Confronting terrestrial biosphere models with forest inventory data

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APPENDIX B. SUPPLEMENTARY TABLE (REGRESSION RESULTS FOR FIA DATA AND LM3V OUTPUT) AND FIGURES.

Table B1. Summary of regression results for FIA data and LM3V output. In each regression, the response variable was aboveground biomass production ("growth") and the explanatory variables were mean annual temperature (linear and quadratic terms: **Temp** and **Temp^2**), mean annual precipitation (linear and quadratic terms: **Precip** and **Precip^2**), and soil available water capacity (**Soil AWC**). Multiple regression coefficients for these terms and for the regression **Intercept** are given in the table ("NA" indicates the term was not included in the model; the symbol "e" followed by a number means 10 raised to the number, e.g., 1.5e-02 means 1.5×10^{-2}; and the symbols *, **, and *** indicate $P < 0.05$, $P < 0.01$, and $P < 0.001$, respectively). For each **Source** (see definitions in Table 1), the regression model with the best (lowest) Akaike Information Criterion among ordinary least squares (OLS) regressions is presented. **Age**: stand-age range of FIA plots or vegetation age in LM3V. **Method**: OLS or Measurement Error Model (MEM; suffixes "10" and "50," respectively, refer to cases where 10% or 50% of the AWC variance was assumed to be due to measurement errors; suffixes "D" and "A," respectively, refer to cases where PRISM temperature and precipitation errors were estimated from Daly et al. [2008] or from eastern U.S. Ameriflux sites). **N**: sample size for regression (number of inventory plots for FIA_{plot} analyses, or number of 1° grid cells for FIA_{grid} and LM3V analyses). **R^2**: proportion of growth variance explained (see Appendix A for details on MEM R^2 calculations). **T_m** and **P_m**: temperature and precipitation values, respectively, at which expected growth reaches a minimum or maximum in models that include the corresponding quadratic term ($Temp^2$ or $Precip^2$); a minimum/maximum occurs if the sign of the quadratic term is positive/negative (some minima/maxima occur near or beyond the limits of temperature and/or precipitation observed in this study [see x-axes in Fig. 4 and Figs. B3-B4]; these estimated growth responses are effectively monotonic).

Table B1. Summary of regression results for FIA data and LM3V output.

