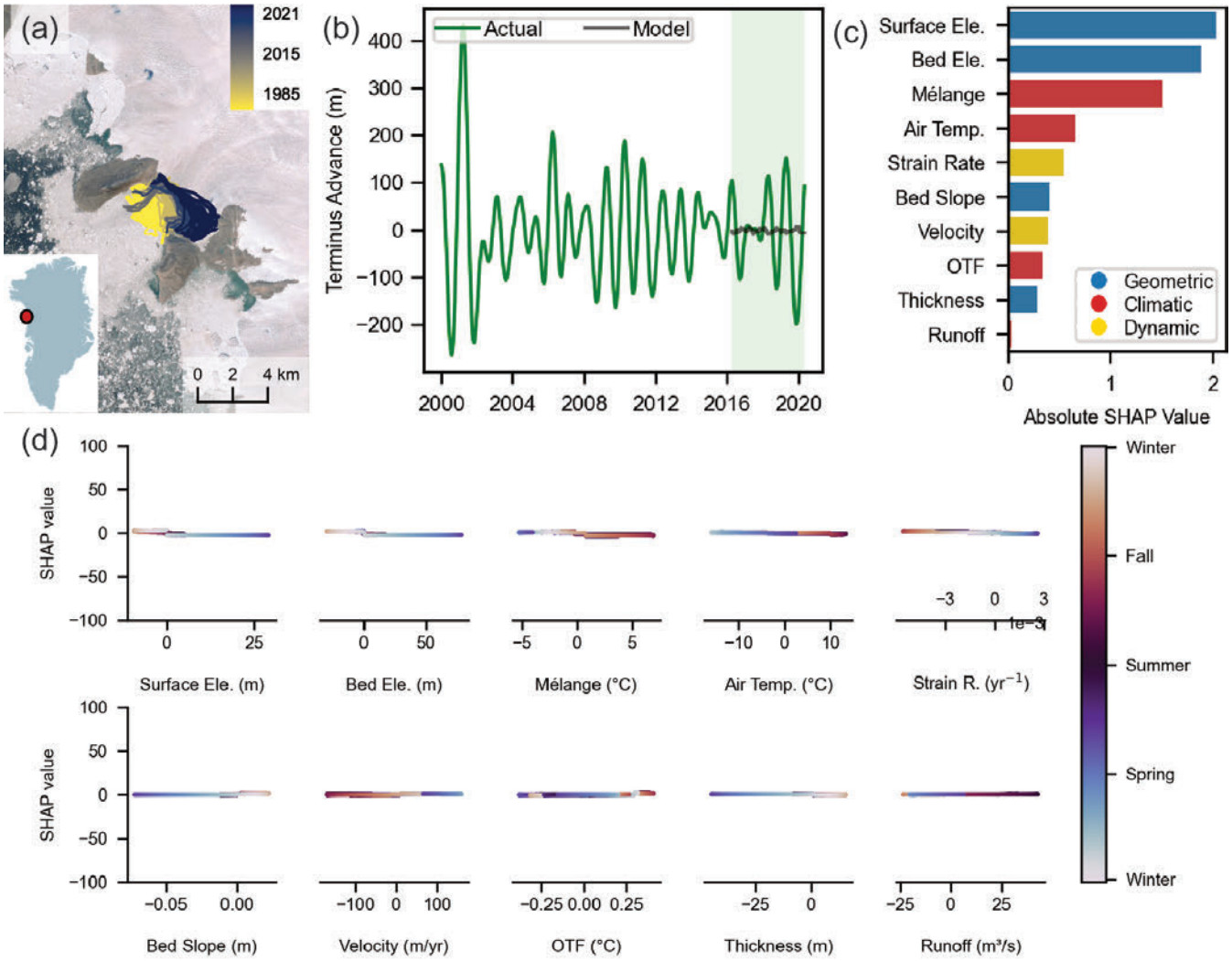

Figure S8. Same as for Fig. S1 but for Hayes N (GID 24). Error scores for this model are NRMSE: 0.190; Spearman; 0.239; R^2: -0.017; offset: 14.6 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

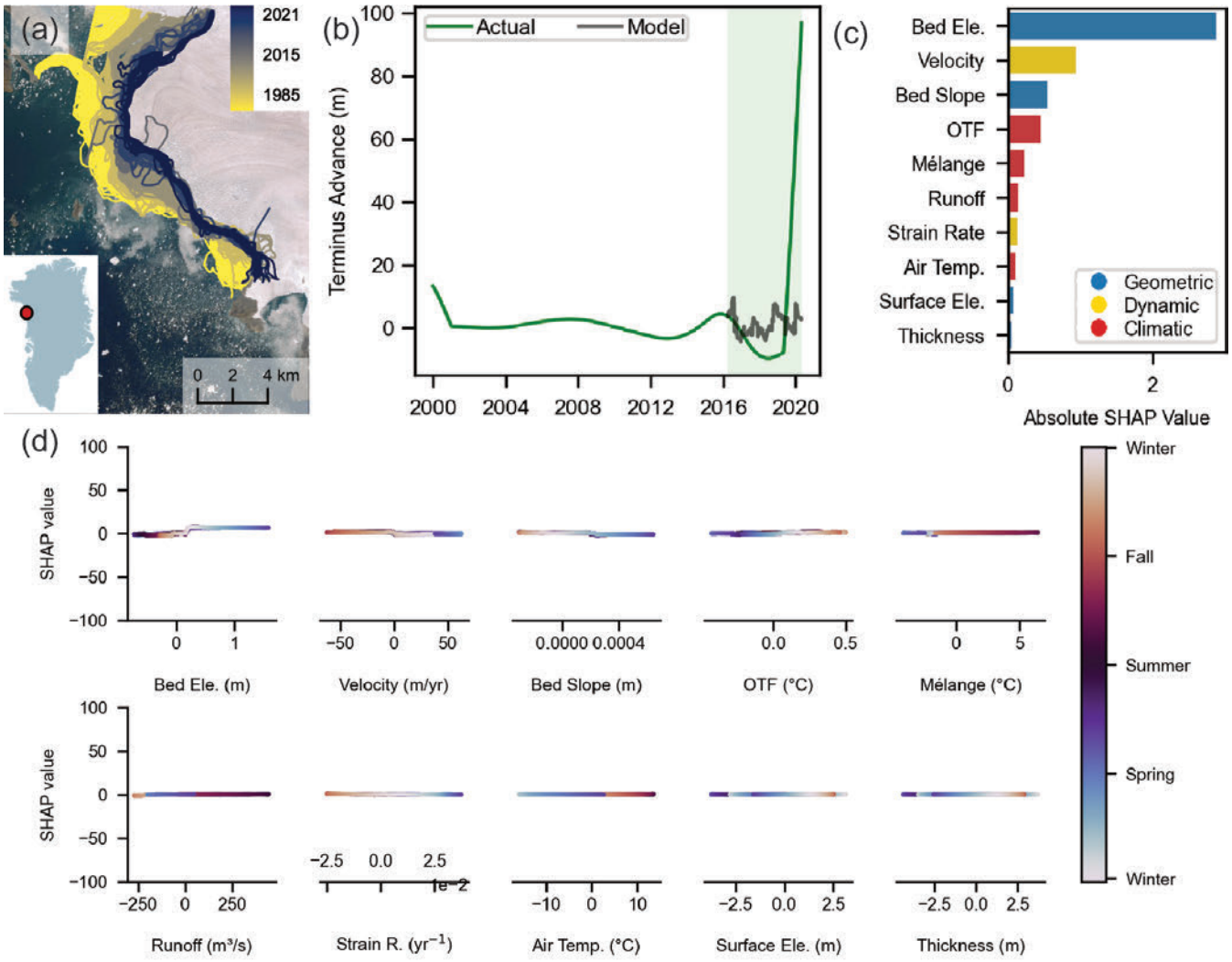

Figure S9. Same as for Fig. S1 but for Hayes Gletscher N' (GID 27). Error scores for this model are NRMSE: 0.144; Spearman; 0.267; R^2: 0.007; offset: 13.2 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

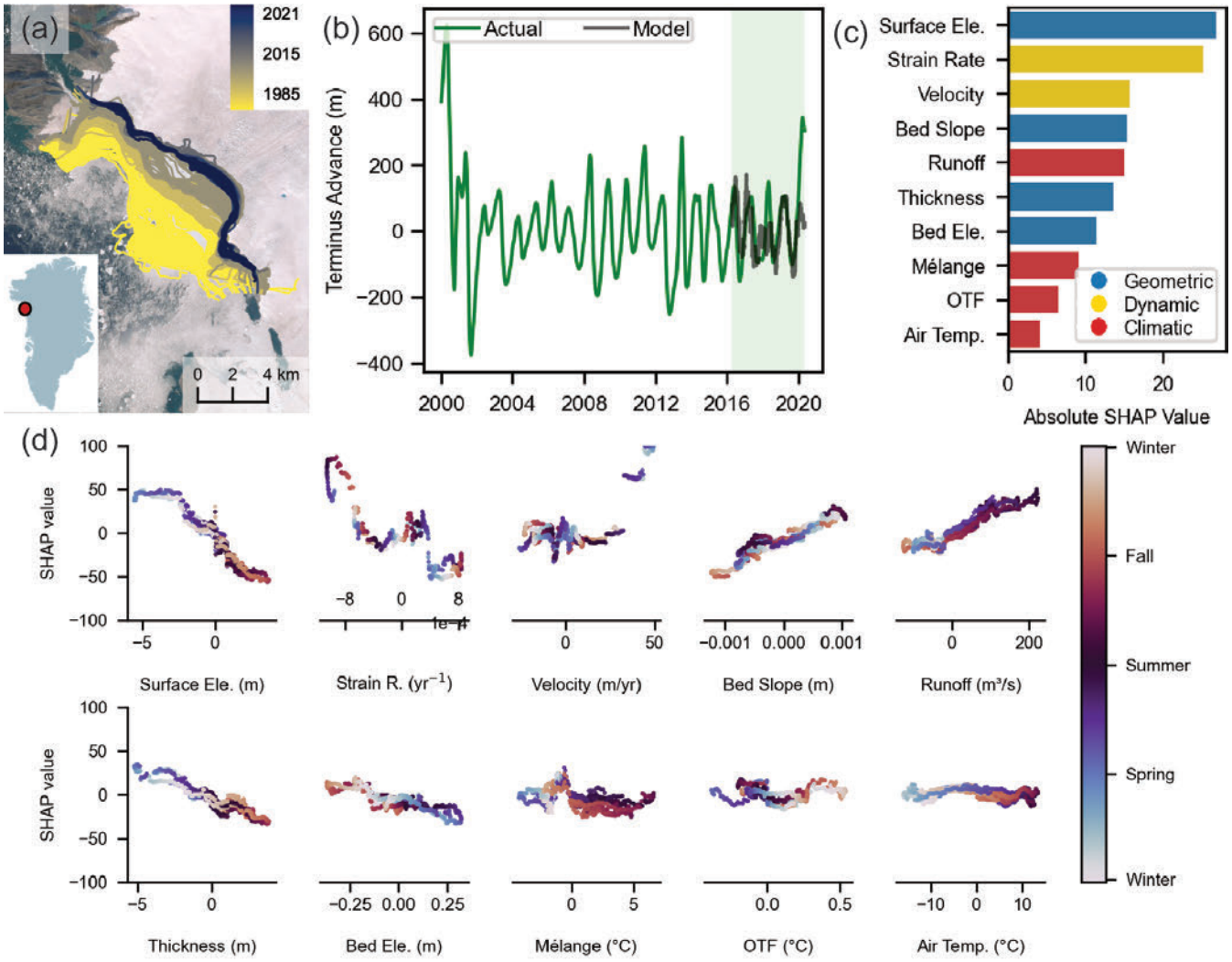

Figure S10. Same as for Fig. S1 but for Steenstrup Gletscher (GID 30). Error scores for this model are NRMSE: 0.132; Spearman; 0.660; R^2: 0.266; offset: 3.8 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

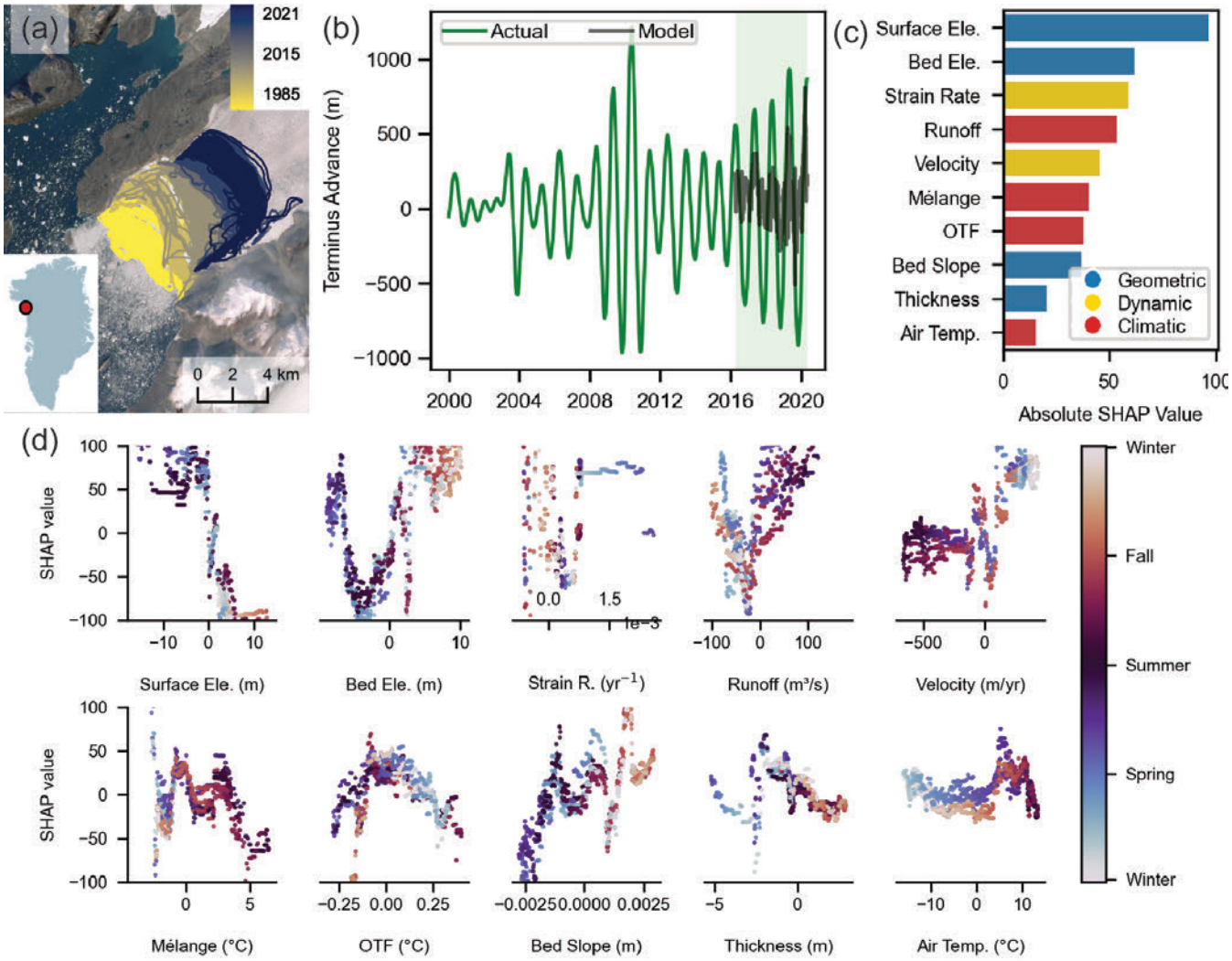

Figure S11. Same as for Fig. S1 but for Sverdrup Gletscher (GID 32). Error scores for this model are NRMSE: 0.234; Spearman; 0.590; R^2: 0.199; offset: 9.6 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

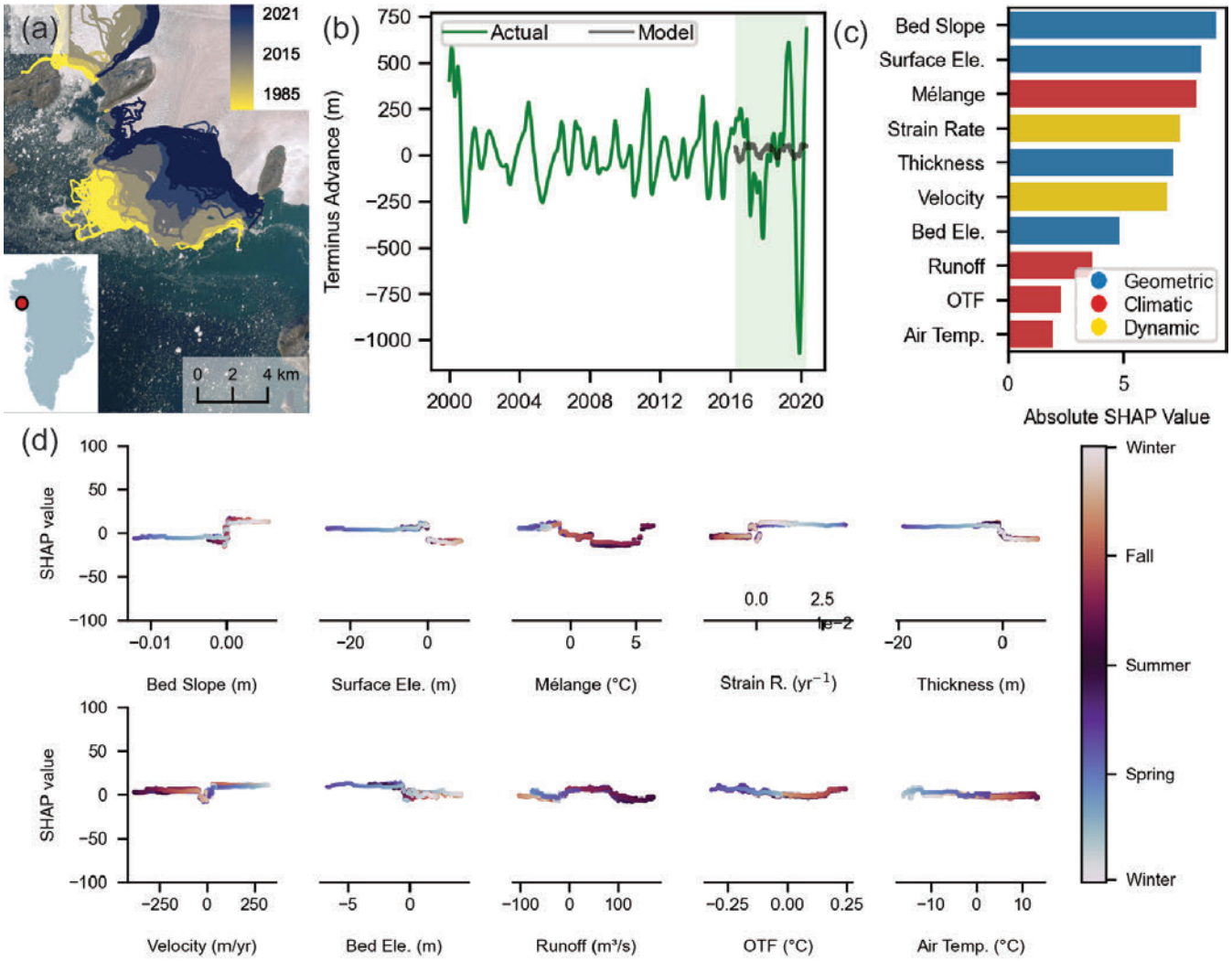

Figure S12. Same as for Fig. S1 but for Nansen Gletscher (GID 34). Error scores for this model are NRMSE: 0.145; Spearman; 0.302; R^2: 0.034; offset: 11.7 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

