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Soil carbon in the Finnish GHG inventory

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Content

- Current submissions and mineral soils
- Testing Yasso07 model
 - Input data
 - Sensitivity of the model
 - Yasso07
 - Old Yasso
 - Uncertainty
 - Land-use change

Current submissions - mineral soils

- Yasso model for forest remaining forest, Yasso07 for conversion categories (and for KP 3.3 reporting)
- Forest remaining forest
 - Weather data for NFI plots (FMI 10*10 km grid)
 - spin-up 1961-90 climate
 - Thereafter 1971-2000 average climate
 - Biomass with Repola et al., Fineroots as a share of leaf mass, based on the Marklund and Helmisaari
 - Litter input from NFI tree level measurements
 - Starting from NFI6
 - Including understorey litter input
 - BEFs applied for natural mortality and loggings (these based on the NFI + Repola et al.)
 - Energy wood removed
- Conversion categories - Yasso07
 - Initial carbon stock from previous land use
 - Afforestation, reforestation sites - no drain, understorey significant

Testing Yasso07 model

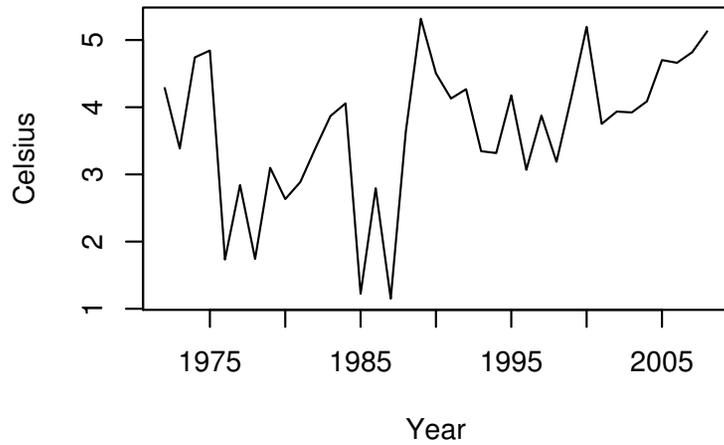
- Yasso07 with current weather data produced a significant source of C (especially for 2008)

- Testing for:
 - assumption of spin-up
 - Impact of weather:
 - Temperature
 - Amplitude
 - Precipitation