Source	**Age**	**Method**	**N**	**R^2**	**Intercept**	**Temp**	**$Temp^2$**	**Precip**	**$Precip^2$**	**Soil AWC**	**T_m**	**P_m**
FIA_{plot}	40-60	OLS	1468	0.09	4.68e-02**	1.62e-02***	-6.79e-04**	4.70e-02***	NA	2.38e-04***	11.92	NA
FIA_{plot}	40-60	MEM10-D	1468	0.1	1.94e-02	2.32e-02***	-1.11e-03**	4.39e-02**	NA	2.87e-04***	10.43	NA
FIA_{plot}	40-60	MEM50-D	1468	0.17	-2.88e-02	3.11e-02***	-1.61e-03***	2.92e-02	NA	5.79e-04***	9.65	NA
FIA_{plot}	40-60	MEM10-A	1468	0.11	1.69e-02	1.72e-02	-8.02e-04	7.83e-02	NA	2.54e-04**	10.74	NA
FIA_{plot}	40-60	MEM50-A	1468	0.15	-2.06e-02	2.42e-02	-1.23e-03	5.78e-02	NA	5.19e-04	9.83	NA
FIA_{plot}	60-80	OLS	1722	0.07	1.65e-02	2.25e-02***	-1.22e-03***	6.77e-02***	NA	1.79e-04***	9.18	NA
FIA_{plot}	60-80	MEM10-D	1722	0.11	-3.12e-02	3.38e-02***	-1.93e-03***	7.02e-02***	NA	2.38e-04***	8.77	NA
FIA_{plot}	60-80	MEM50-D	1722	0.16	-8.14e-02*	4.23e-02***	-2.46e-03***	6.08e-02***	NA	4.96e-04***	8.60	NA
FIA_{plot}	60-80	MEM10-A	1722	0.13	-4.67e-02	2.80e-02**	-1.67e-03**	1.21e-01	NA	1.96e-04*	8.38	NA
FIA_{plot}	60-80	MEM50-A	1722	0.16	-8.18e-02	3.42e-02*	-2.05e-03*	1.10e-01	NA	4.07e-04	8.32	NA
FIA_{plot}	80-100	OLS	799	0.04	6.14e-02*	2.00e-02***	-1.08e-03**	3.34e-02	NA	1.63e-04*	9.30	NA
FIA_{plot}	80-100	MEM10-D	799	0.06	2.32e-02	2.85e-02***	-1.60e-03***	3.70e-02	NA	2.11e-04**	8.93	NA
FIA_{plot}	80-100	MEM50-D	799	0.09	-1.87e-02	3.43e-02***	-1.96e-03***	3.39e-02	NA	4.27e-04*	8.73	NA
FIA_{plot}	80-100	MEM10-A	799	0.06	1.90e-02	2.55e-02*	-1.46e-03*	5.79e-02	NA	1.9e-04	8.73	NA
FIA_{plot}	80-100	MEM50-A	799	0.09	-1.59e-02	3.02e-02*	-1.76e-03	5.38e-02	NA	3.89e-04	8.58	NA
FIA_{grid}	40-60	OLS	101	0.45	-9.50e-02*	3.15e-02***	-1.60e-03***	1.20e-01***	NA	3.24e-04*	9.84	NA
FIA_{grid}	60-80	OLS	115	0.47	-3.20e-02	2.48e-02***	-1.31e-03***	9.97e-02***	NA	2.11e-04*	9.46	NA
FIA_{grid}	80-100	OLS	59	0.29	3.33e-02	2.45e-02**	-1.36e-03***	6.20e-02*	NA	3.25e-06	9.02	NA
$LM3V_{baseline}$	50	OLS	101	0.73	-1.35e-01***	1.62e-02**	-7.80e-04*	1.52e-01***	NA	7.22e-04***	10.37	NA
$LM3V_{baseline}$	70	OLS	115	0.75	-1.52e-01***	1.85e-02***	-9.47e-04***	1.50e-01***	NA	7.84e-04***	9.78	NA
$LM3V_{baseline}$	90	OLS	59	0.74	-1.17e-01**	1.59e-02*	-8.07e-04	1.16e-01***	NA	8.25e-04***	9.84	NA
$LM3V_{SbasePopt}$	50	OLS	101	0.75	-1.42e-02	1.07e-02**	-3.60e-04	7.89e-02***	NA	3.97e-04***	14.86	NA
$LM3V_{SbasePopt}$	70	OLS	115	0.75	-2.17e-02	1.22e-02***	-4.63e-04*	7.90e-02***	NA	4.01e-04***	13.13	NA
$LM3V_{SbasePopt}$	90	OLS	59	0.72	2.92e-02	3.50e-03**	NA	5.37e-02**	NA	4.12e-04***	NA	NA
$LM3V_{SmeanPopt}$	50	OLS	102	0.67	1.41e-01*	1.01e-02**	-2.98e-04	-1.11e-01	9.38e-02	NA	16.86	0.59
$LM3V_{SmeanPopt}$	70	OLS	116	0.68	1.54e-01**	1.29e-02***	-4.76e-04**	-1.64e-01	1.22e-01**	NA	13.56	0.67
$LM3V_{SmeanPopt}$	90	OLS	62	0.58	2.37e-01**	4.58e-03***	NA	-2.80e-01	1.74e-01*	NA	NA	0.80