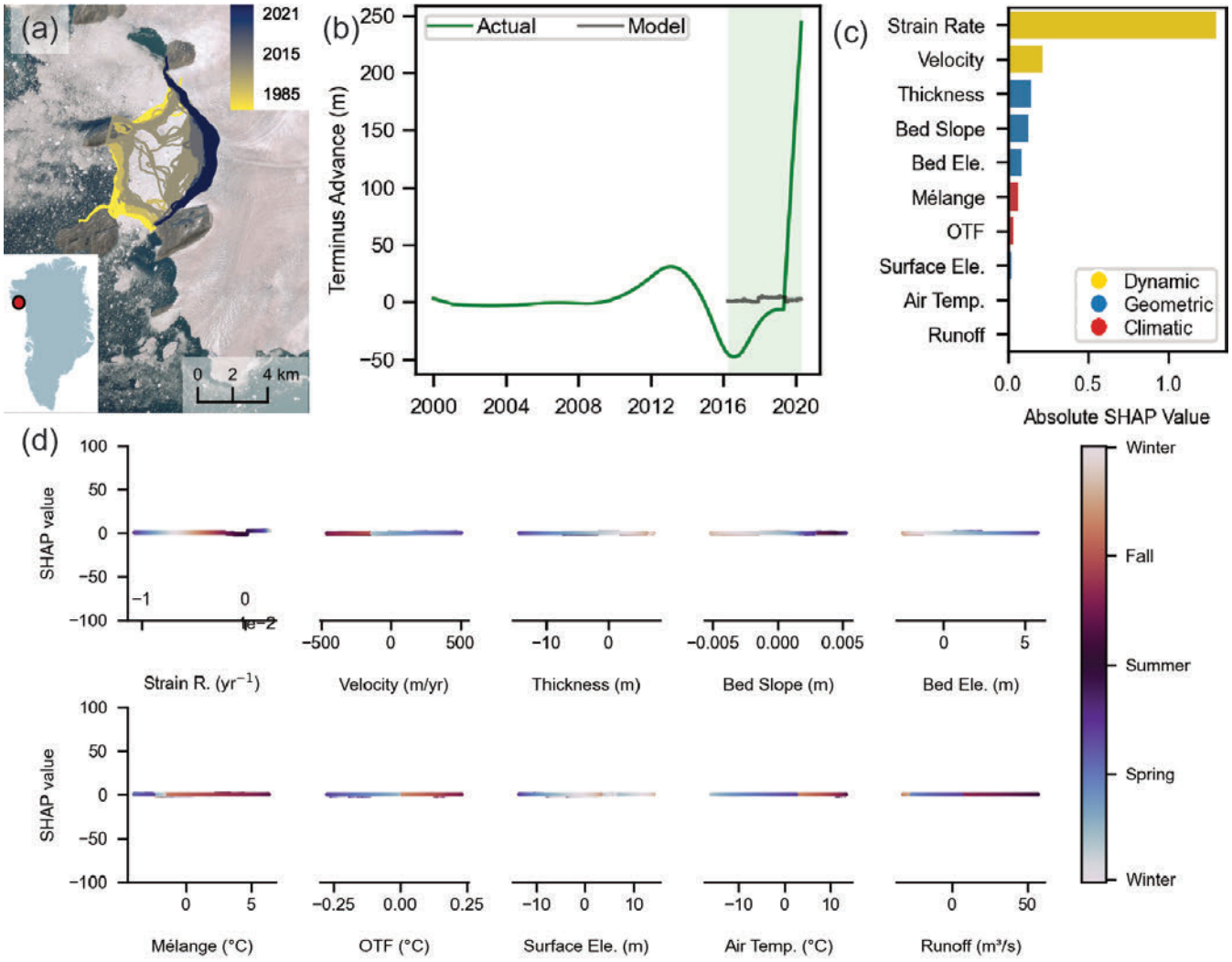

Figure S13. Same as for Fig. S1 but for Nordenskiöld Gletscher (GID 35). Error scores for this model are NRMSE: 0.169; Spearman; 0.336; R^2: -0.018; offset: 14.7 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

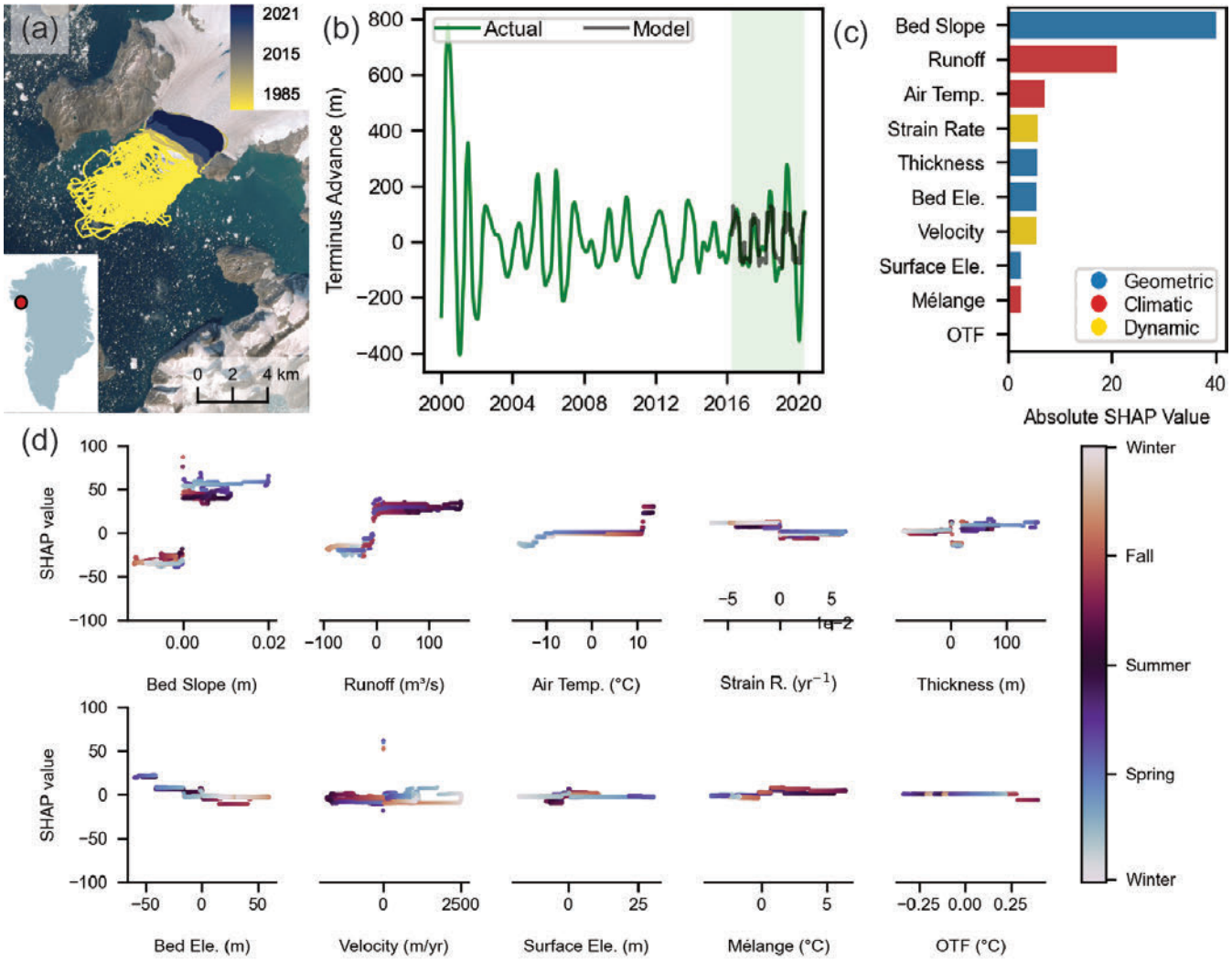

Figure S14. Same as for Fig. S1 but for Oscar Gletscher (GID 39). Error scores for this model are NRMSE: 0.098; Spearman; 0.717; R^2: 0.453; offset: 10.5 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

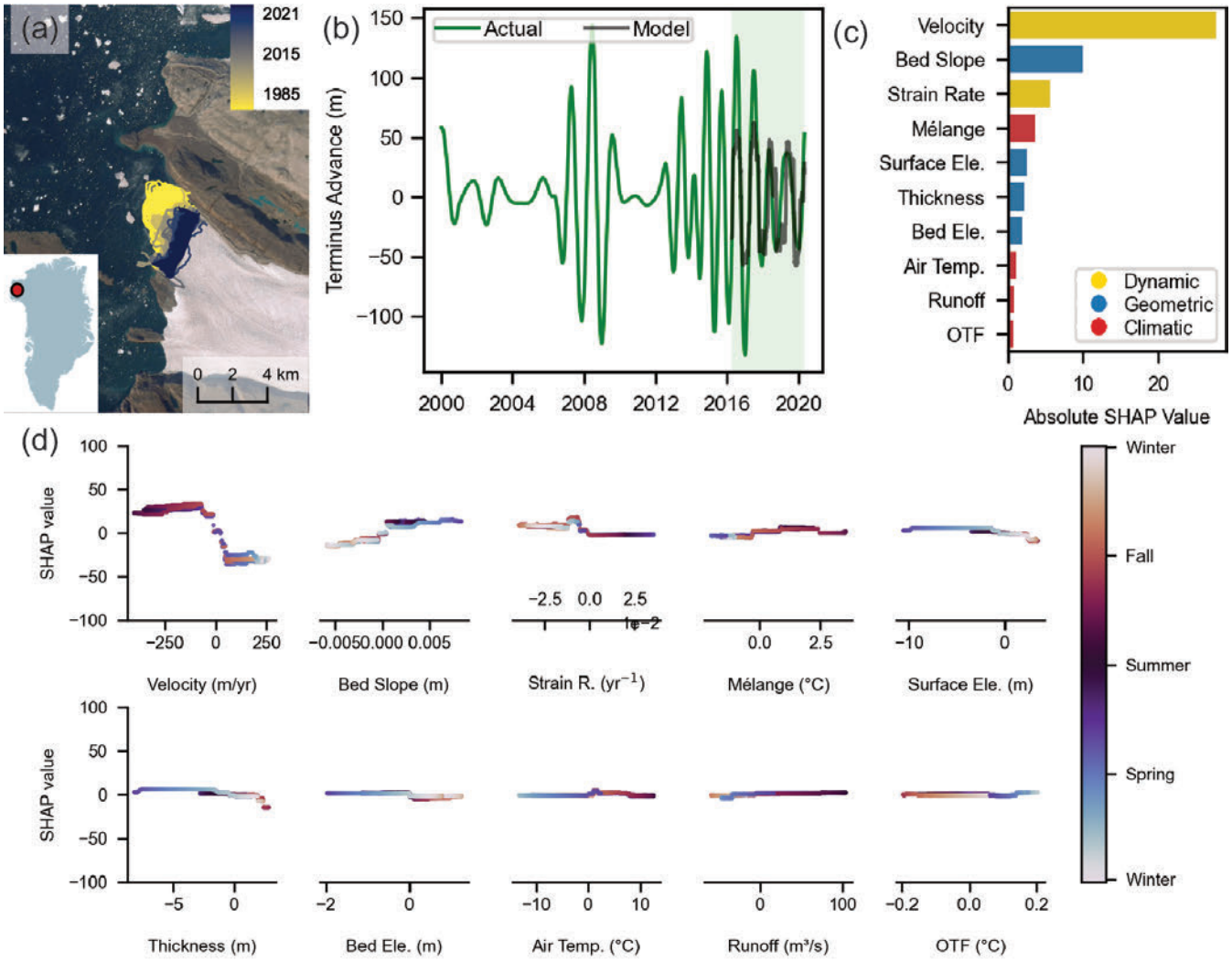

Figure S15. Same as for Fig. S1 but for Heilprin Gletscher (GID 72). Error scores for this model are NRMSE: 0.112; Spearman; 0.813; R^2: 0.569; offset: 10.4 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

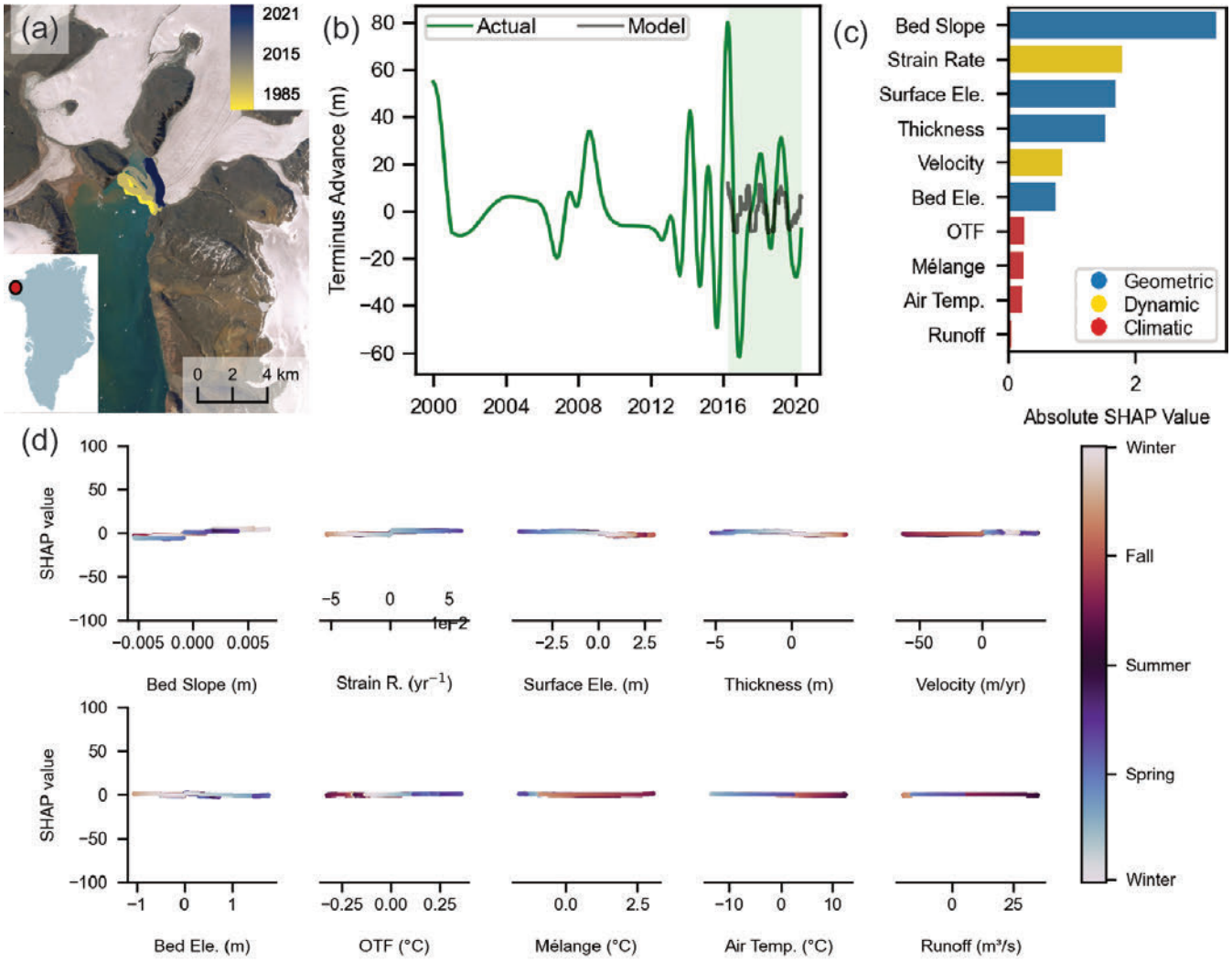

Figure S16. Same as for Fig. S1 but for Bowdoin Gletscher (GID 77). Error scores for this model are NRMSE: 0.144; Spearman; 0.492; R^2: 0.153; offset: 13.0 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

