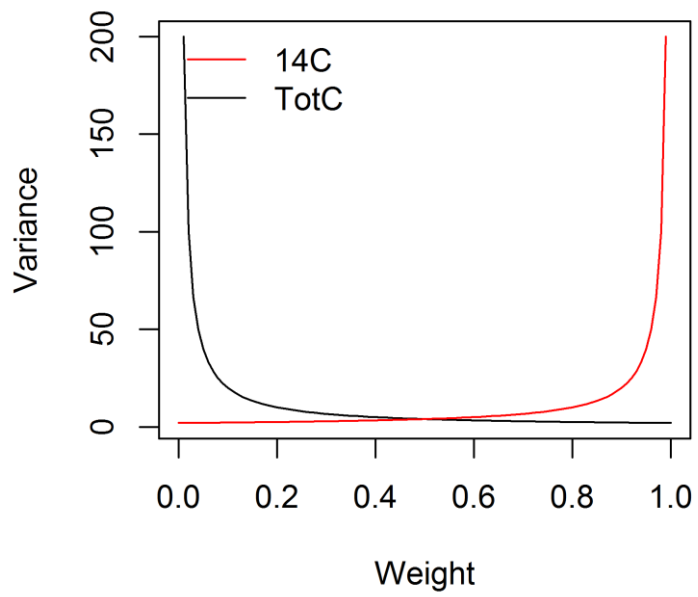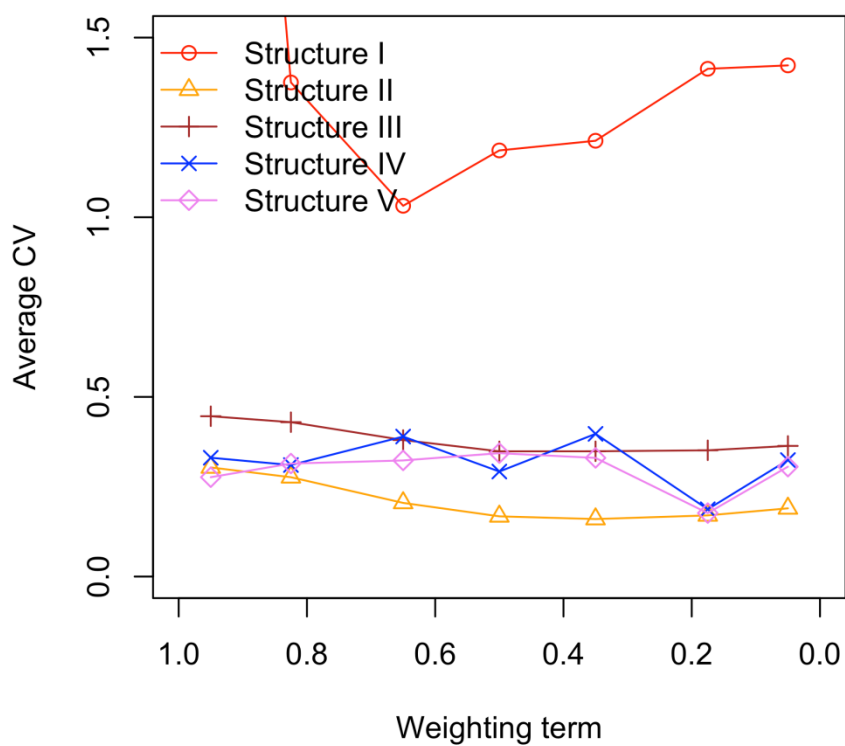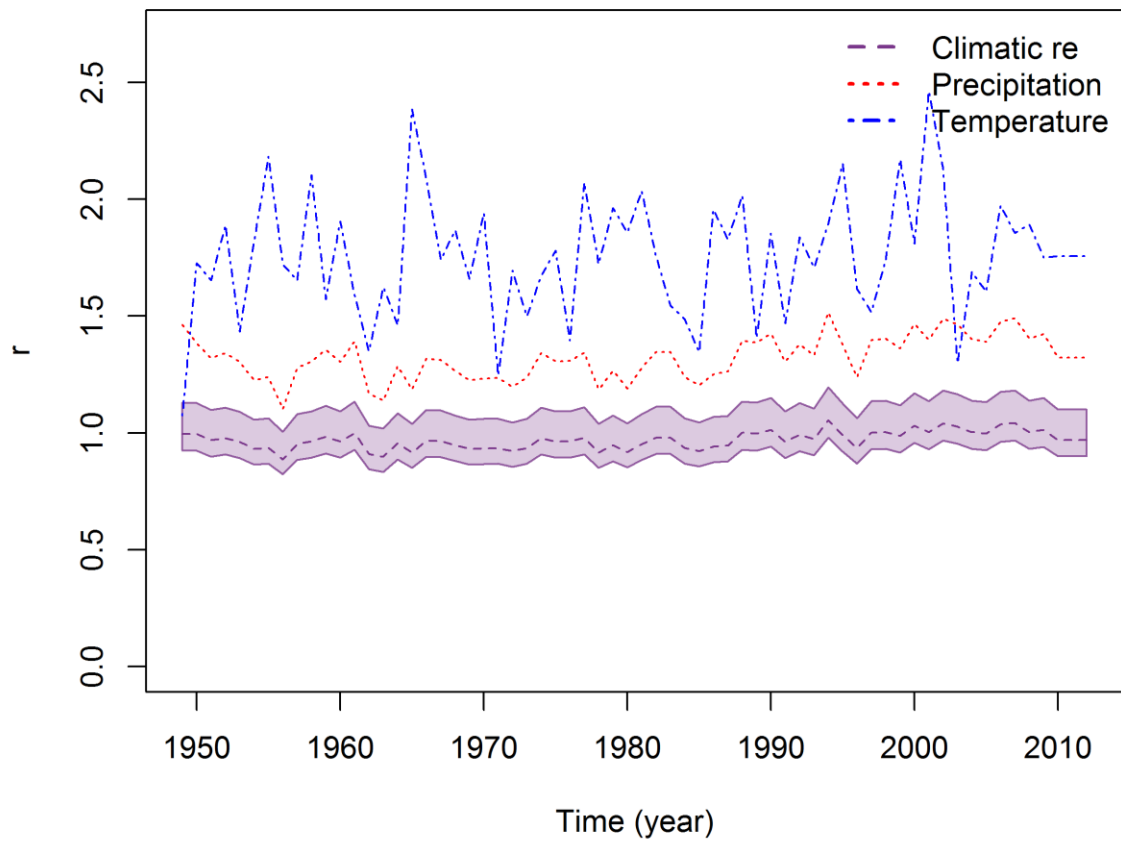**S1: Effect of the weighting parameter on the variance