SUPPLEMENTARY FIGURES

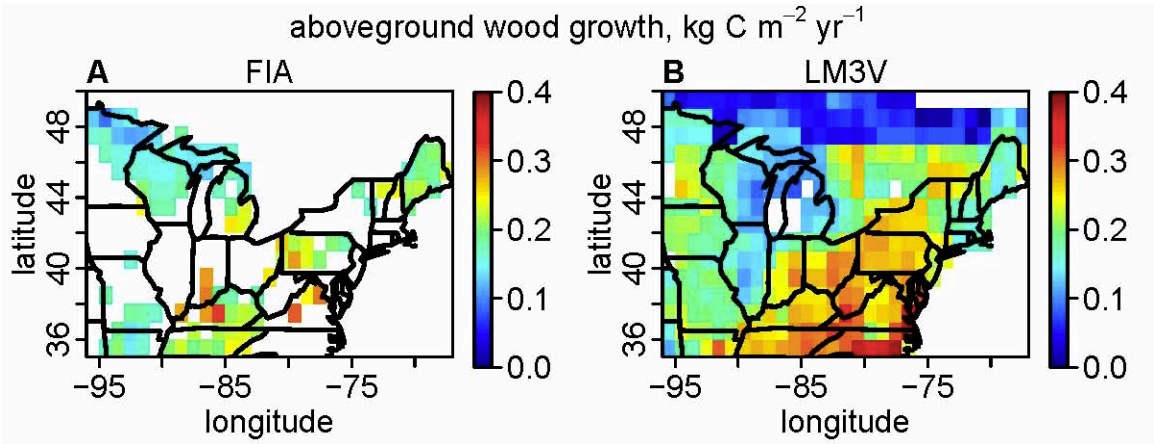

Figure B1. Aboveground wood growth in 40-60 year-old FIA inventory plots and 50 year-old vegetation in the baseline LM3V model (Shevliakova et al. 2009). See Fig. 3 legend for additional details.

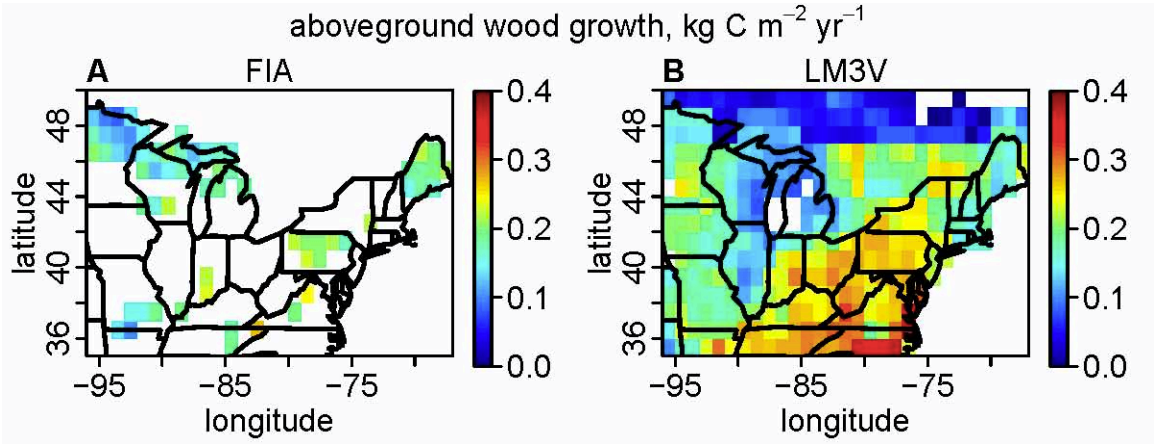

Figure B2. Aboveground wood growth in 80-100 year-old FIA inventory plots and 90 year-old vegetation in the baseline LM3V model (Shevliakova et al. 2009). See Fig. 3 legend for additional details.