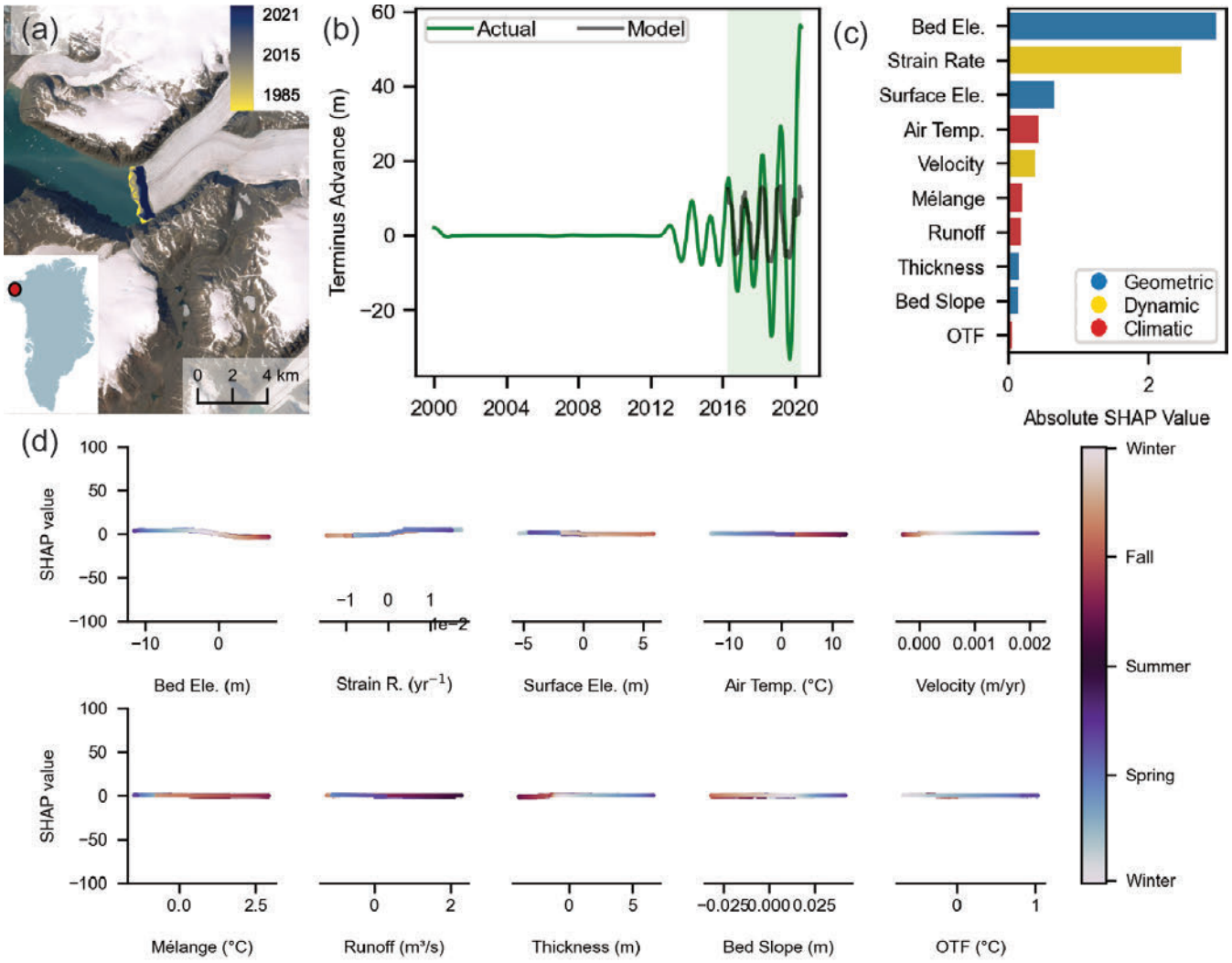

Figure S17. Same as for Fig. S1 but for Verhoeff Gletscher (GID 78). Error scores for this model are NRMSE: 0.125; Spearman; 0.827; R^2: 0.421; offset: 5.1 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

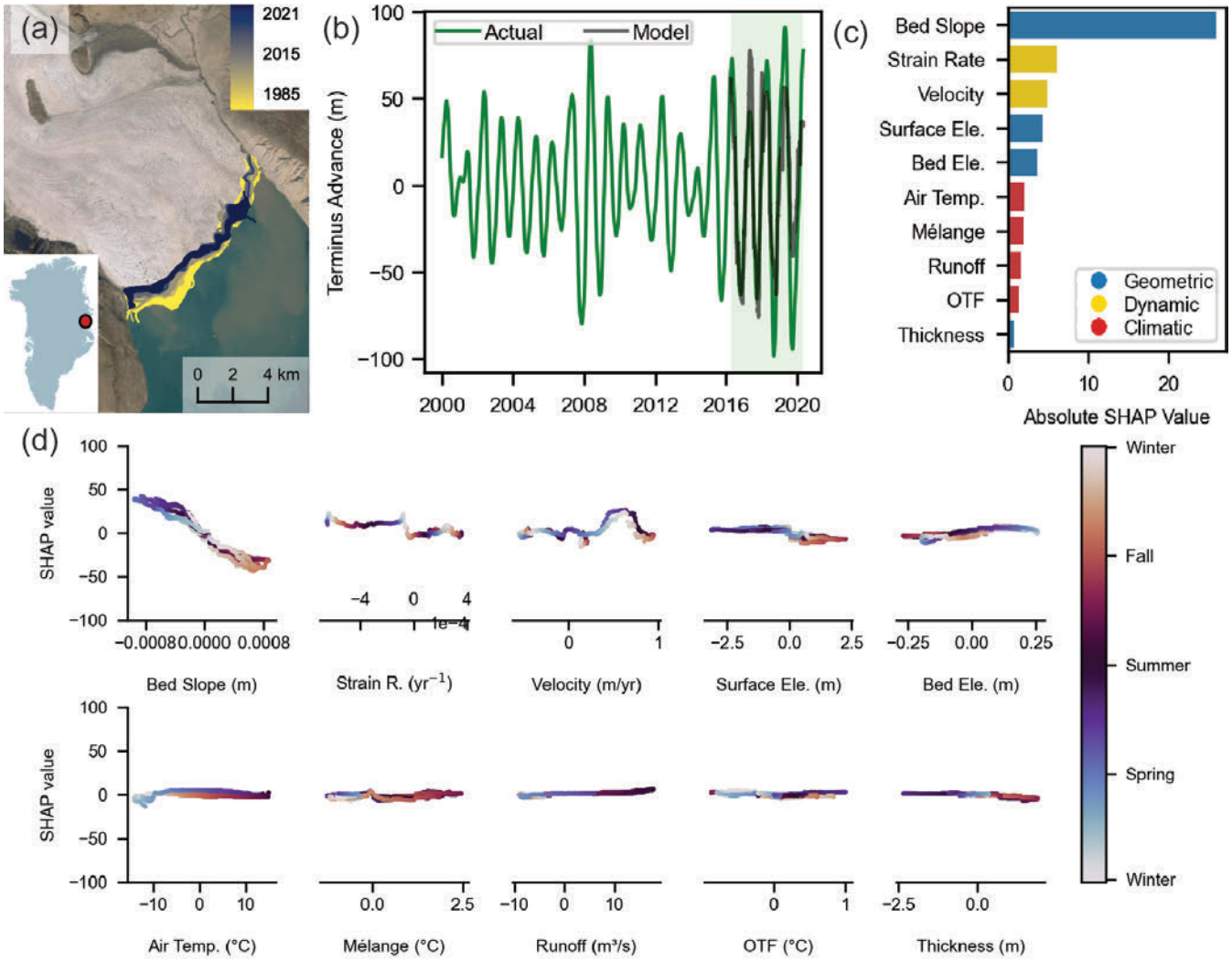

Figure S18. Same as for Fig. S1 but for Waltershausen Gletscher (GID 110). Error scores for this model are NRMSE: 0.123; Spearman; 0.859; R^2: 0.727; offset: 1.5 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

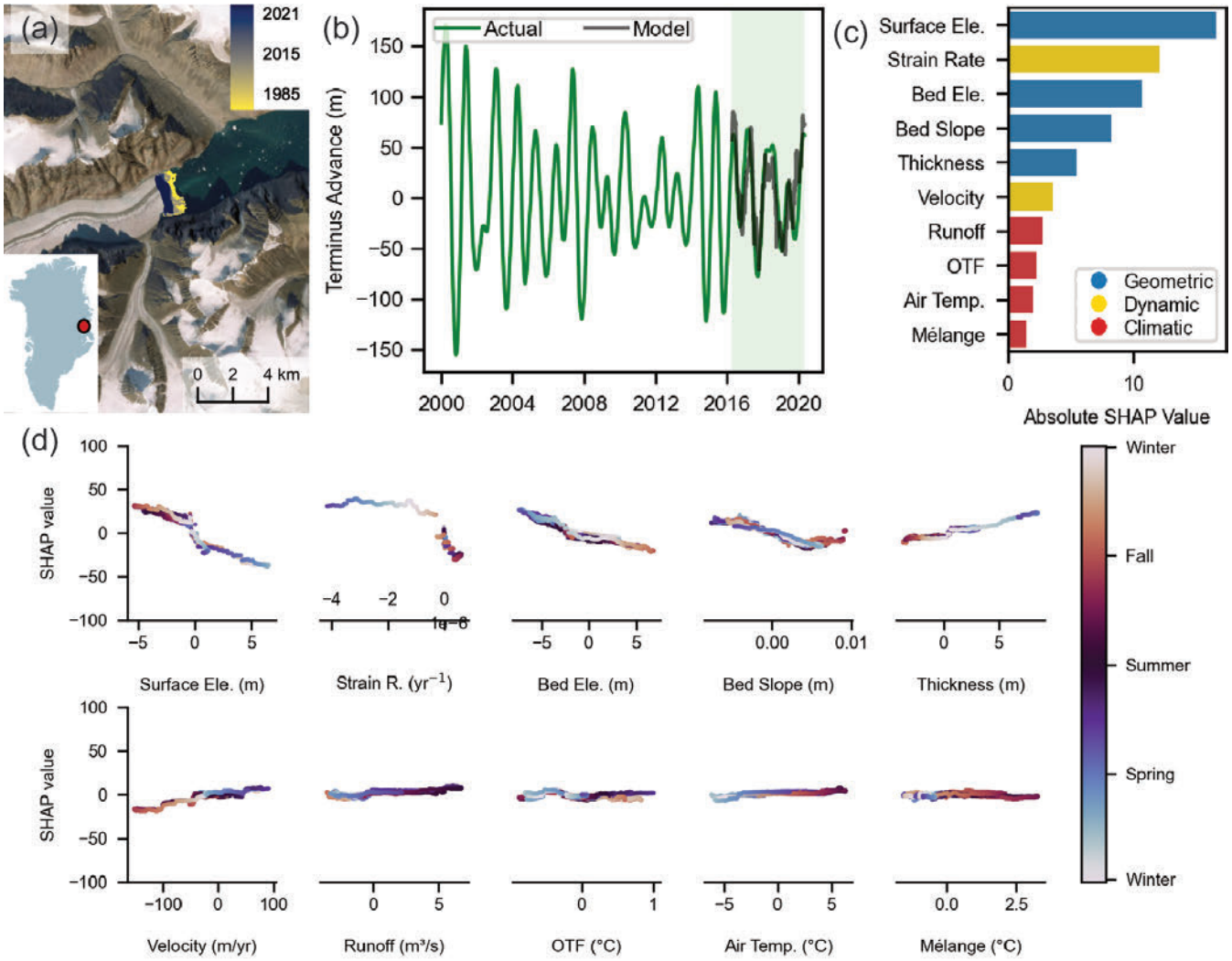

Figure S19. Same as for Fig. S1 but for Nordenskiöld Gletscher (GID 114). Error scores for this model are NRMSE: 0.141; Spearman; 0.796; R^2: 0.619; offset: 2.1 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

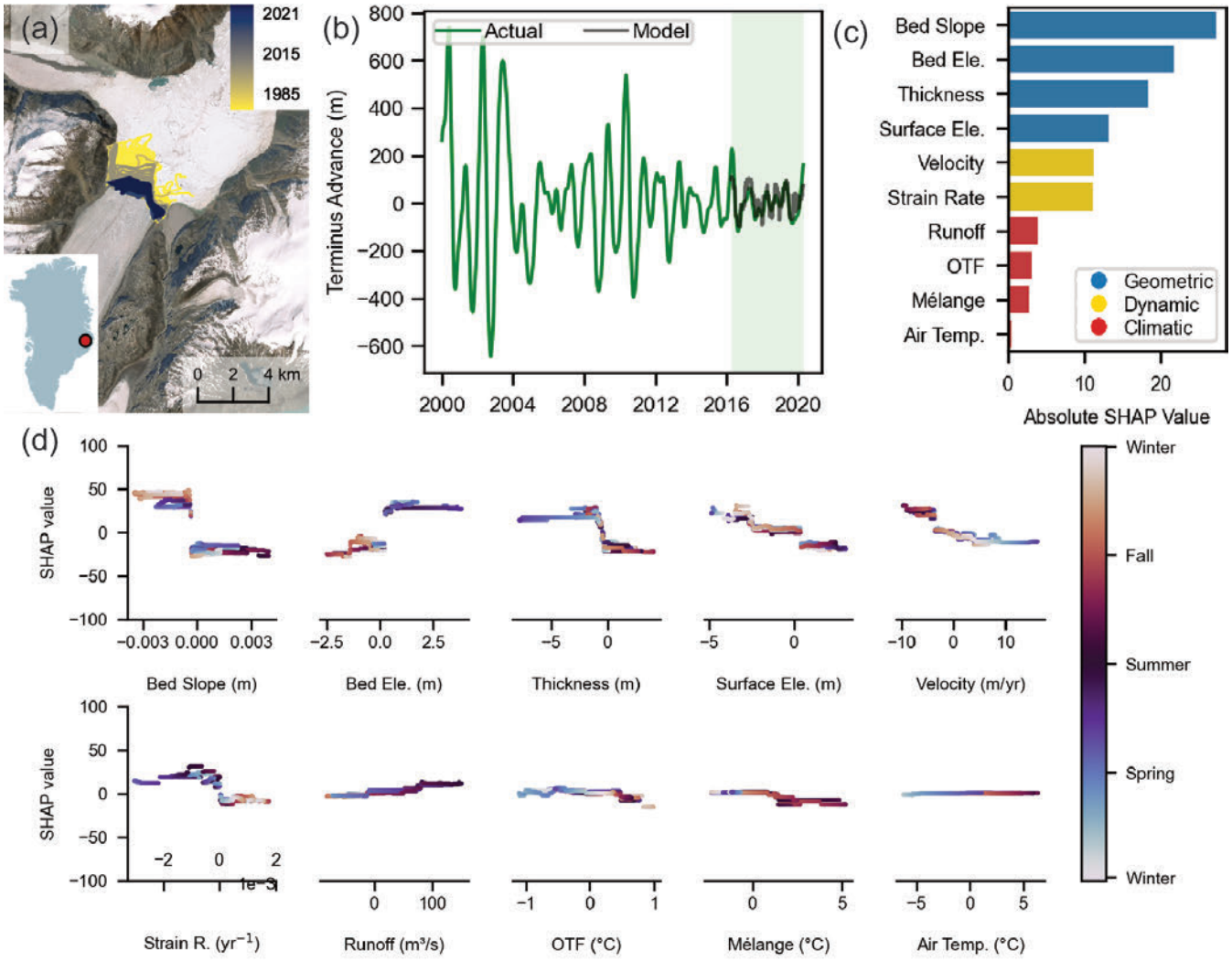

Figure S20. Same as for Fig. S1 but for Vestfjord Gletscher (GID 121). Error scores for this model are NRMSE: 0.094; Spearman; 0.792; R^2: 0.514; offset: 13.6 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

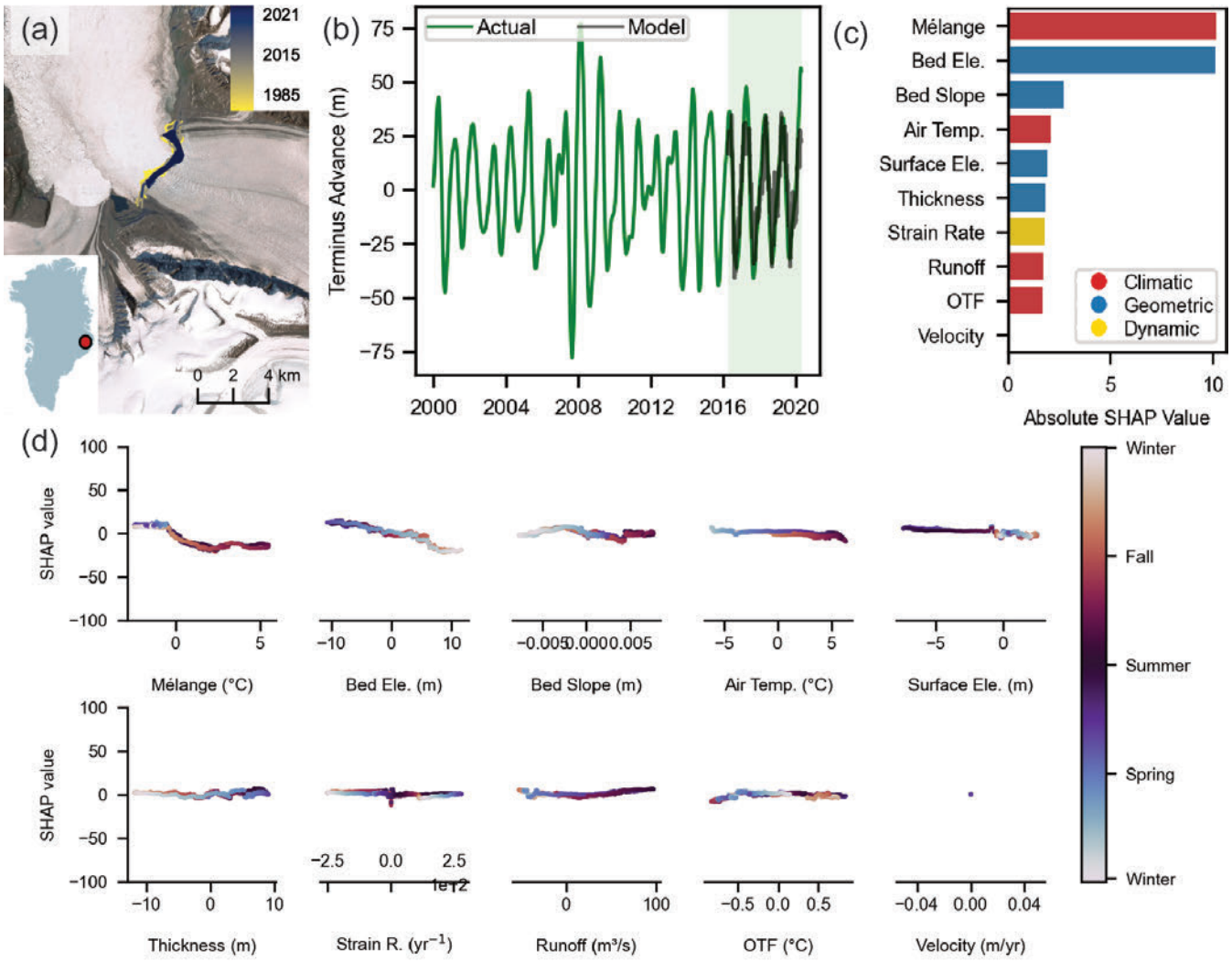

Figure S21. Same as for Fig. S1 but for Magga Dan Gletscher (GID 125). Error scores for this model are NRMSE: 0.106; Spearman; 0.916; R^2: 0.772; offset: 0.8 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