defining the probability distribution of the two data streams.**
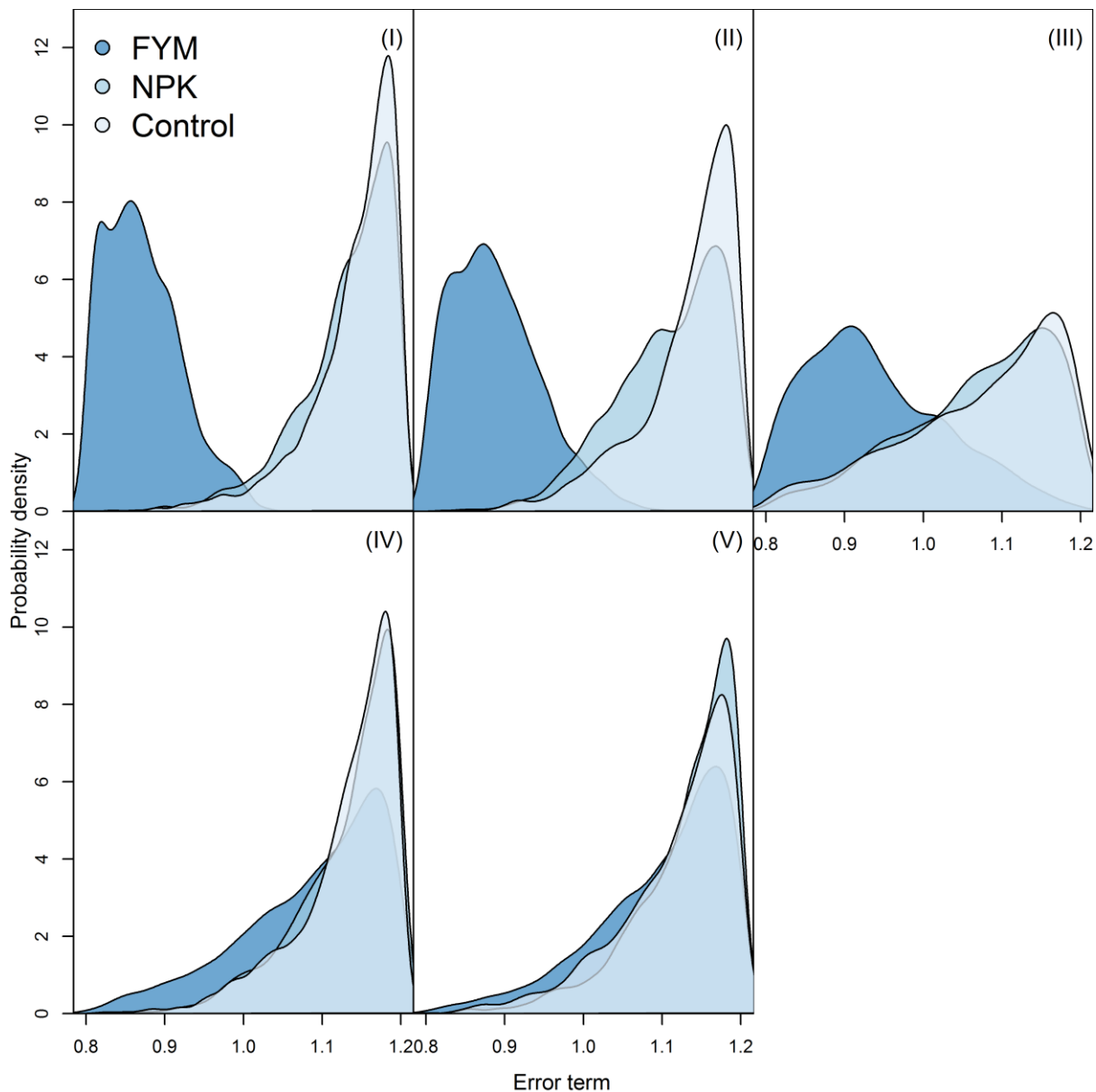
S2: Coefficient of variation of all the parameters (average) among all the three treatments for the five model structures with the variation of the relative weight of SO^{14}C over total C. In this scale 1 means only total C, 0 means only SO^{14}C.