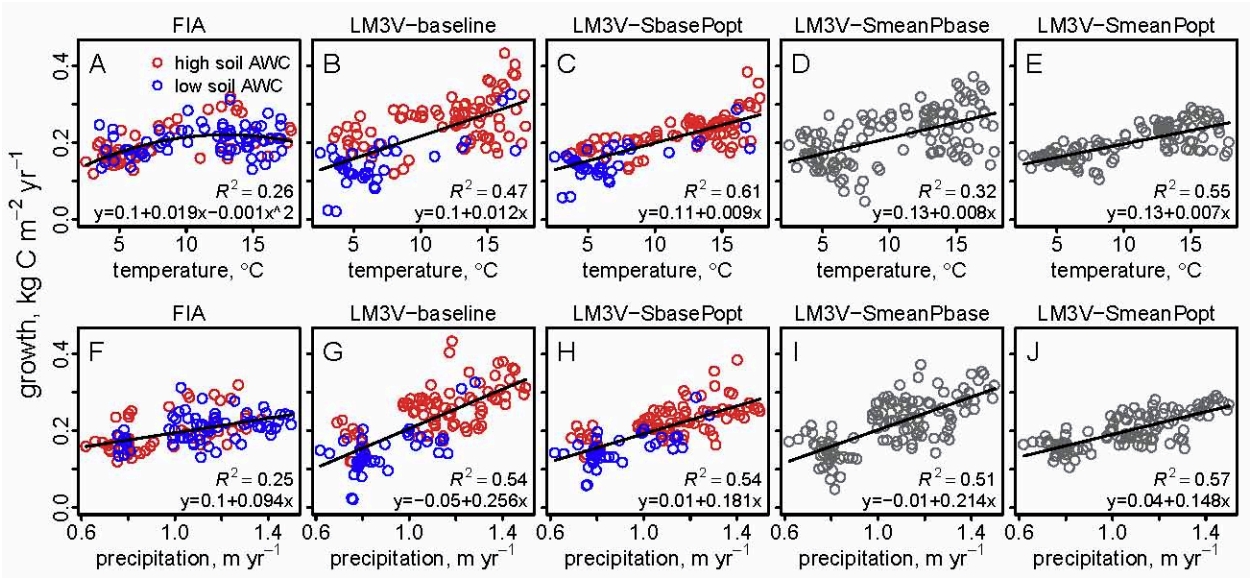

Figure B3. Aboveground wood growth of 40-60 year old FIA inventory plots (1° grid-cell means) and 50 year-old vegetation in four versions of the LM3V model (Table 1) vs. mean annual temperature (A-E) and mean annual precipitation (F-J). See Fig. 4 legend for additional details.

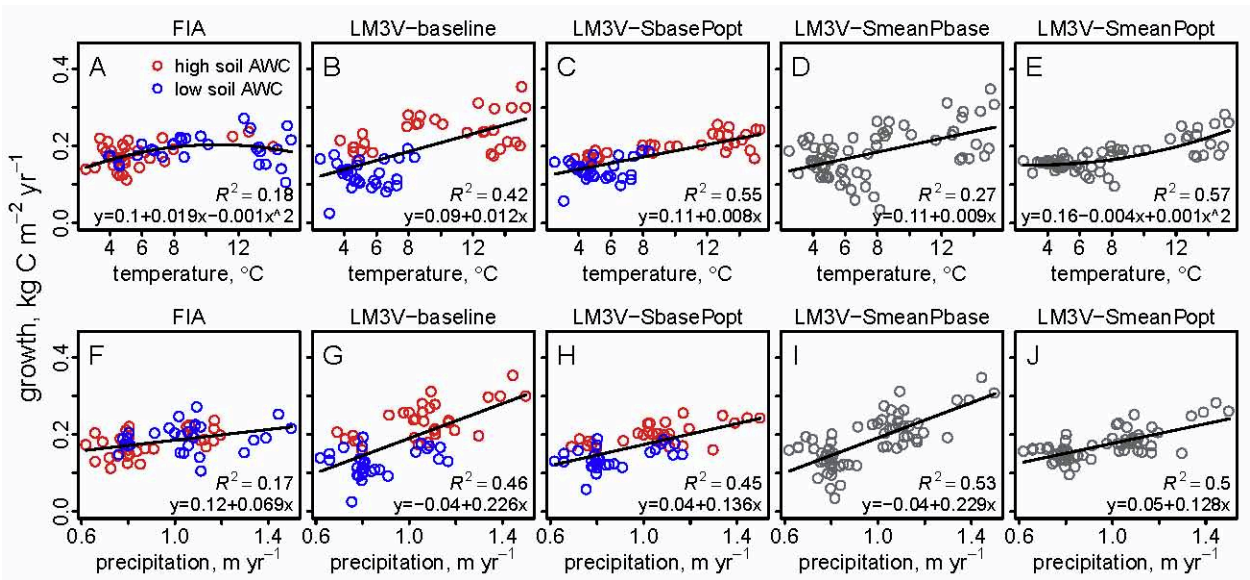

Figure B4. Aboveground wood growth of 80-100 year old FIA inventory plots (1° grid-cell means) and 90 year-old vegetation in four versions of the LM3V model (Table 1) vs. mean annual temperature (A-E) and mean annual precipitation (F-J). See Fig. 4 legend for additional details.