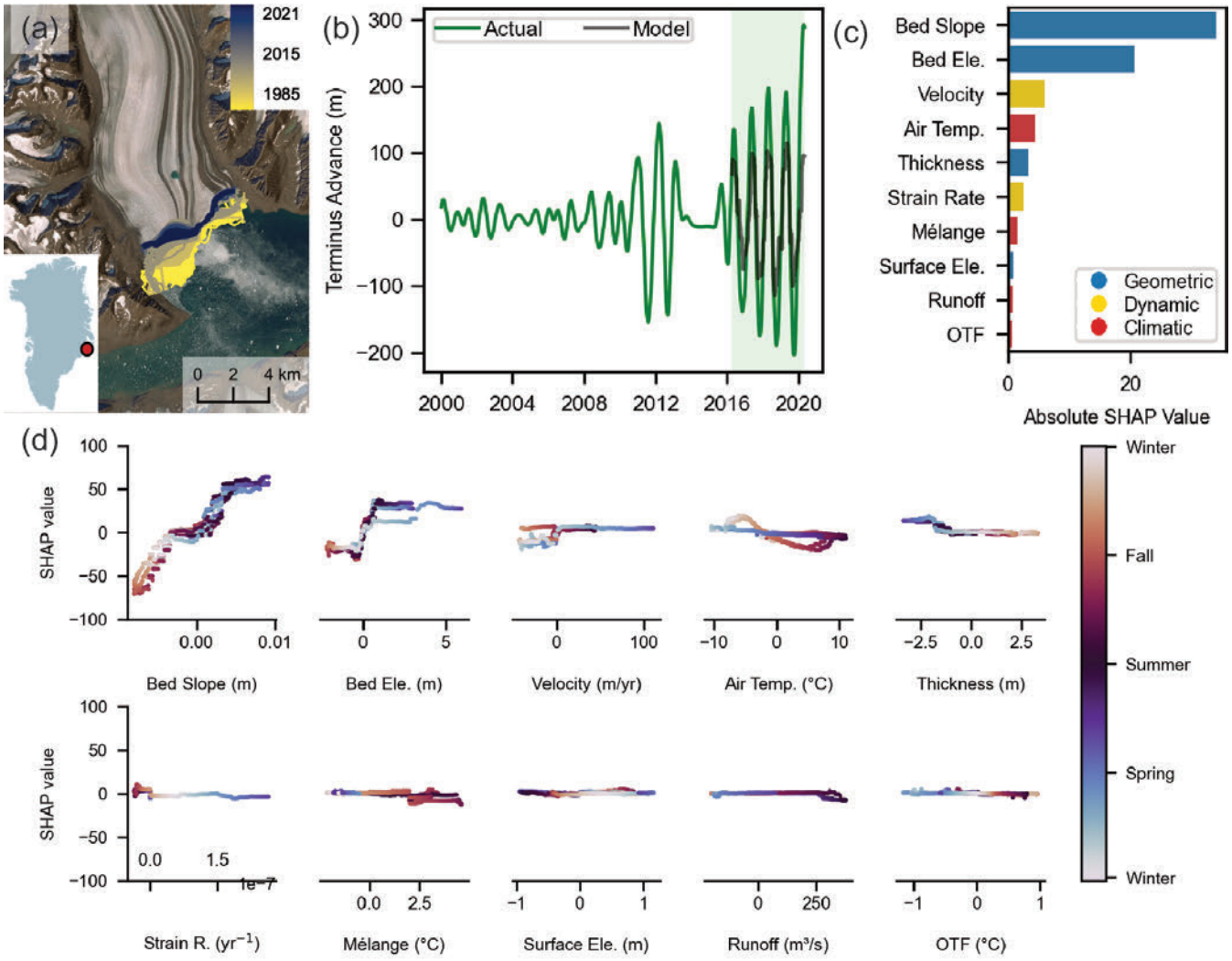

Figure S22. Same as for Fig. S1 but for Dendritgletscher (GID 132). Error scores for this model are NRMSE: 0.127; Spearman; 0.906; R^2: 0.668; offset: 0.6 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

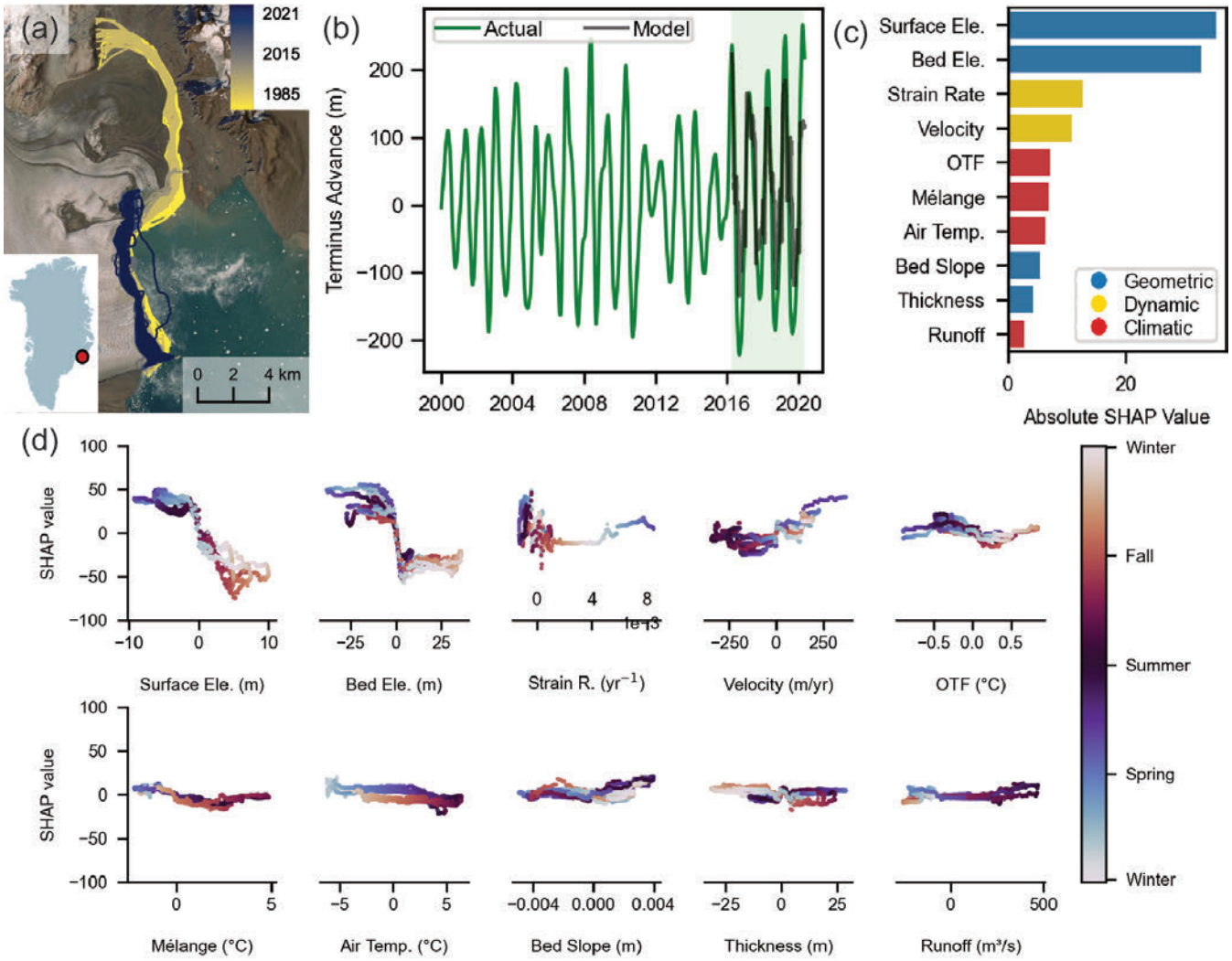

Figure S23. Same as for Fig. S1 but for Kong Christian IV Gletscher (GID 145). Error scores for this model are NRMSE: 0.153; Spearman; 0.841; R^2: 0.624; offset: 2.5 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

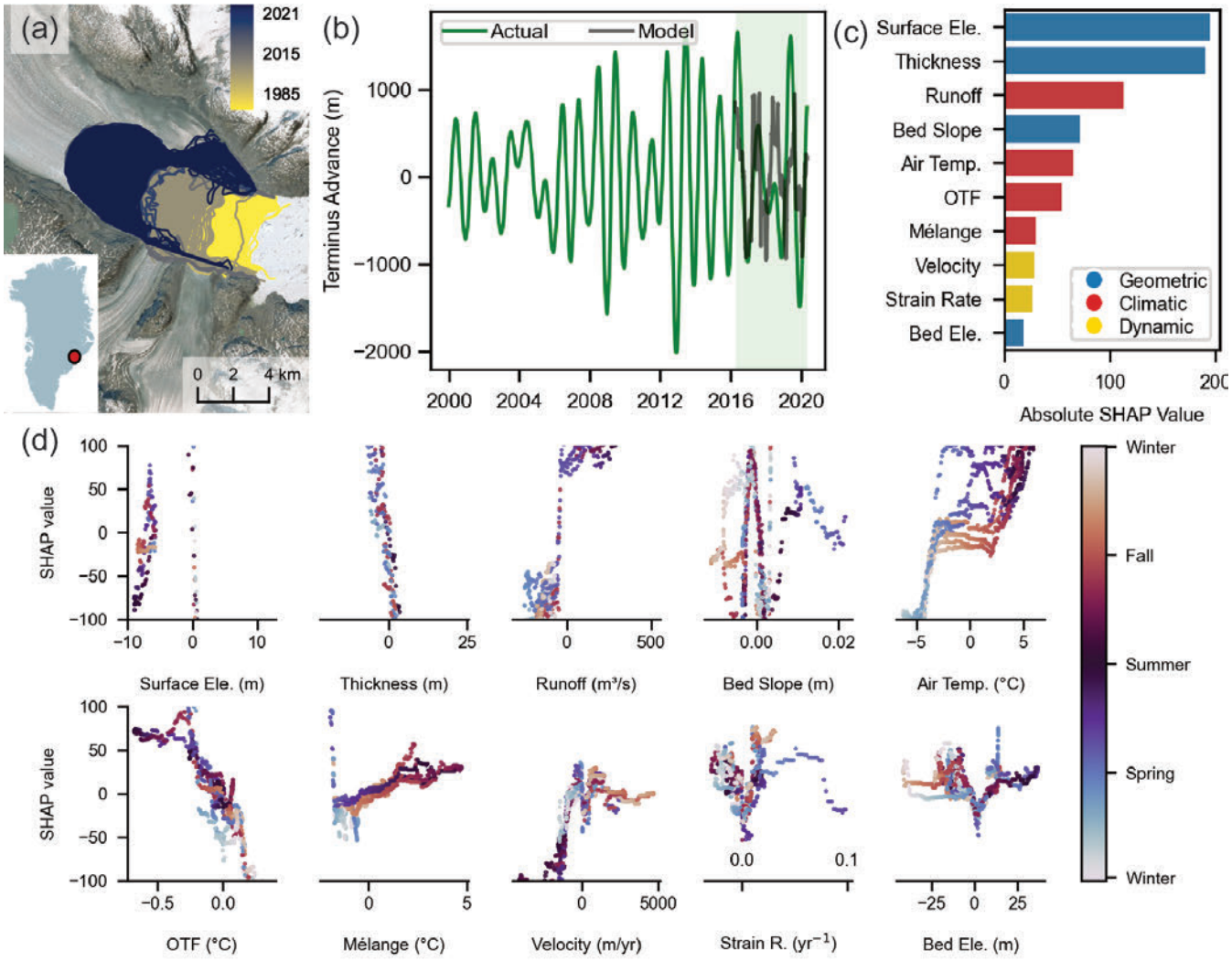

Figure S24. Same as for Fig. S1 but for Kangerlussuaq Gletscher (GID 152). Error scores for this model are NRMSE: 0.179; Spearman; 0.593; R^2: 0.308; offset: 6.5 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

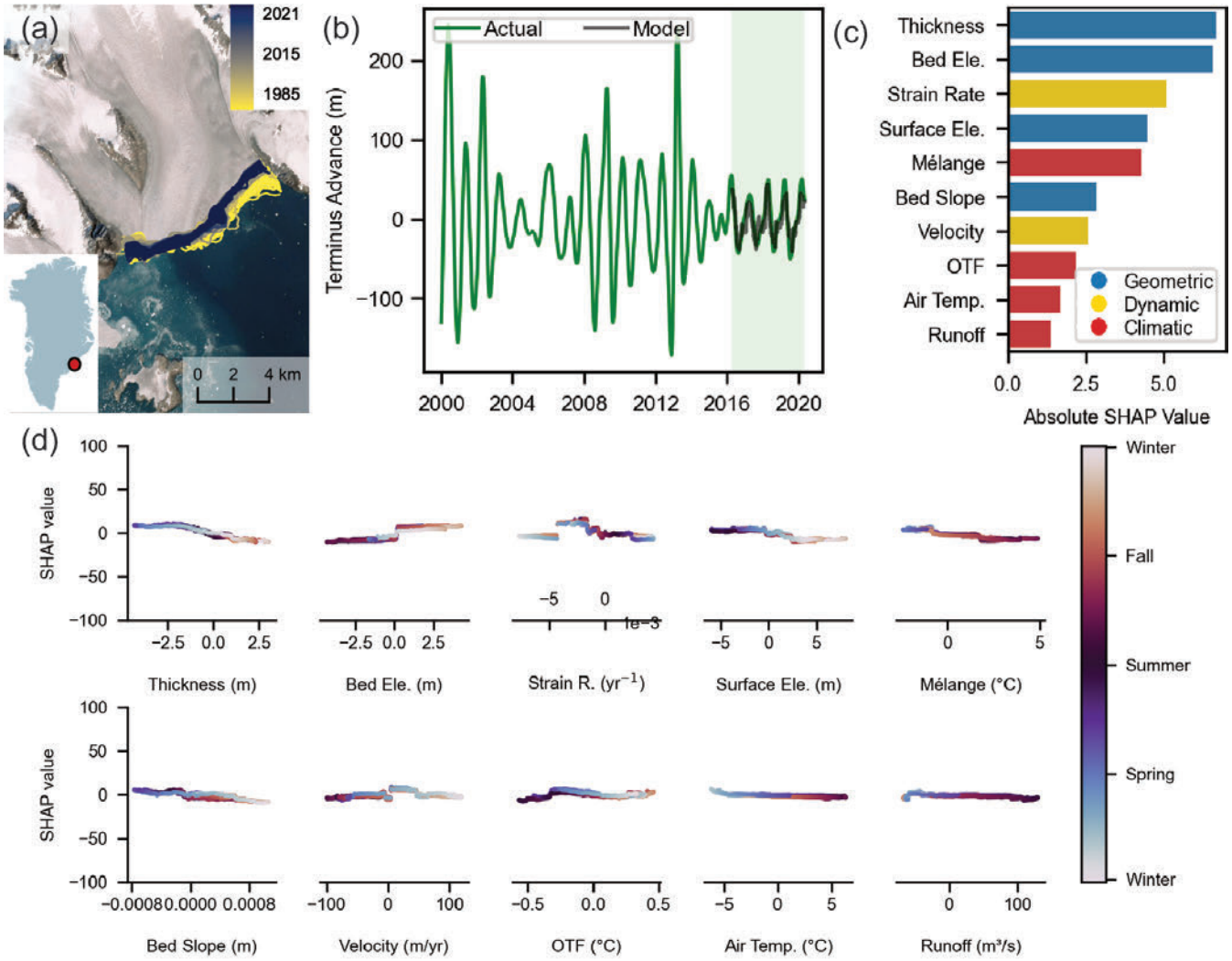

Figure S25. Same as for Fig. S1 but for Polaric Gletscher (GID 157). Error scores for this model are NRMSE: 0.105; Spearman; 0.888; R^2: 0.773; offset: 6.9 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