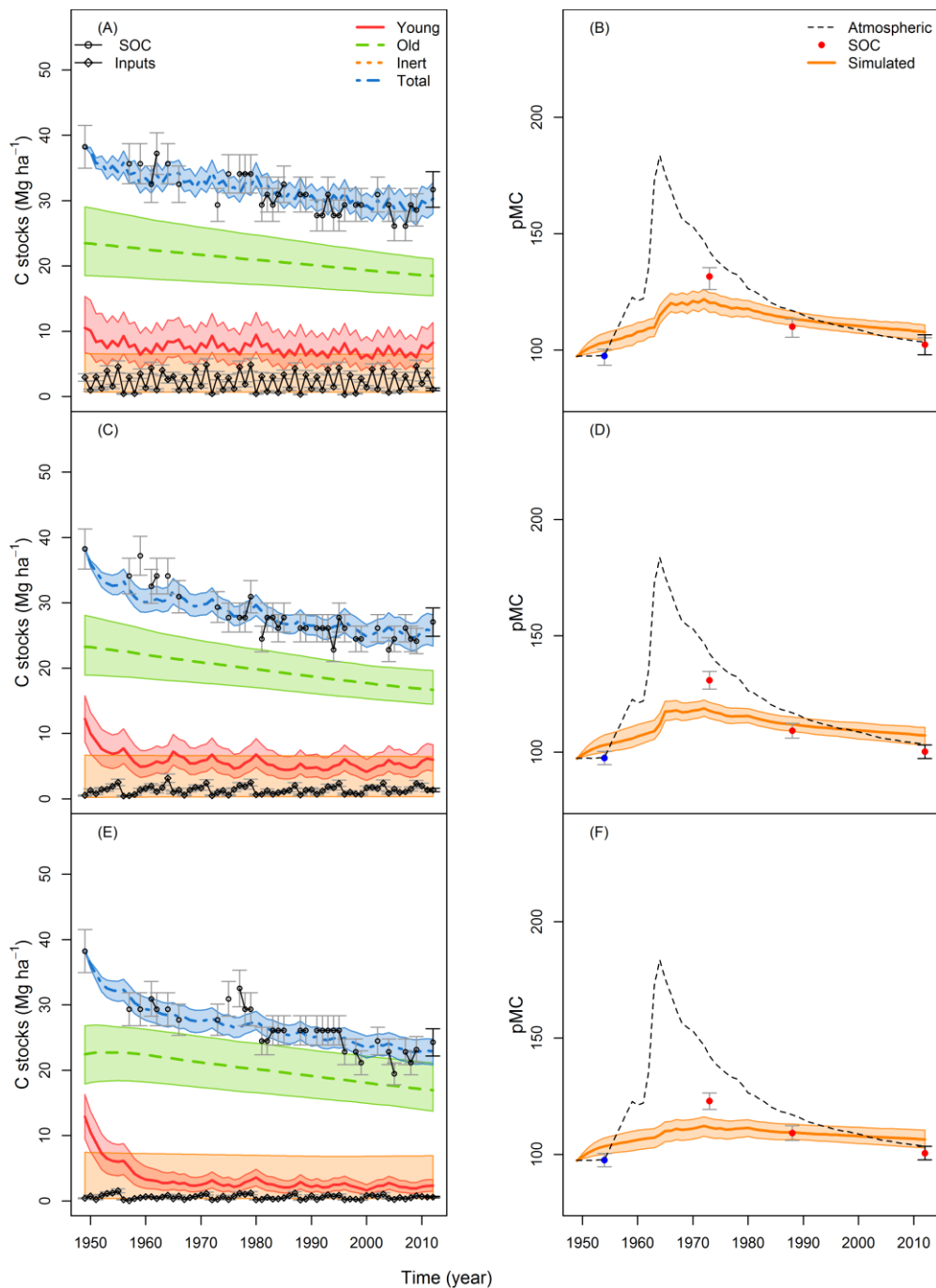
S3: Value (dimensionless) took by the climatic parameter _r_ (Eq. (9)) over the simulation. The shaded area represents the parameter uncertainty.