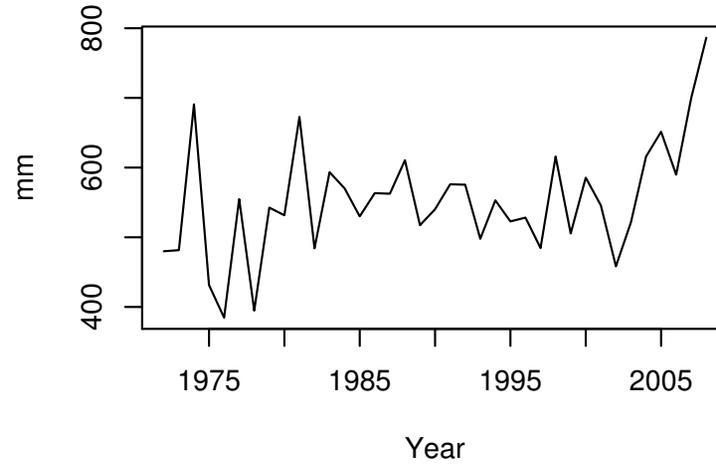
- Comparisons to old Yasso version

Input data - weather, Southern Finland

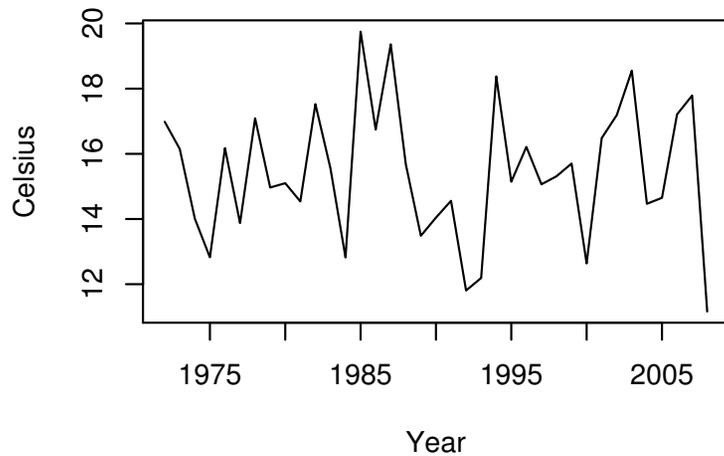
Temperature SF



Precipitation SF

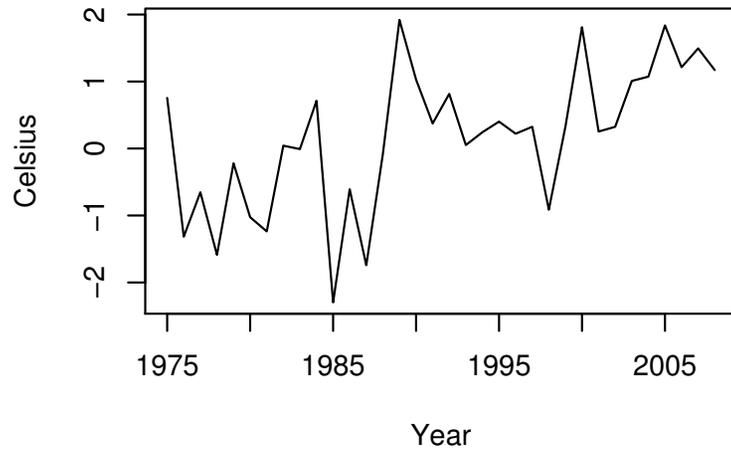


Amplitude SF