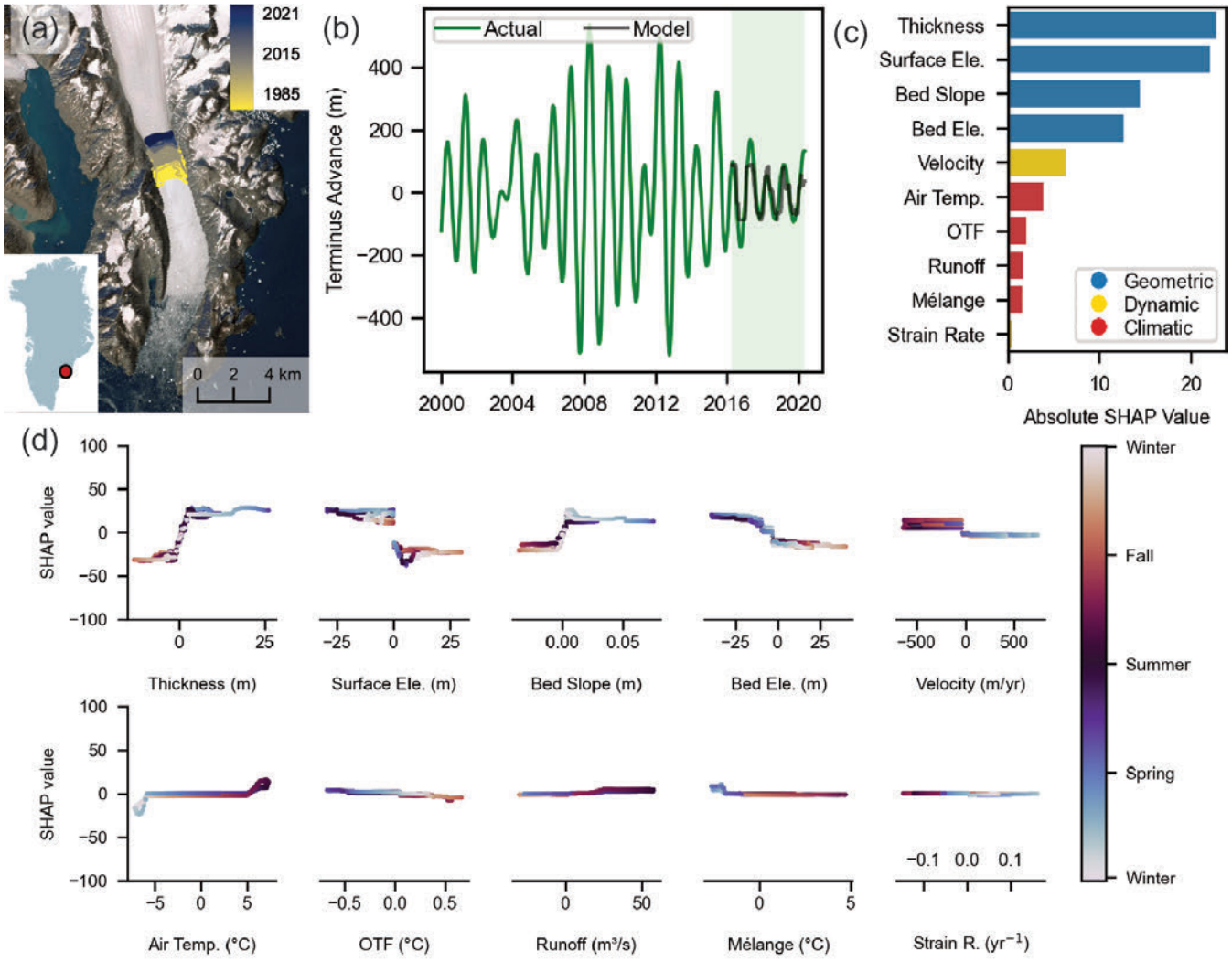

Figure S26. Same as for Fig. S1 but for Laube S (GID 167). Error scores for this model are NRMSE: 0.110; Spearman; 0.852; R^2: 0.696; offset: 10.2 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

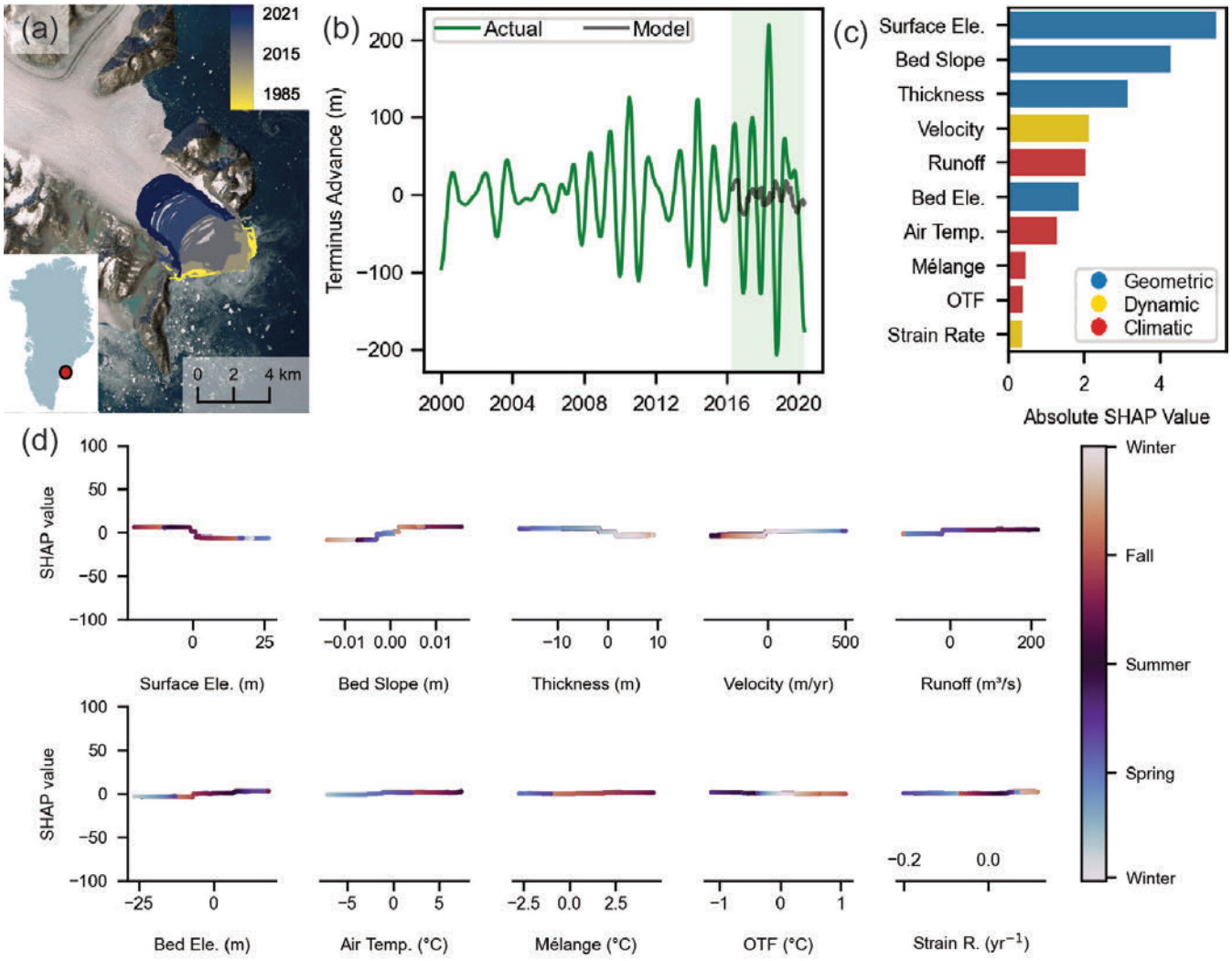

Figure S27. Same as for Fig. S1 but for Steenstrup Nodre Bræ (GID 171). Error scores for this model are NRMSE: 0.185; Spearman; 0.264; R^2: 0.028; offset: 15.5 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

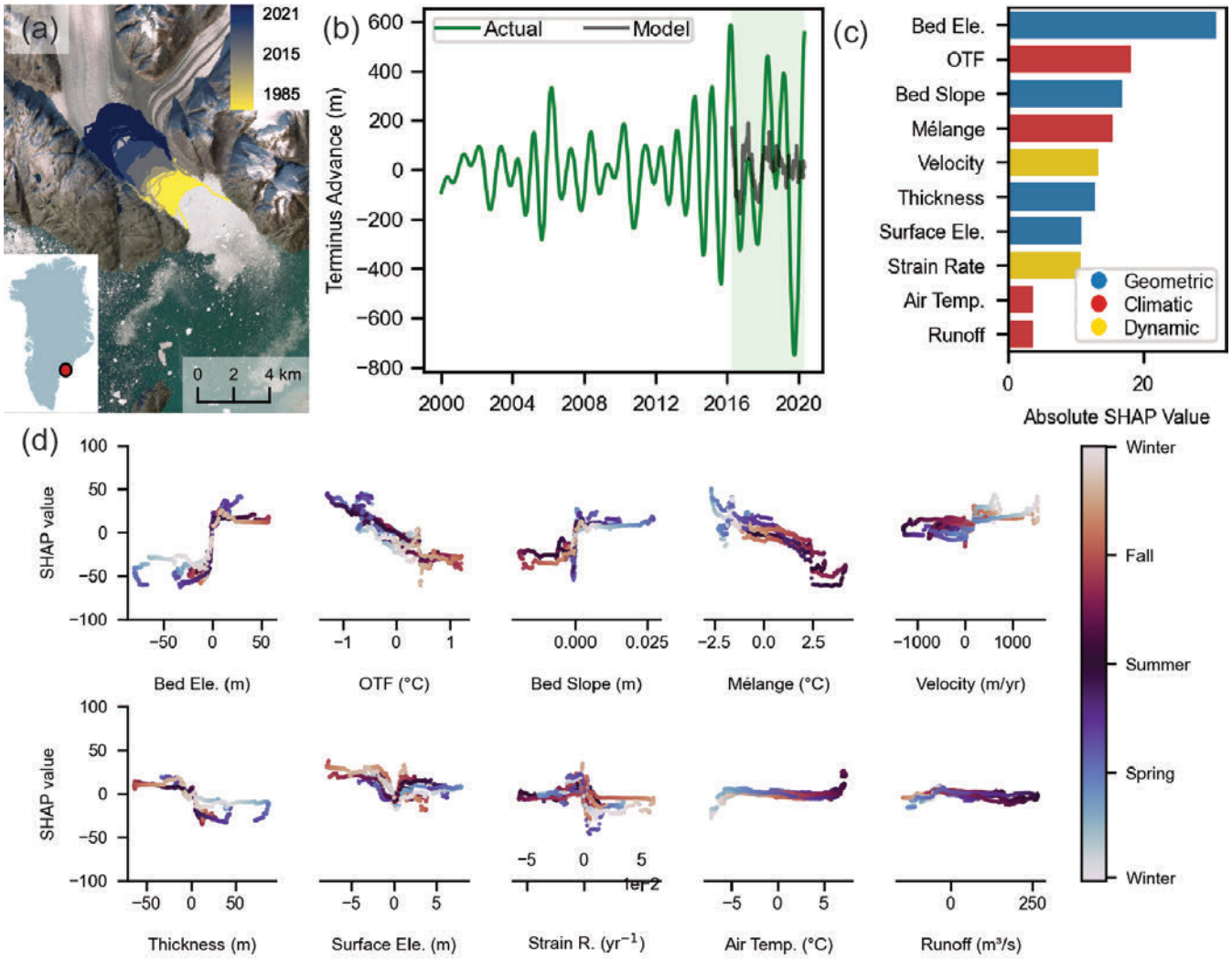

Figure S28. Same as for Fig. S1 but for Fenrisgletscher (GID 180). Error scores for this model are NRMSE: 0.181; Spearman; 0.533; R^2: 0.120; offset: 7.4 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

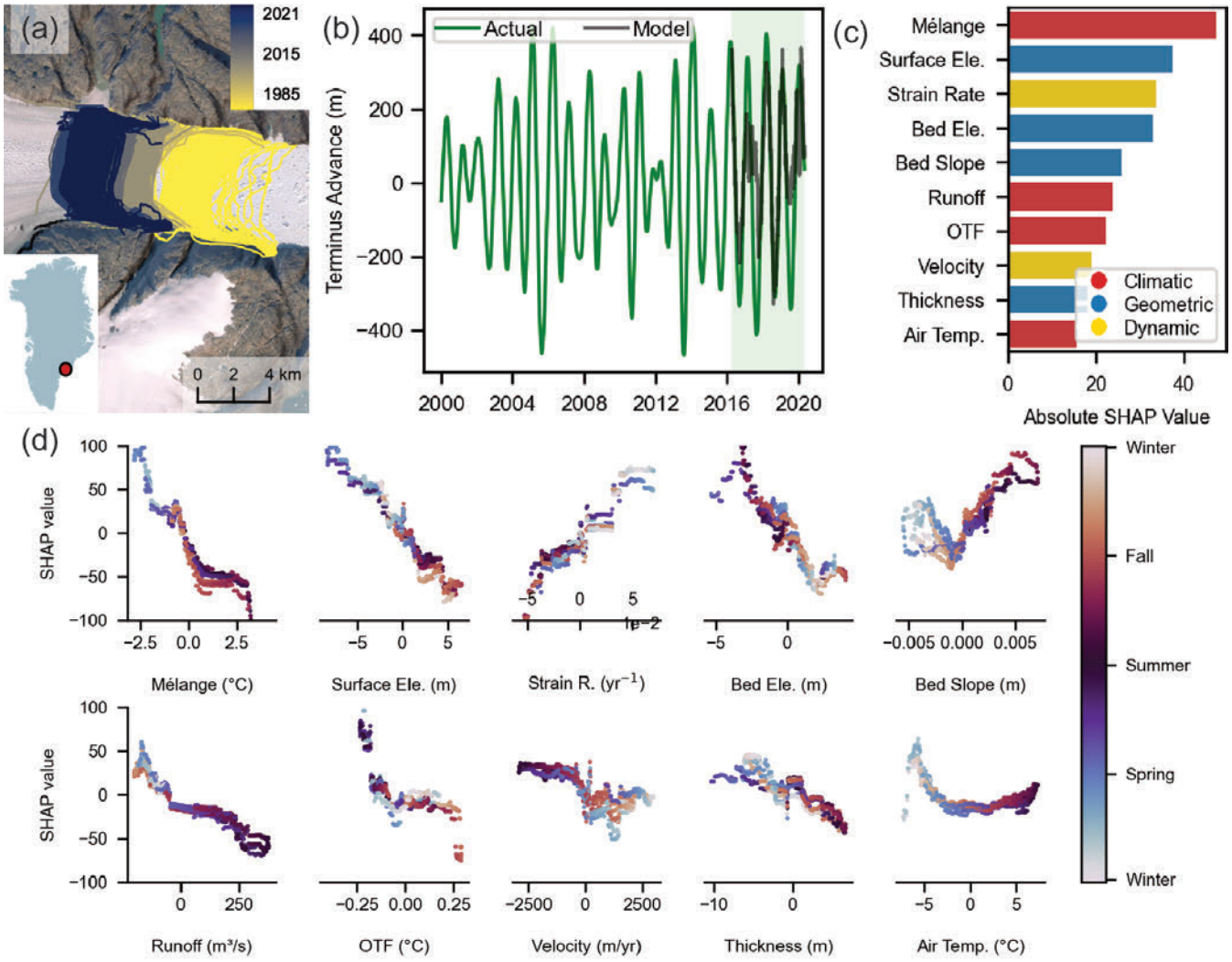

Figure S29. Same as for Fig. S1 but for Helheimgletscher (GID 181). Error scores for this model are NRMSE: 0.136; Spearman; 0.871; R^2: 0.702; offset: 10.4 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

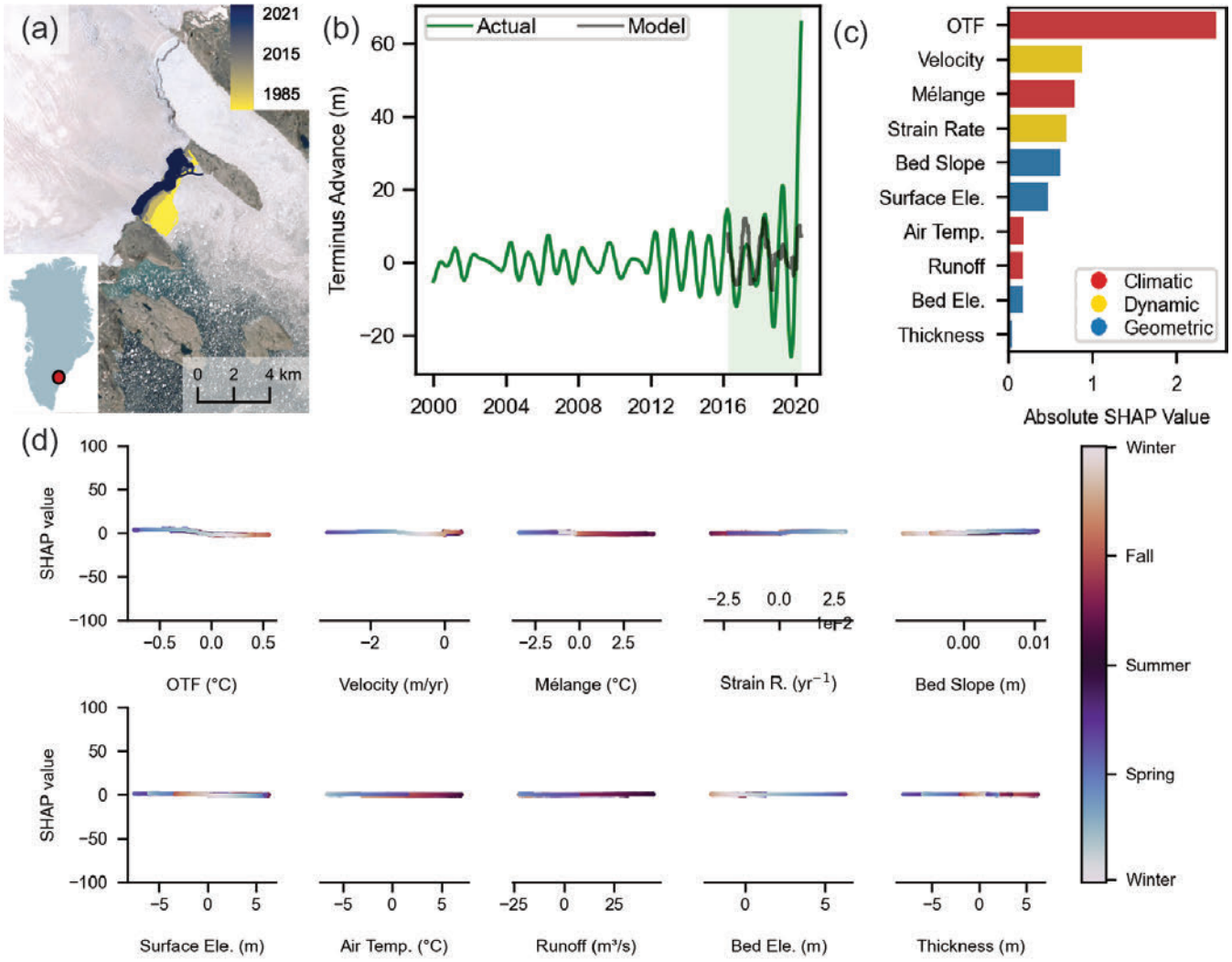

Figure S30. Same as for Fig. S1 but for Ikertivaq N (GID 186). Error scores for this model are NRMSE: 0.098; Spearman; 0.681; R^2: 0.304; offset: 1.4 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