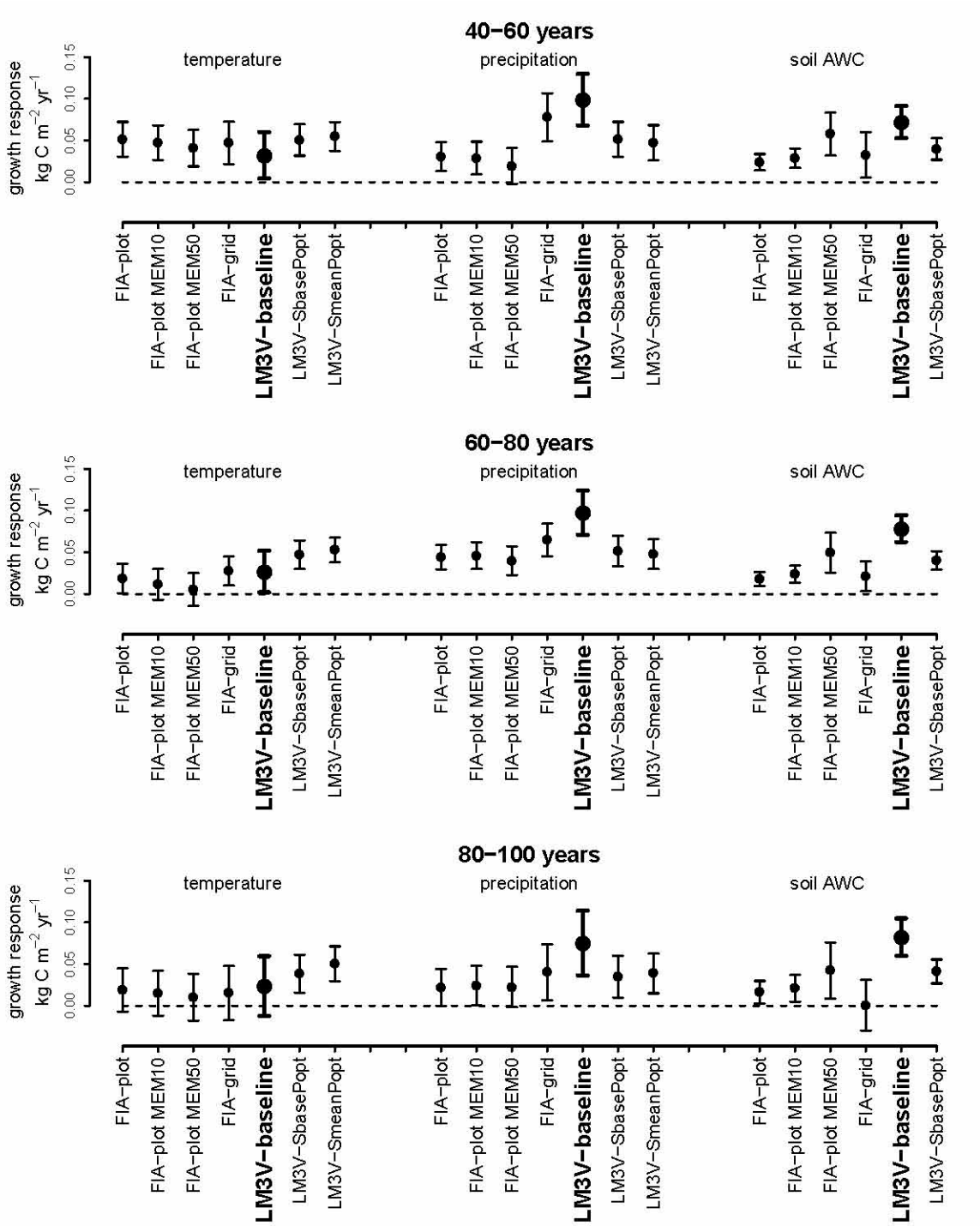

Figure B5. Response of aboveground wood growth to temperature, precipitation, and soil available water capacity (AWC) estimated from FIA data and output from different versions of the LM3V model for three different age classes. The 60-80 year-old age class results in Fig. 5 are reproduced here for convenience. Measurement error models (MEMs) were fit using temperature and precipitation error estimates from Daly et al. (2008).