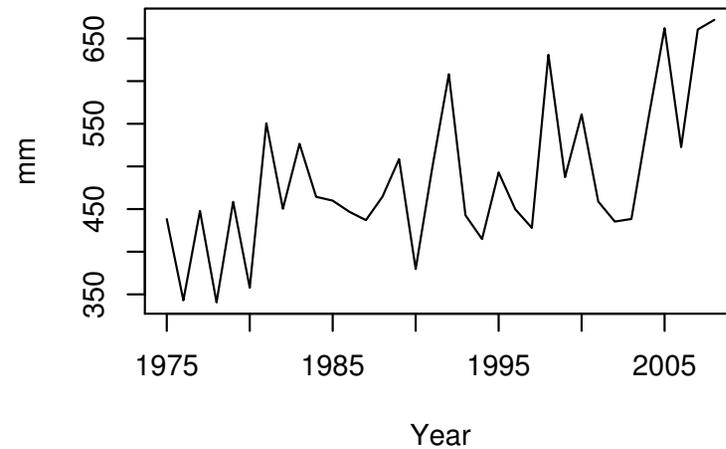


Input data - weather, Northern Finland

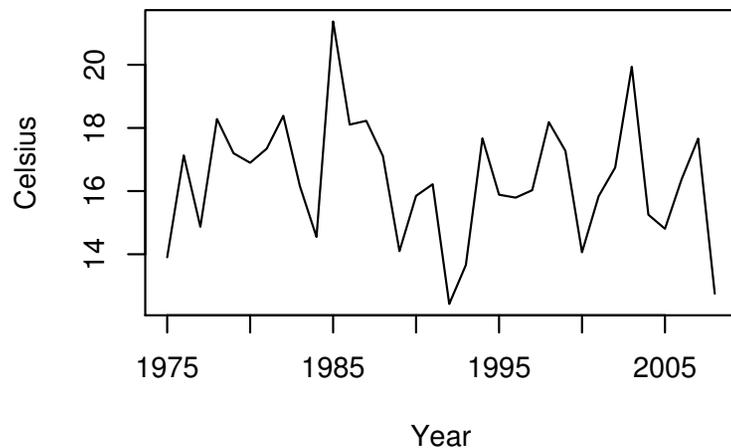
Temperature NF



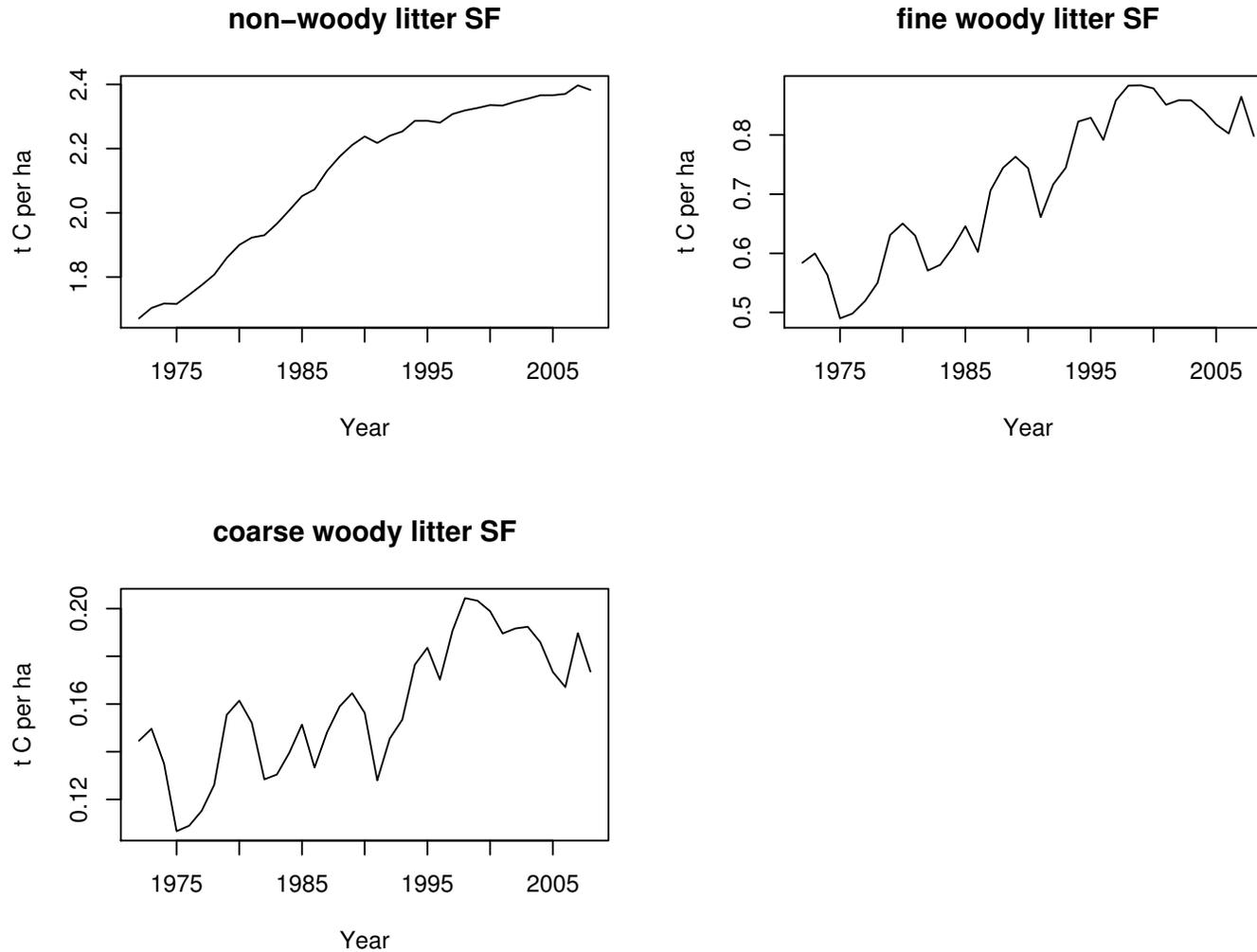
Precipitation NF



Amplitude NF

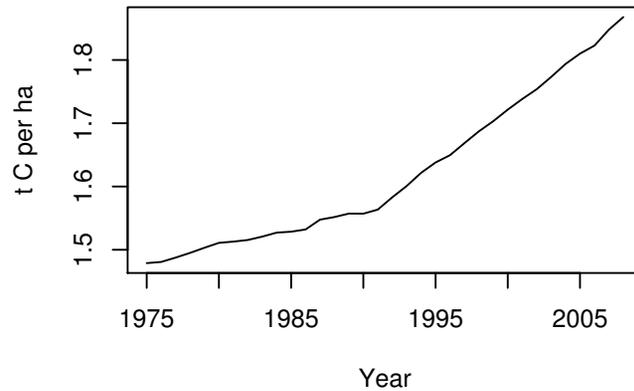