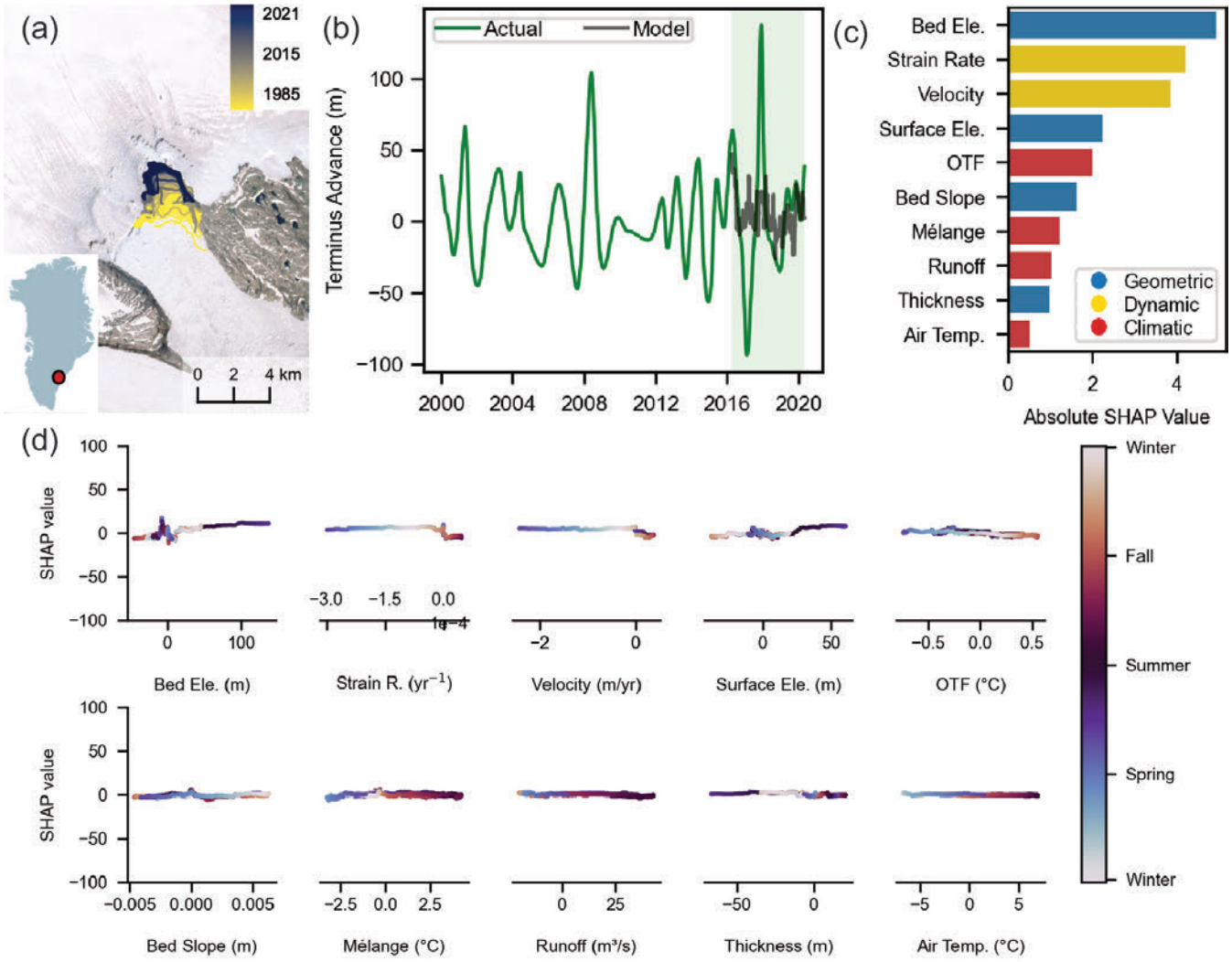

Figure S31. Same as for Fig. S1 but for Ikertivaq M (GID 187). Error scores for this model are NRMSE: 0.131; Spearman; 0.387; R^2: 0.093; offset: 2.7 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

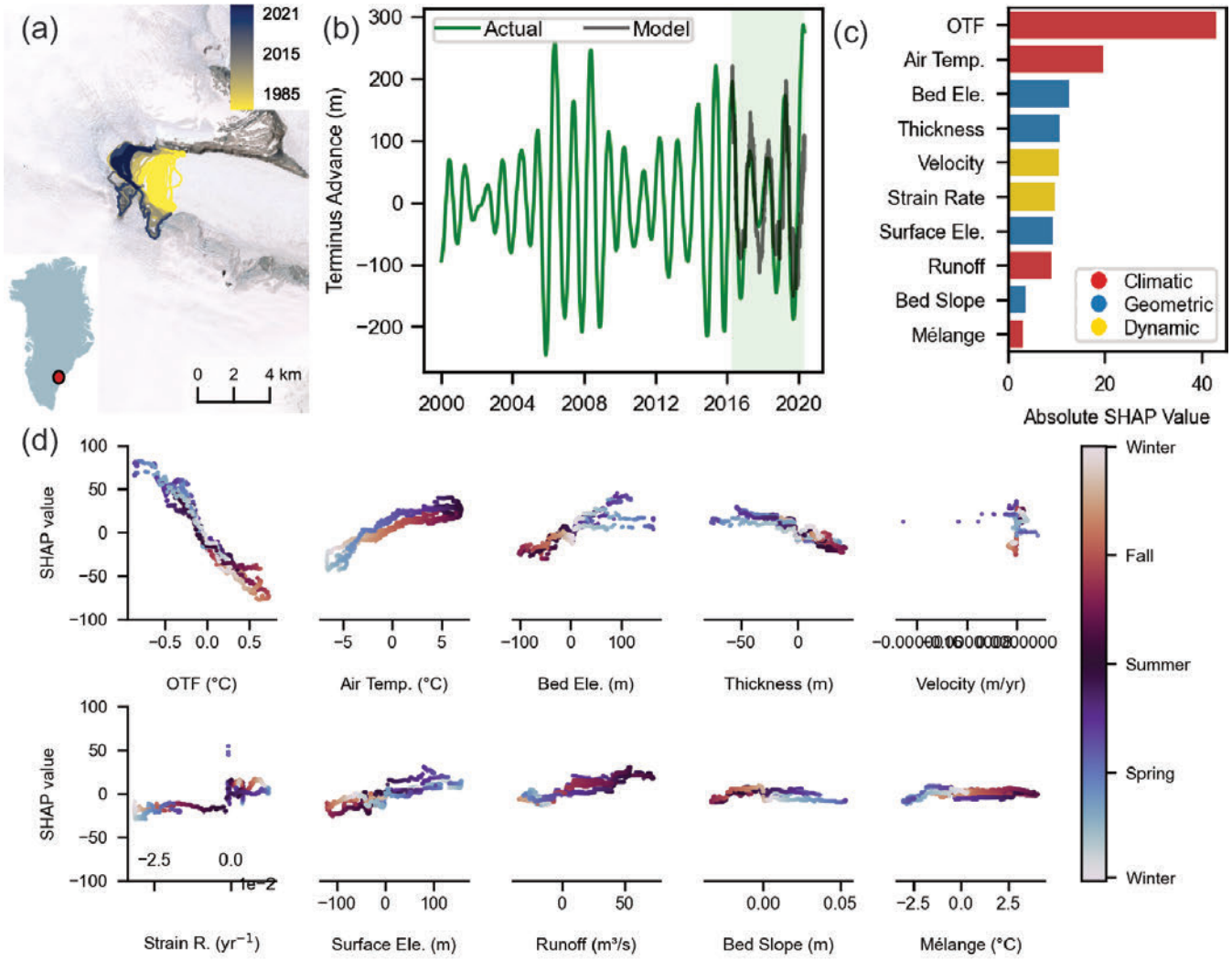

Figure S32. Same as for Fig. S1 but for Ikertivaq S (GID 189). Error scores for this model are NRMSE: 0.092; Spearman; 0.902; R^2: 0.731; offset: 4.9 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

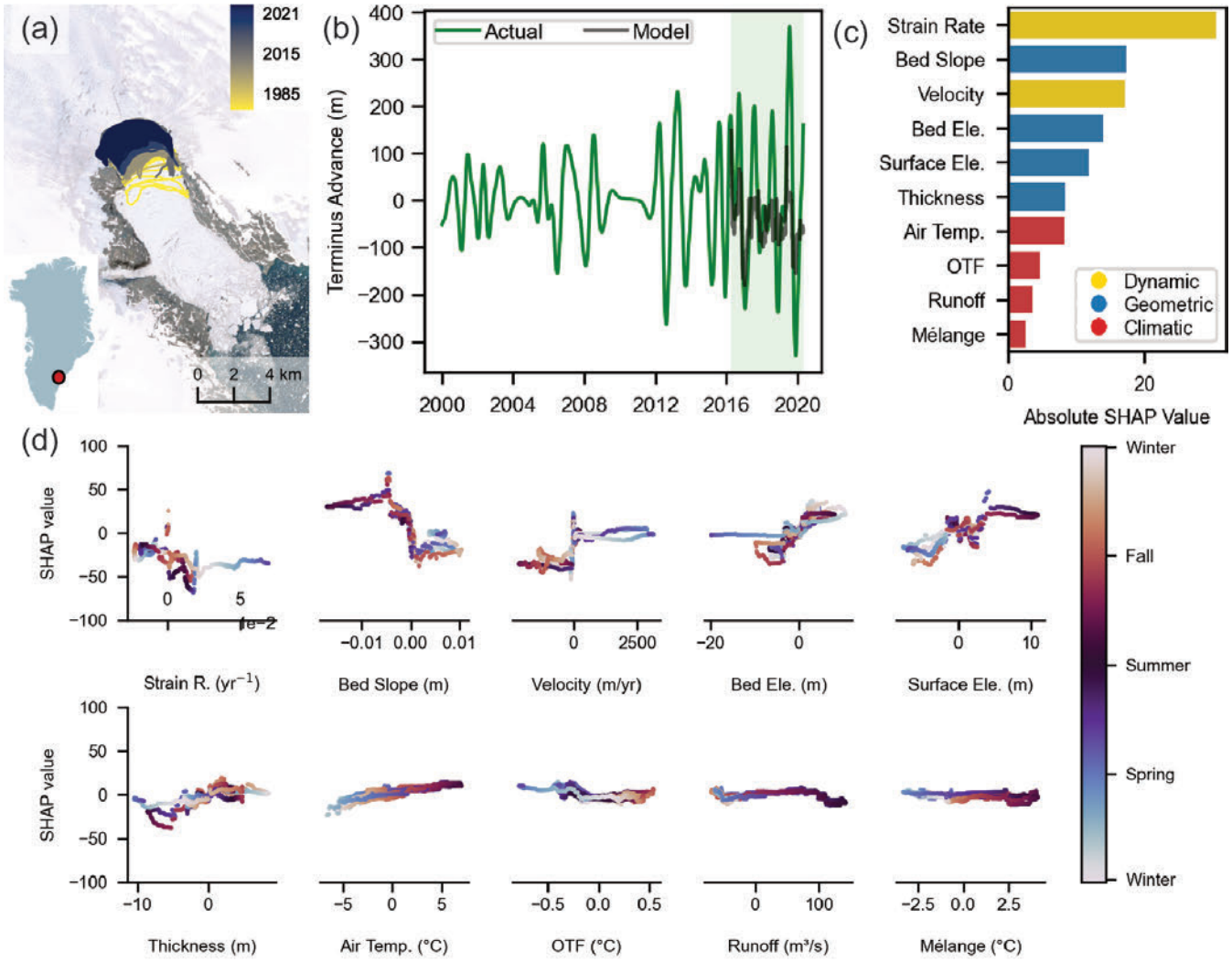

Figure S33. Same as for Fig. S1 but for Køge Bugt C (GID 196). Error scores for this model are NRMSE: 0.141; Spearman; 0.745; R^2: 0.347; offset: 2.7 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

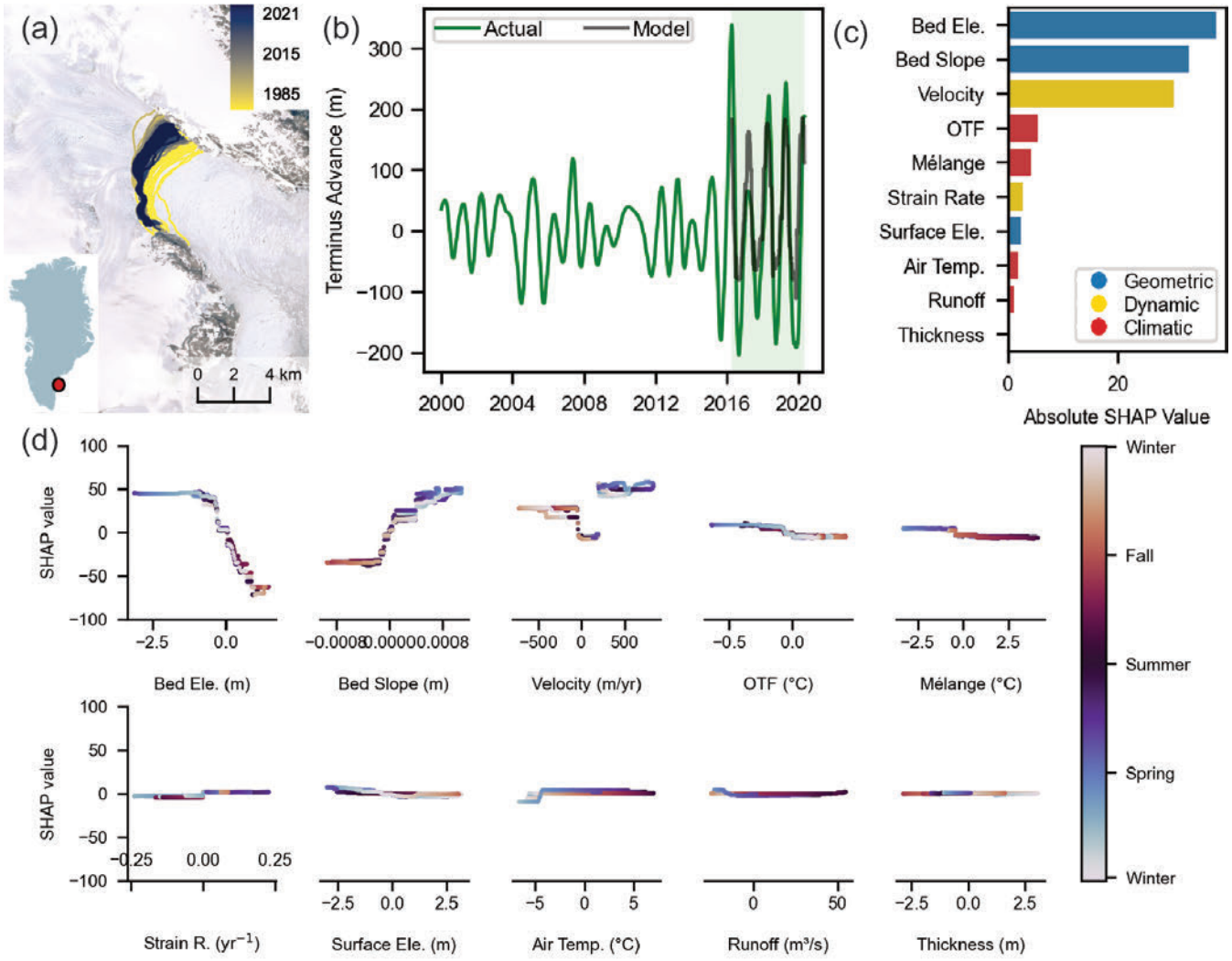

Figure S34. Same as for Fig. S1 but for Køge Bugt S (GID 197). Error scores for this model are NRMSE: 0.148; Spearman; 0.821; R^2: 0.532; offset: 2.7 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

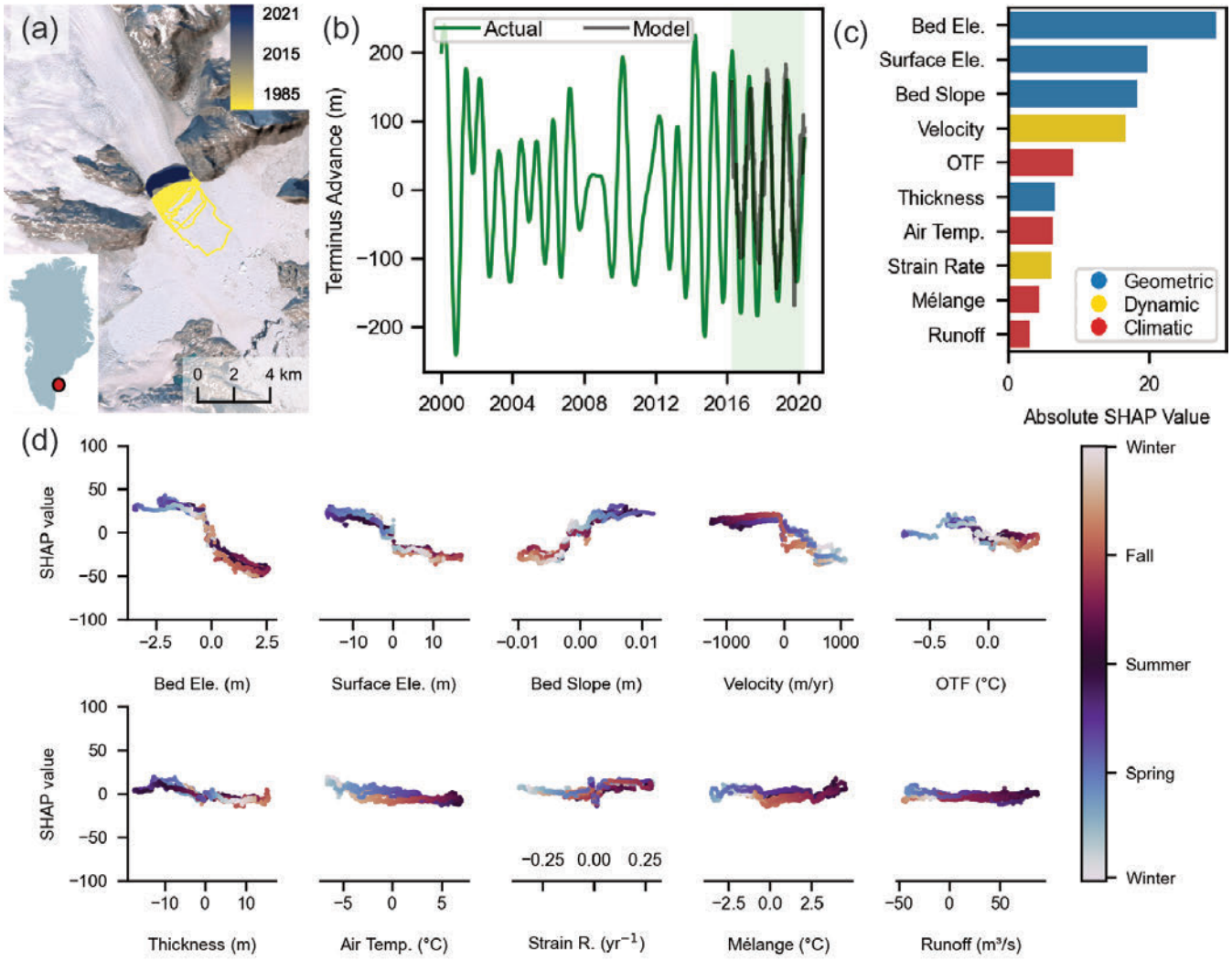

Figure S35. Same as for Fig. S1 but for Graulv (GID 210). Error scores for this model are NRMSE: 0.131; Spearman; 0.869; R^2: 0.724; offset: 1.8 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