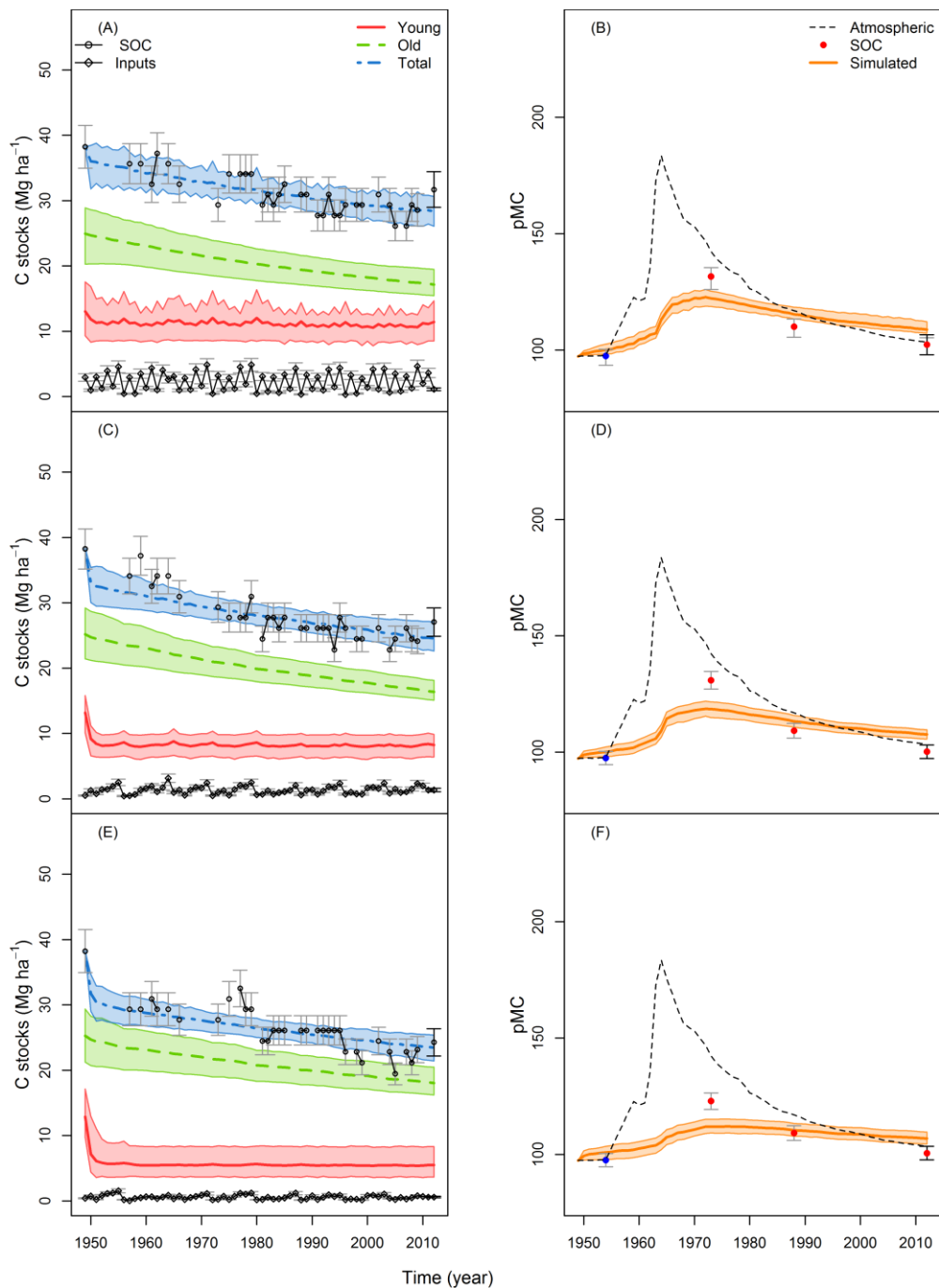
S4: The posterior probability density (vertical axis) for the input error term (dimensionless, horizontal axis) for model structure I (A), II (B), II, (C), IV (D) and V (E).