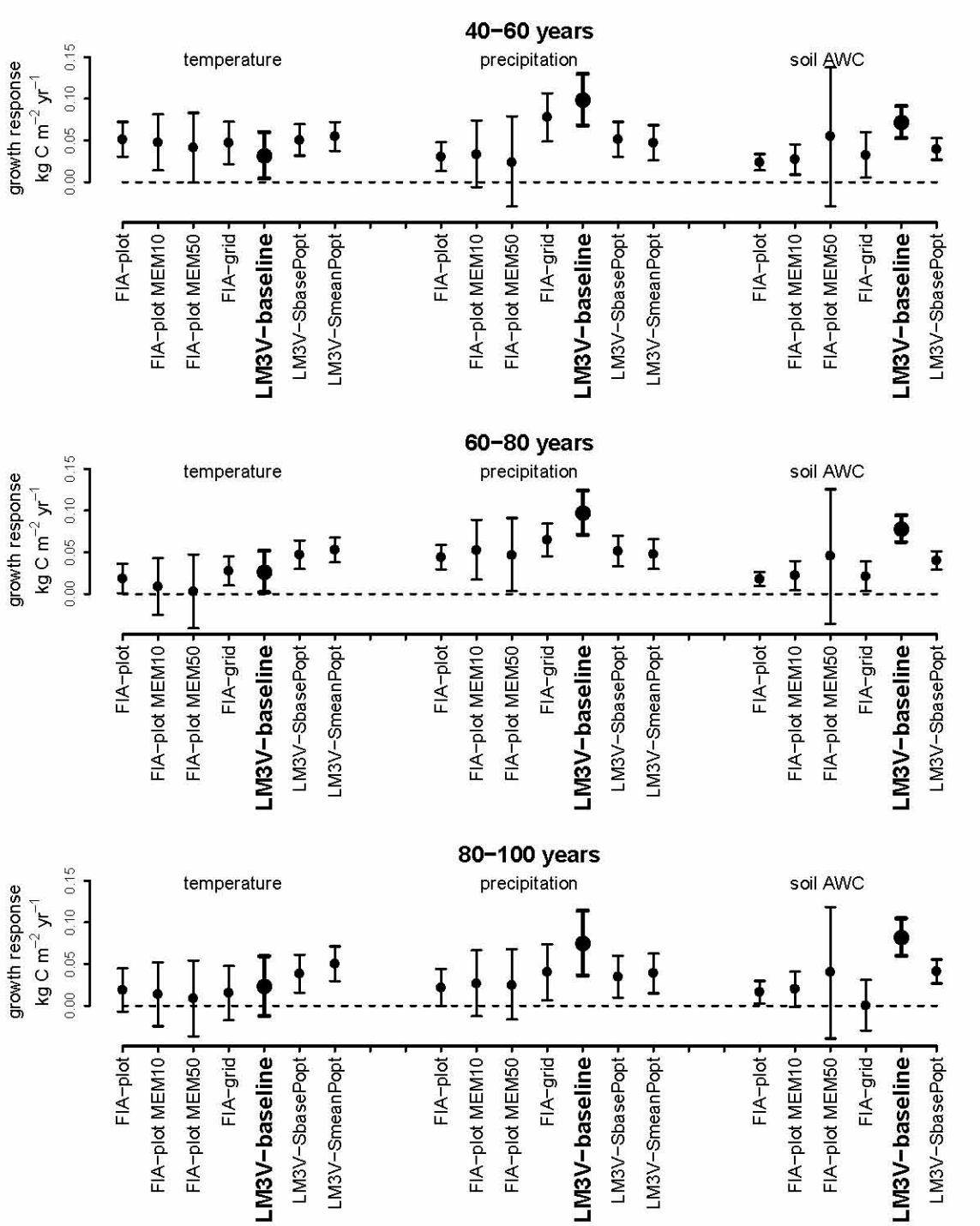

Figure B6. Same as Fig. B5, except that measurement error models (MEMs) were fit using temperature and precipitation errors estimated from 15 eastern U.S. AmeriFlux sites, which are larger than the error estimates assumed in Fig. B5. The larger error estimates result in wider MEM confidence intervals (compared to Fig. B5), but do not always result in larger estimated growth responses due to the presence of quadratic temperature terms in the models and/or interactions among multiple explanatory variables. All values are the same as in Fig. B5 except for the MEM results.