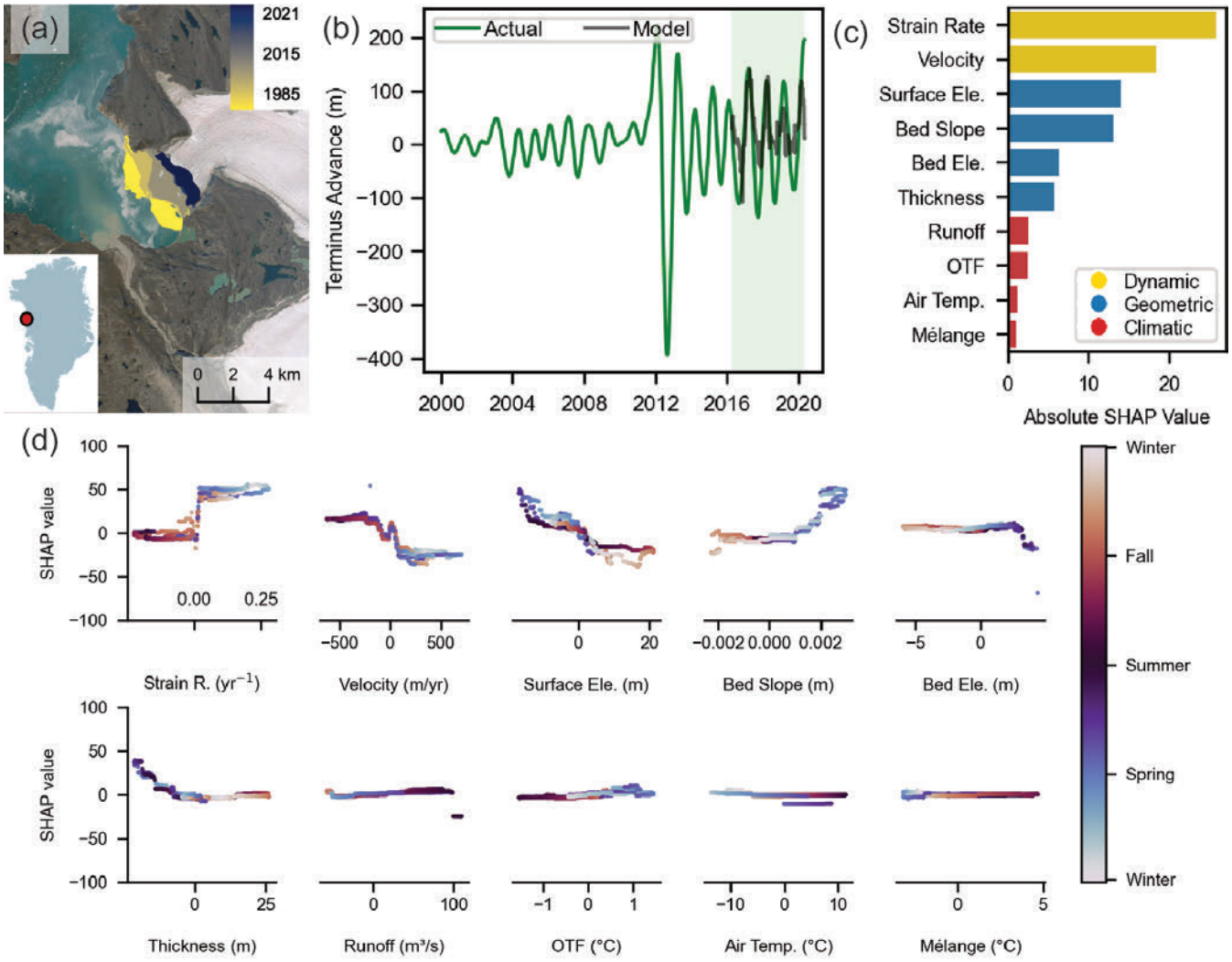

Figure S36. Same as for Fig. S1 but for Eqip Sermia (GID 280). Error scores for this model are NRMSE: 0.171; Spearman; 0.775; R^2: 0.463; offset: 10.2 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

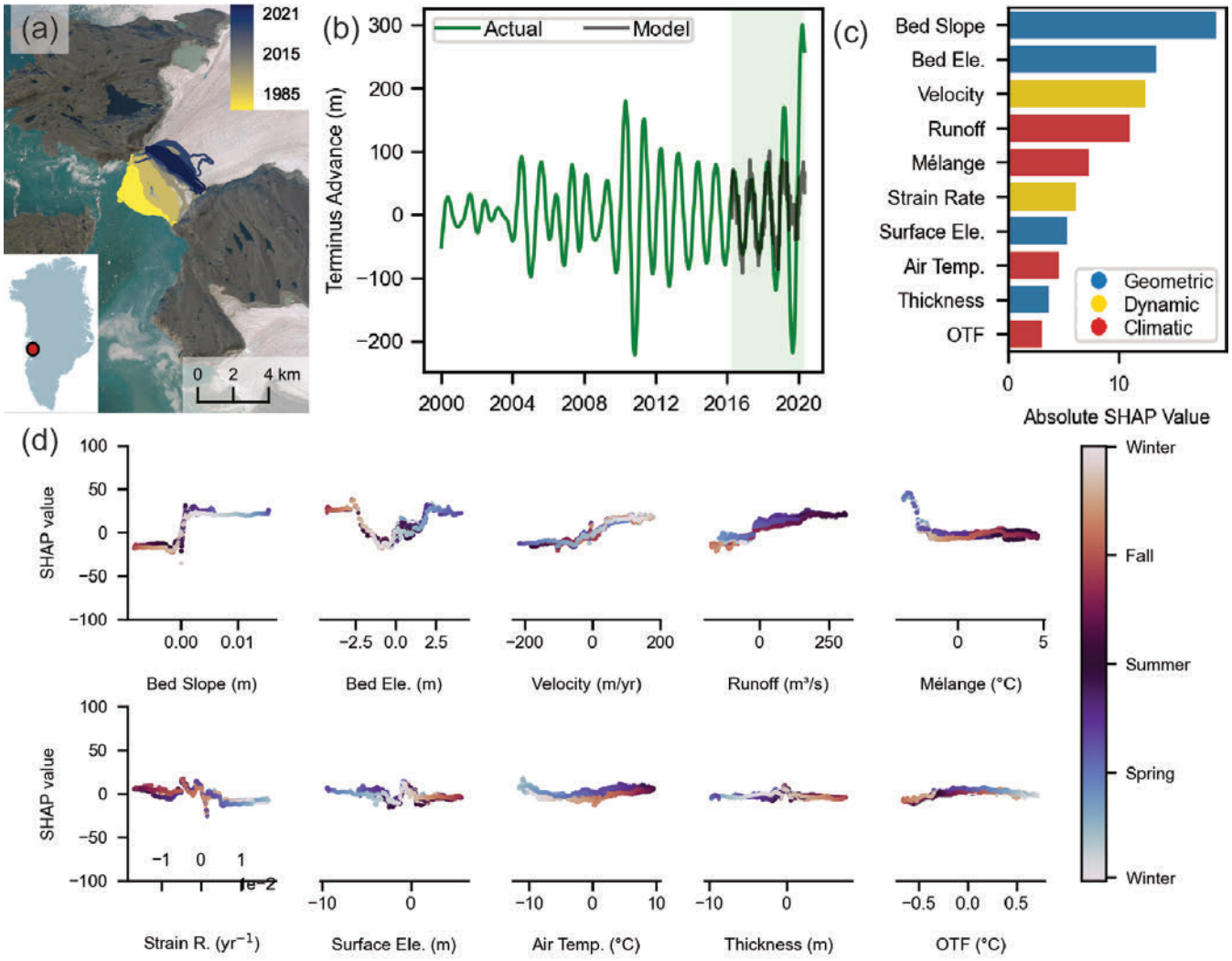

Figure S37. Same as for Fig. S1 but for Kangilerngata Sermia (GID 281). Error scores for this model are NRMSE: 0.107; Spearman; 0.802; R^2: 0.363; offset: 0.5 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

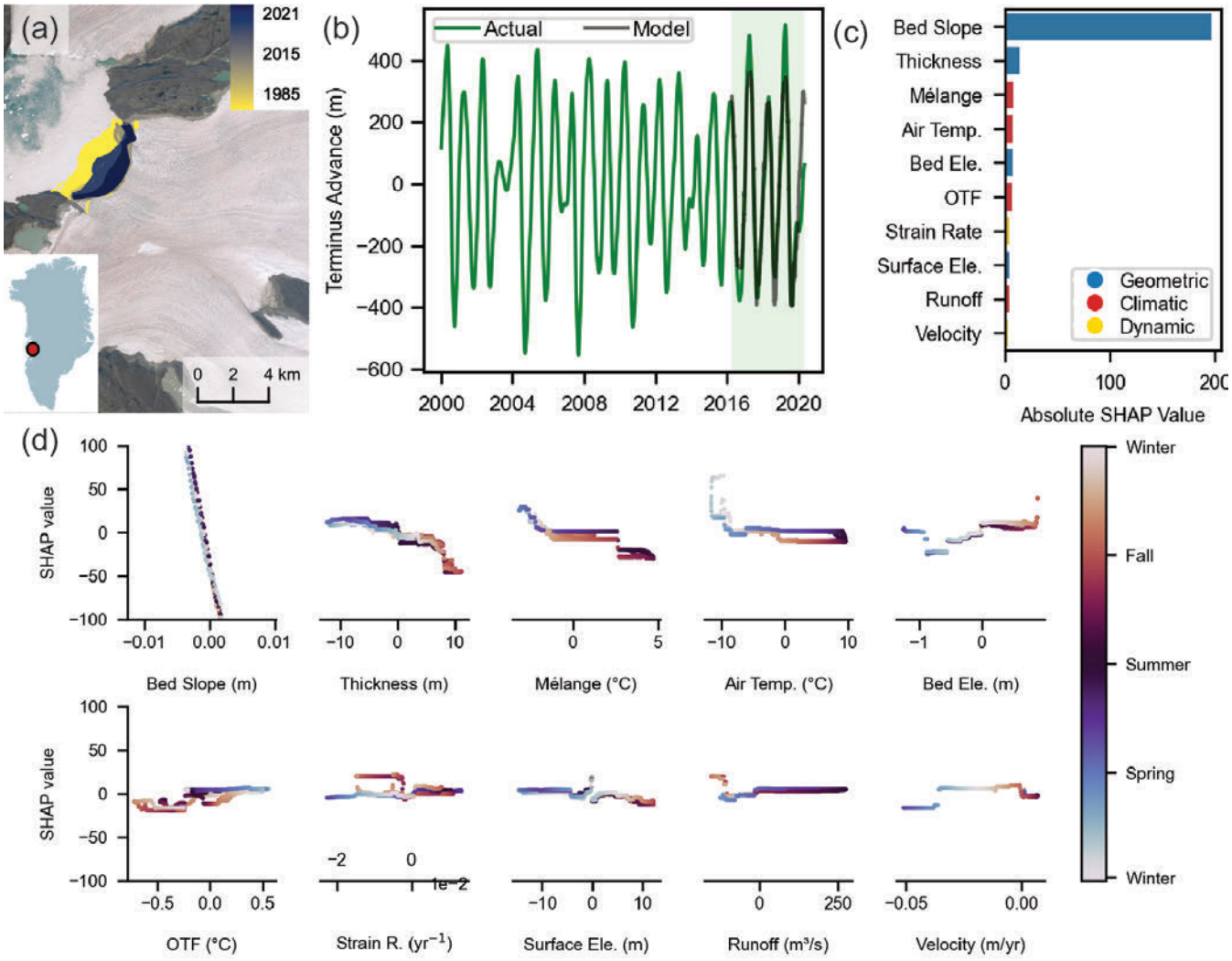

Figure S38. Same as for Fig. S1 but for Sermeq Kujalleq (GID 282). Error scores for this model are NRMSE: 0.068; Spearman; 0.955; R^2: 0.878; offset: 7.2 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

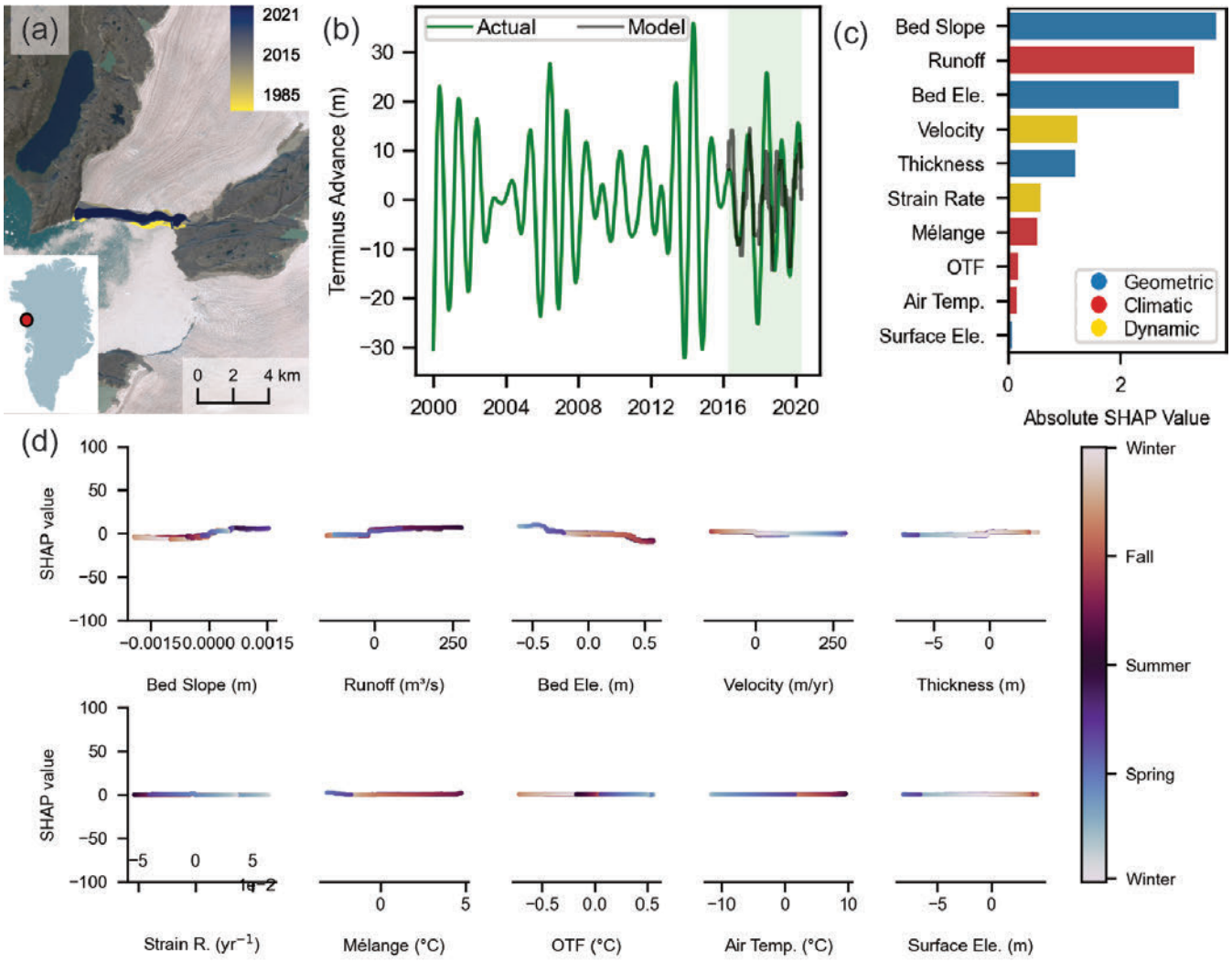

Figure S39. Same as for Fig. S1 but for Sermeq Avannarleq (GID 283). Error scores for this model are NRMSE: 0.147; Spearman; 0.698; R^2: 0.410; offset: 12.4 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