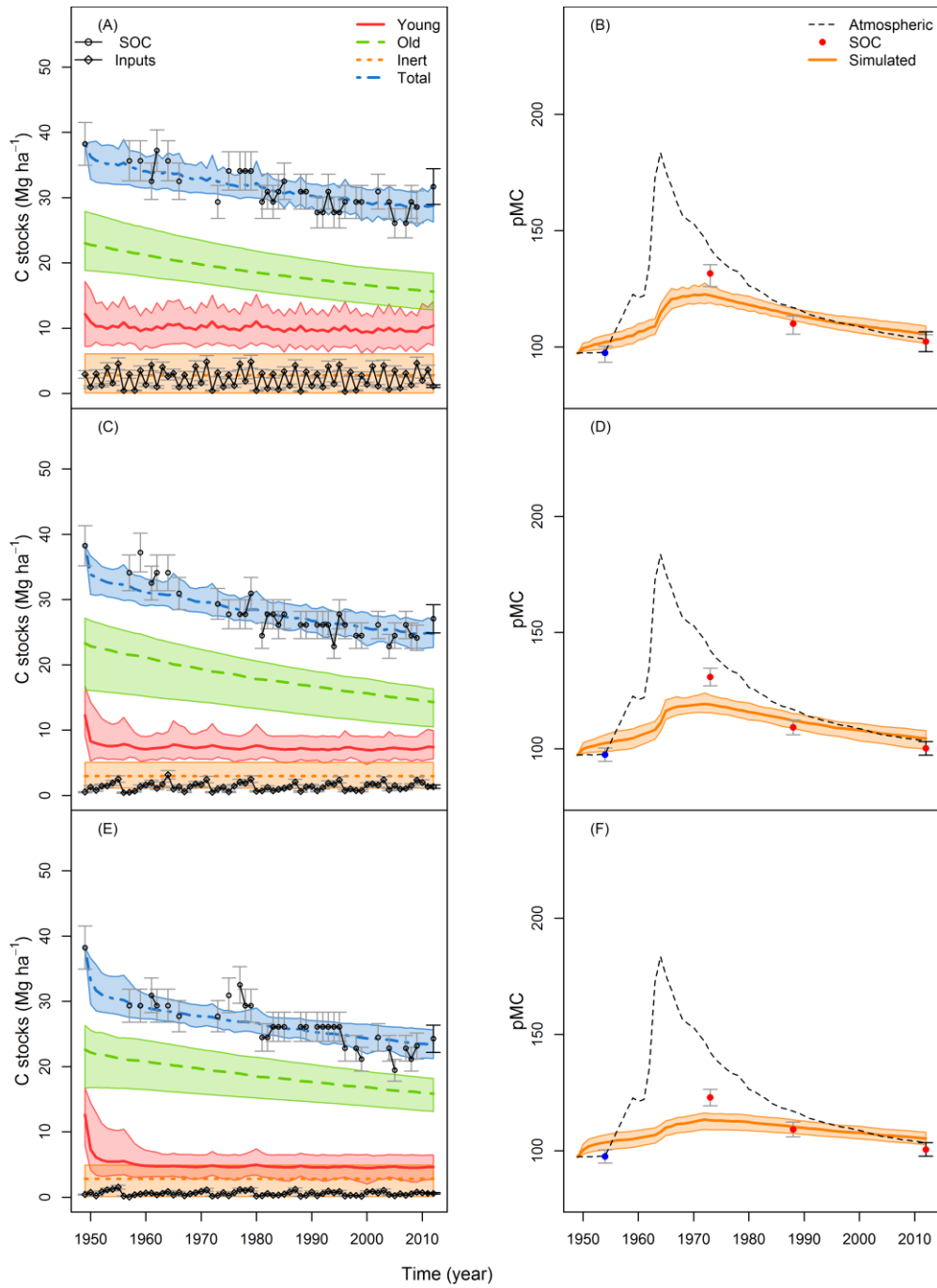
S5: Simulation of SOC pools in the ZOFE trial as described by model structure III, with weighting factor = 0.35. Error bars represent the measured (black) and estimated (dark grey) standard error of the measurements. SOC (A,C,E) is in Mg ha^{-1}, while SO^{14}C (B, D, F) is in pMC.

S6: Simulation of SOC pools in the ZOFE trial as described by model structure IV, with weighting factor = 0.35. Error bars represent the measured (black) and estimated (dark grey) standard error of the measurements. SOC (A,C,E) is in Mg ha^{-1}, while SO^{14}C (B, D, F) is in pMC.