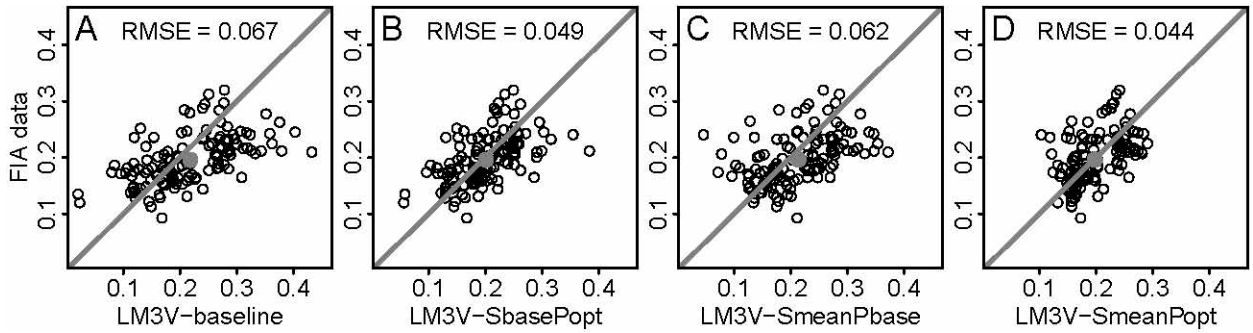

Figure B7. Aboveground wood growth (kg C m^{-2} yr^{-1}) observed in 1° grid cells (mean of ≥ 10 FIA plots) vs. values predicted by four versions of the LM3V model (Table 1). Results are for 40-60 year-old FIA plots and 50 year-old LM3V vegetation. See Fig. 6 legend for additional details.

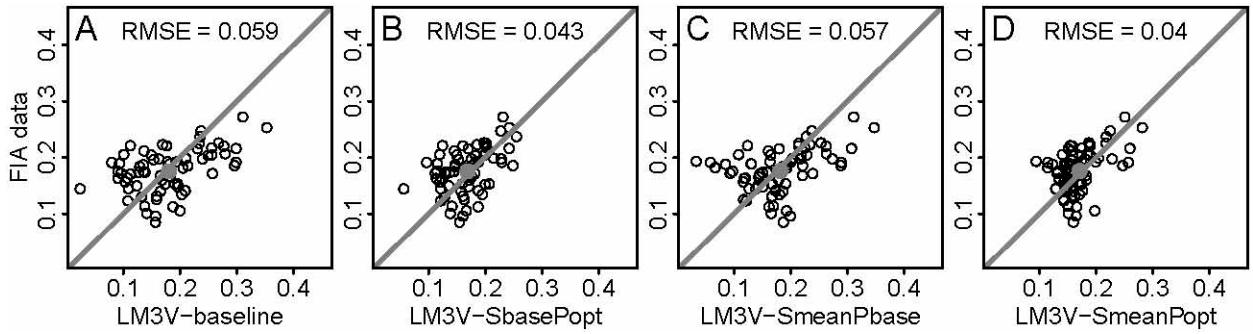

Figure B8. Aboveground wood growth (kg C m^{-2} yr^{-1}) observed in 1° grid cells (mean of ≥ 10 FIA plots) vs. values predicted by four versions of the LM3V model (Table 1). Results are for 80-100 year-old FIA plots and 90 year-old LM3V vegetation. See Fig. 6 legend for additional details.

Literature Cited

Daly, C., M. Halbleib, J. I. Smith, W. P. Gibson, M. K. Doggett, G. H. Taylor, J. Curtis, and P. P. Pasteris. 2008. Physiographically sensitive mapping of climatological temperature and precipitation across the conterminous United States. International Journal of Climatology 28:2031–2064.

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