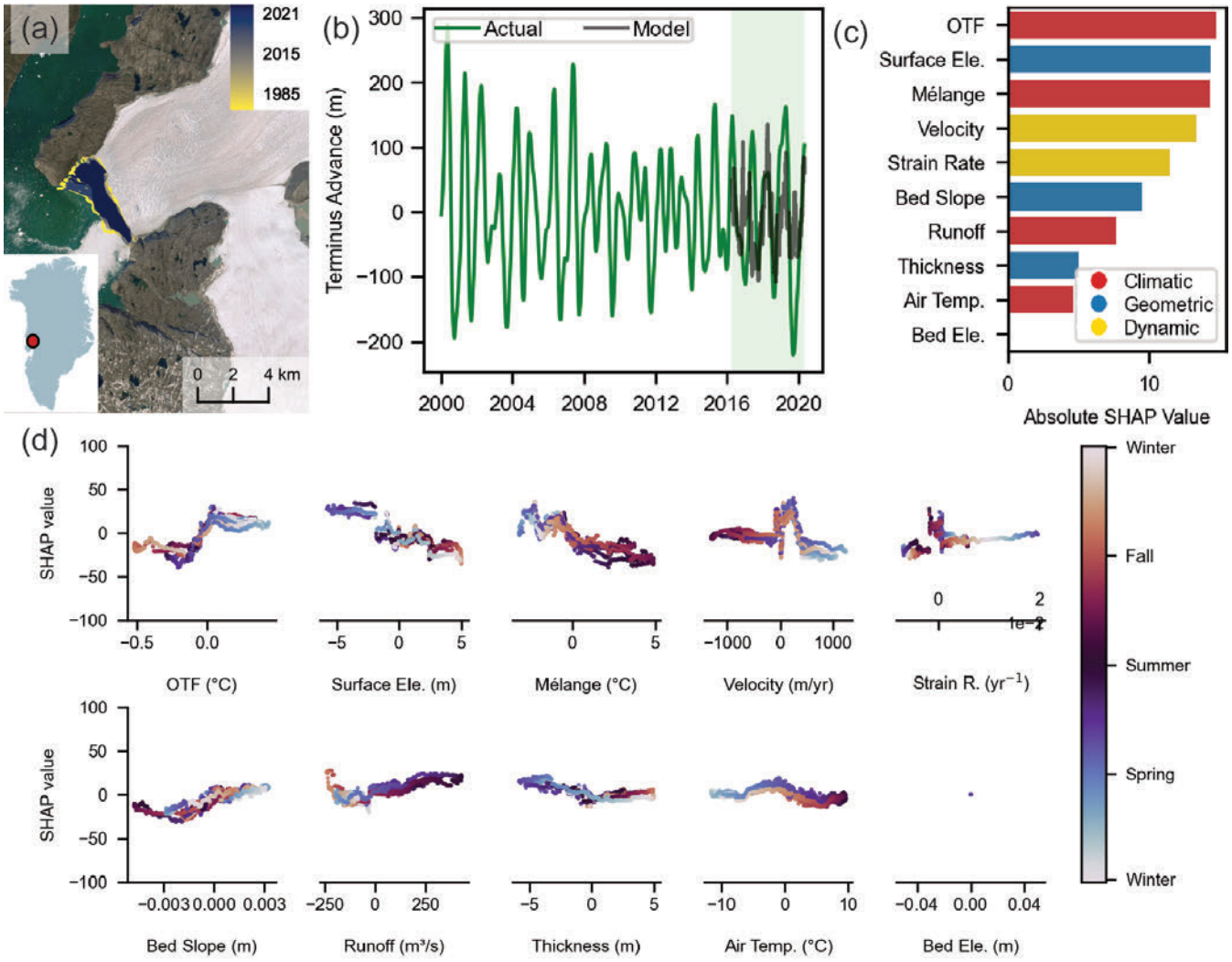

Figure S40. Same as for Fig. S1 but for Store Gletscher (GID 284). Error scores for this model are NRMSE: 0.192; Spearman; 0.377; R^2: 0.574; offset: 5.8 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

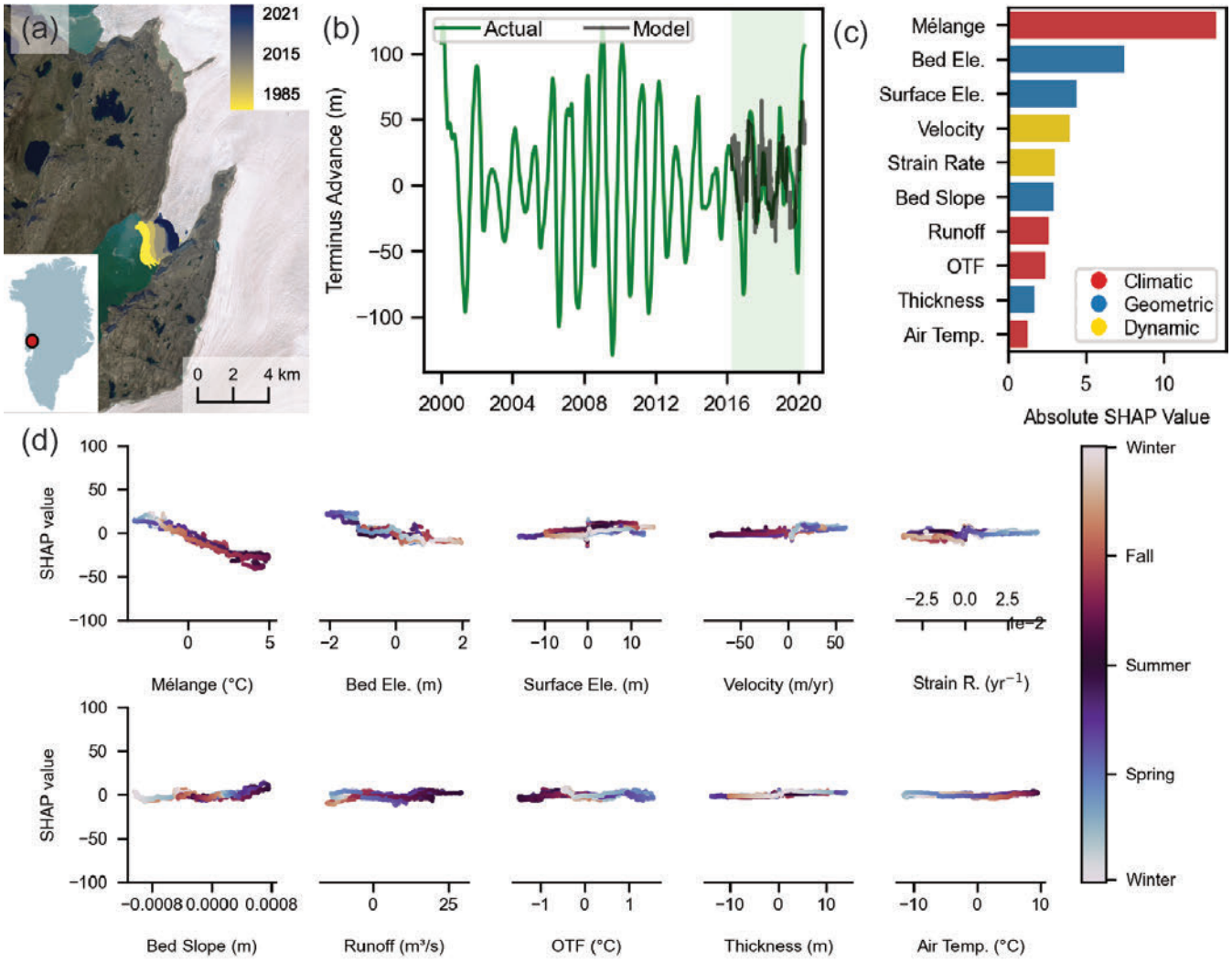

Figure S41. Same as for Fig. S1 but for Lille Gletscher (GID 285). Error scores for this model are NRMSE: 0.152; Spearman; 0.175; R^2: 0.084; offset: 6.0 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

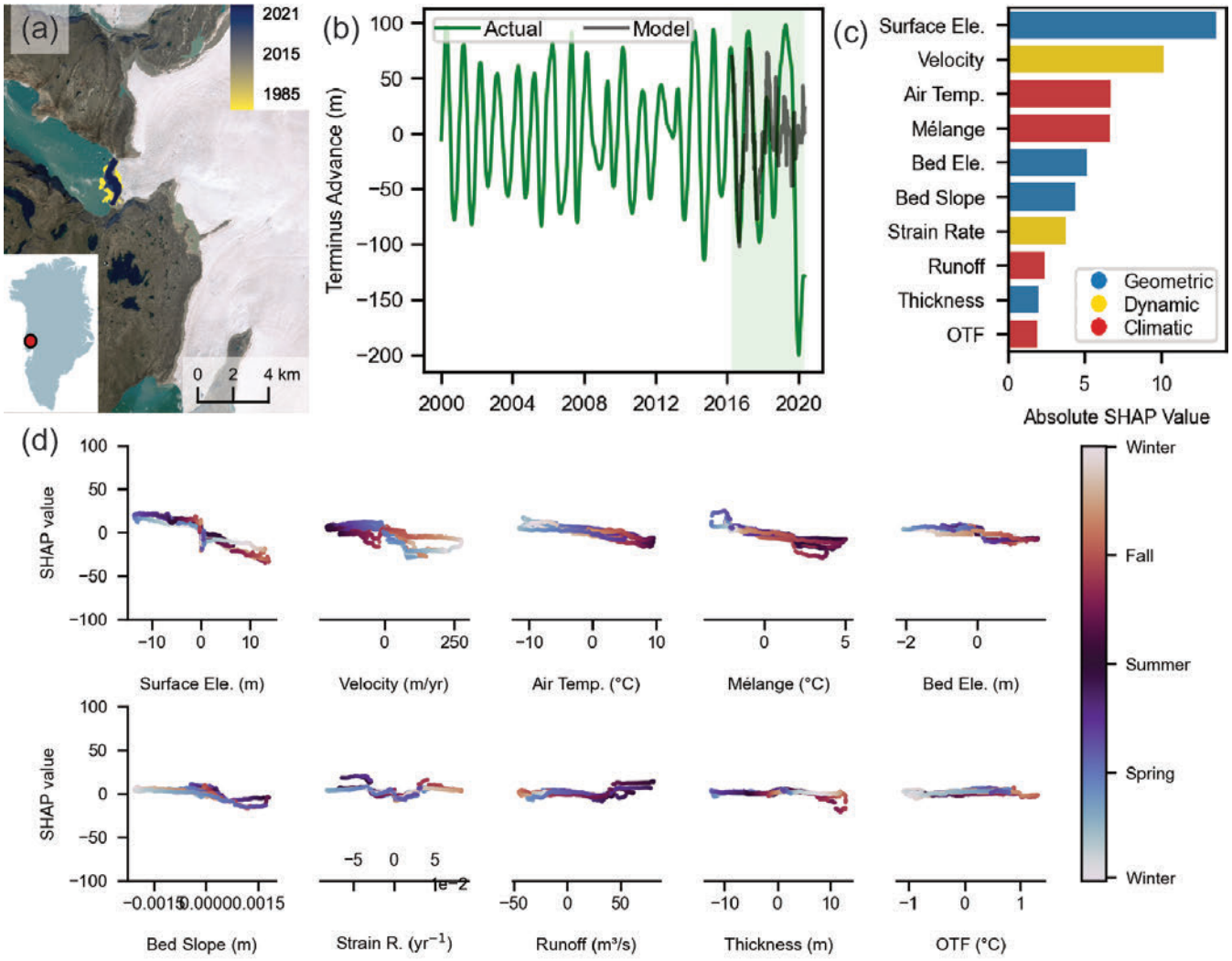

Figure S42. Same as for Fig. S1 but for Sermilik (GID 286). Error scores for this model are NRMSE: 0.189; Spearman; 0.440; R^2: 0.138; offset: 4.2 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

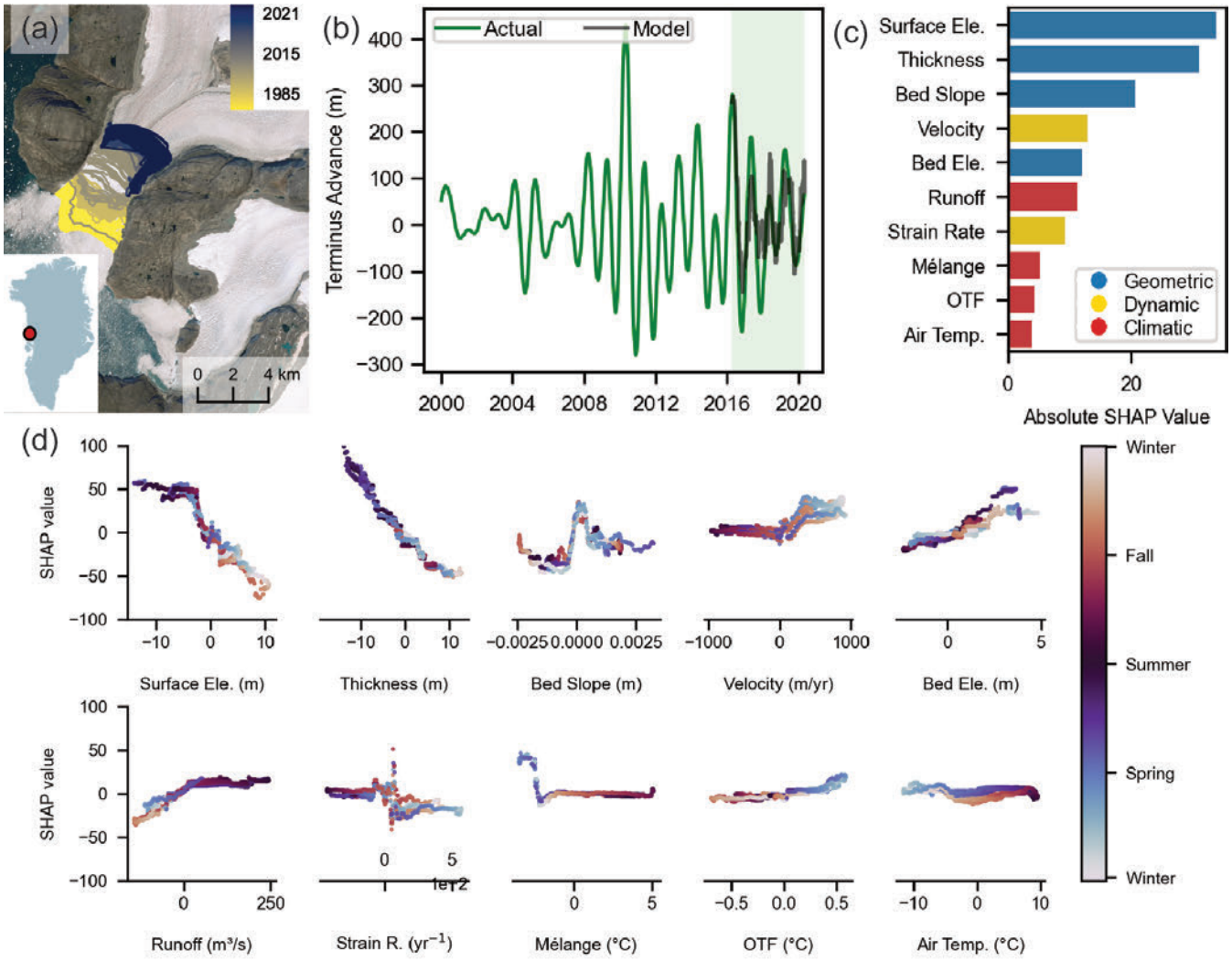

Figure S43. Same as for Fig. S1 but for Sermeq Silarleq (GID 288). Error scores for this model are NRMSE: 0.127; Spearman; 0.741; R^2: 0.574; offset: 5.8 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).

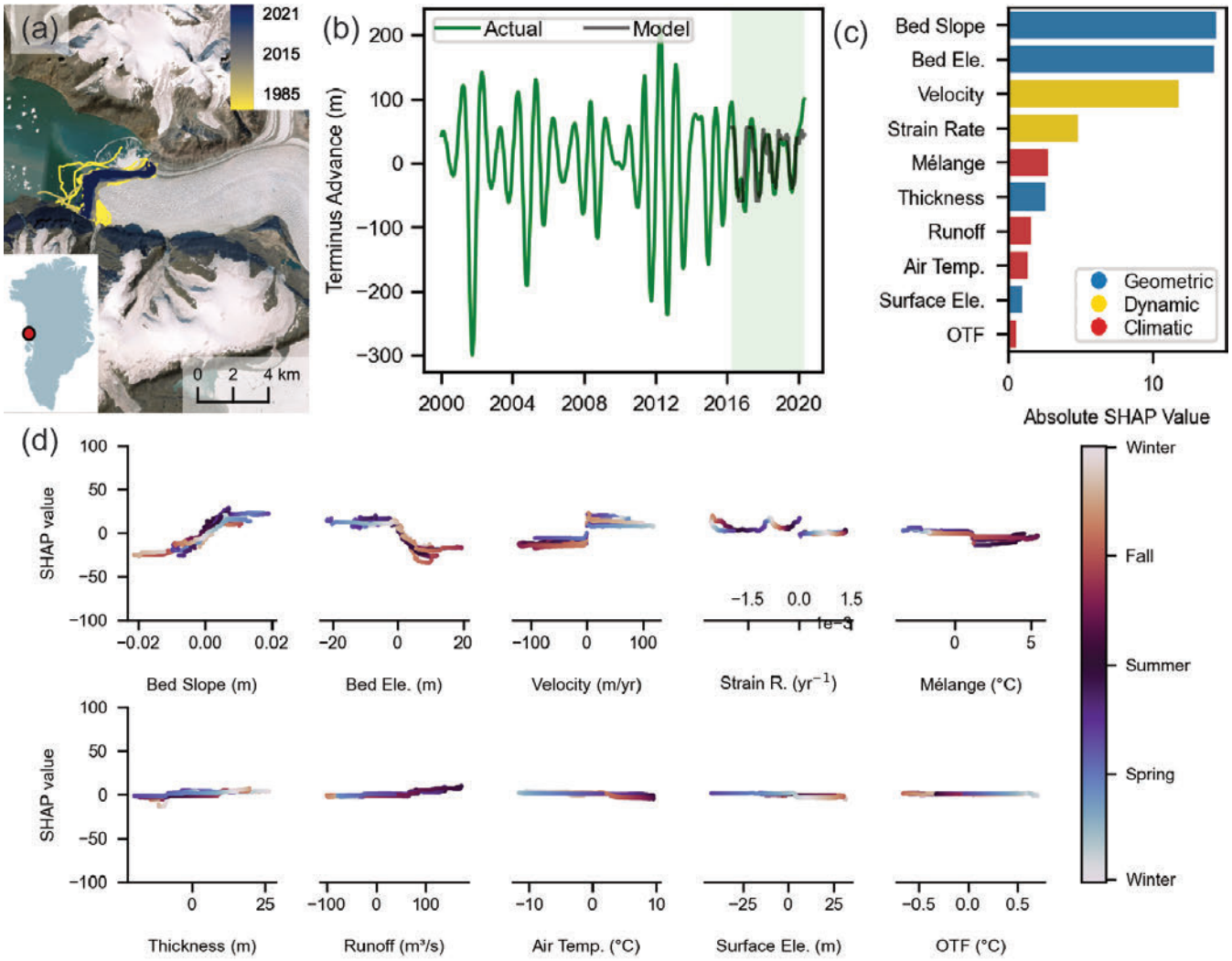

Figure S44. Same as for Fig. S1 but for Kangerlussuup Sermersua (GID 291). Error scores for this model are NRMSE: 0.120; Spearman; 0.725; R^2: 0.579; offset: 15.3 weeks. Greenland basemap used in Figure (a) accessed from Esri (2025).