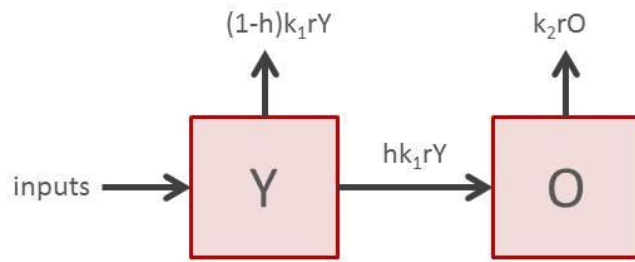
S7: Simulation of <u>SOC</u> pools in the <u>ZOFE</u> trial as described by model structure V, with weighting factor = 0.35. Error bars represent the measured (black) and estimated (dark grey) standard error of the measurements. SOC (A,C,E) is in Mg ha^{-1}, while SO^{14}C (B, D, F) is in pMC.
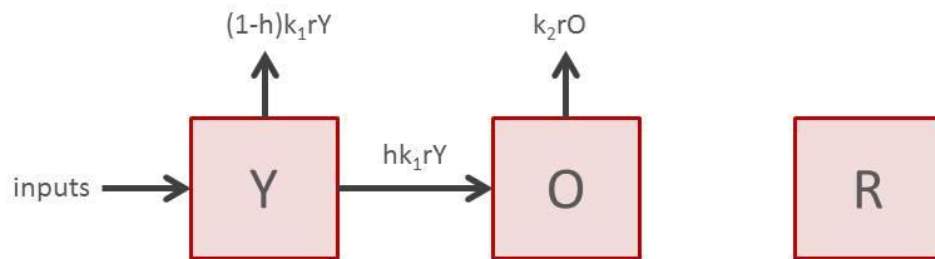
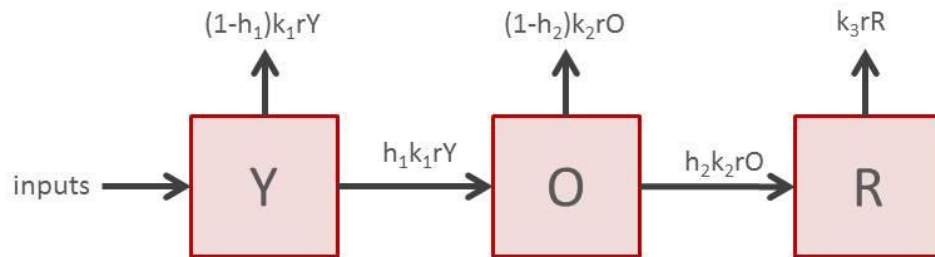**S8: Graphical abstract of model structure I**

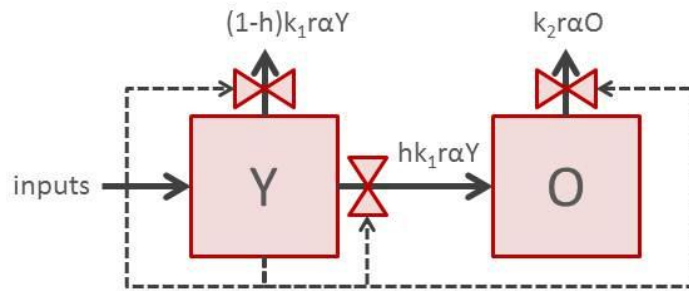Model Structure I

S9: Graphical abstract of model structure II

S10: Graphical abstract of model structure III

Model Structure III

$(1-h_1)k_1rY$ $(1-h_2)k_2rO$ k_3rR

inputs → Y → h_1k_1rY → O → h_2k_2rO → R

S11: Graphical abstract of model structure IV

Model
Structure IV

S12: Graphical abstract of model structure V

Model Structure IV