Input data - litter, Southern Finland

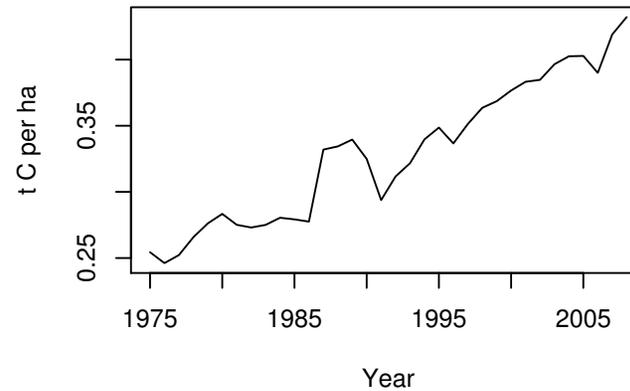


Input data - litter, Northern Finland

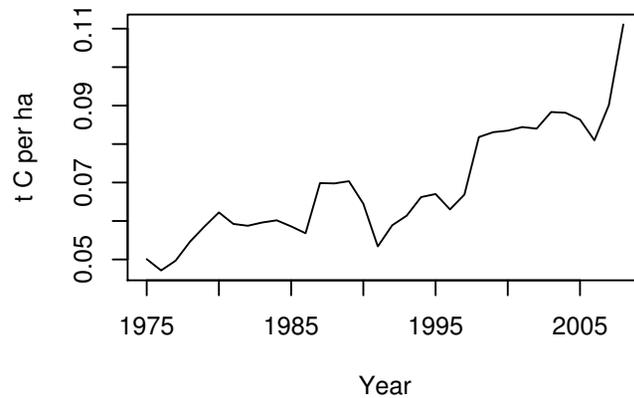
non-woody litter NF



fine woody litter NF

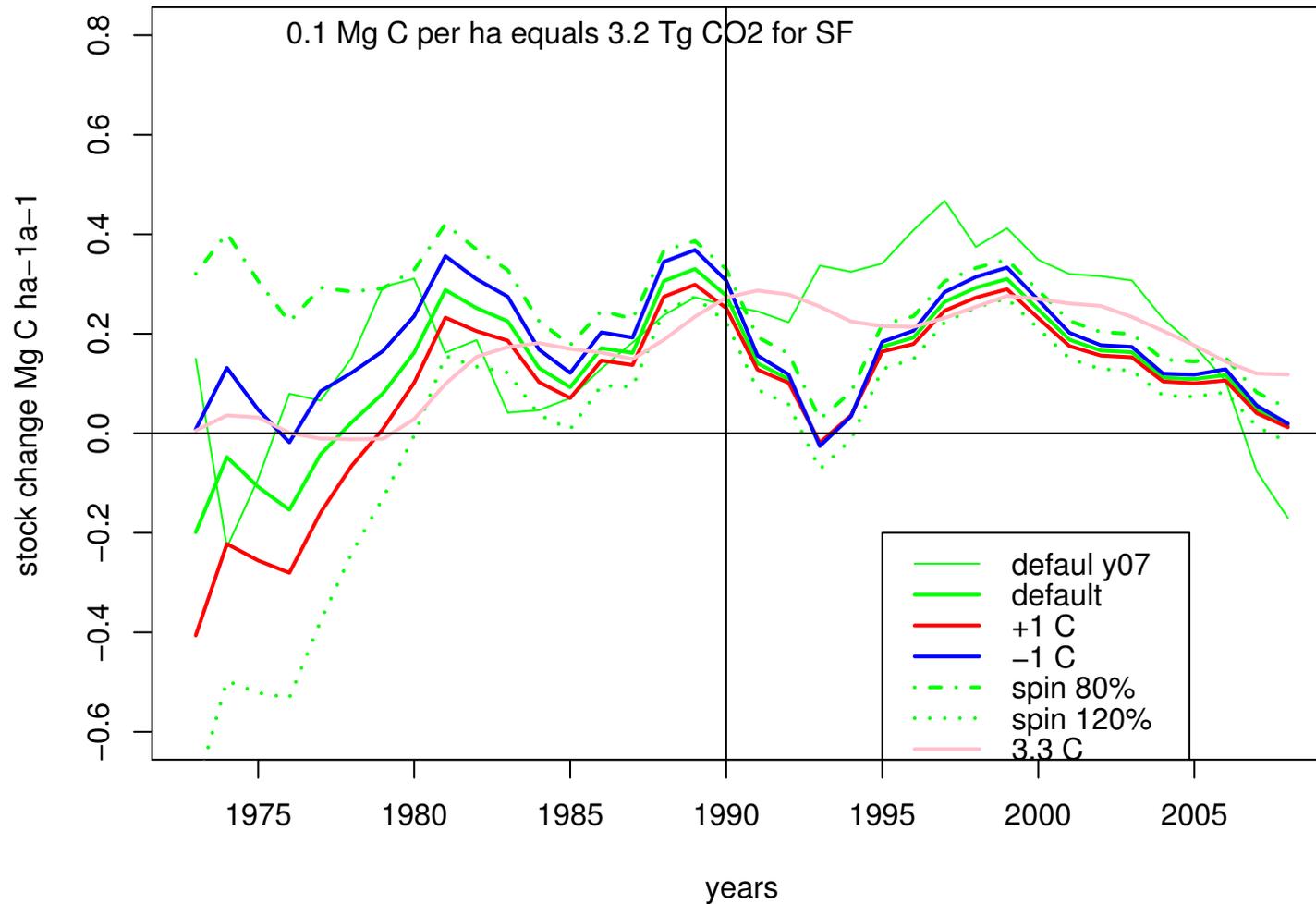


coarse woody litter NF



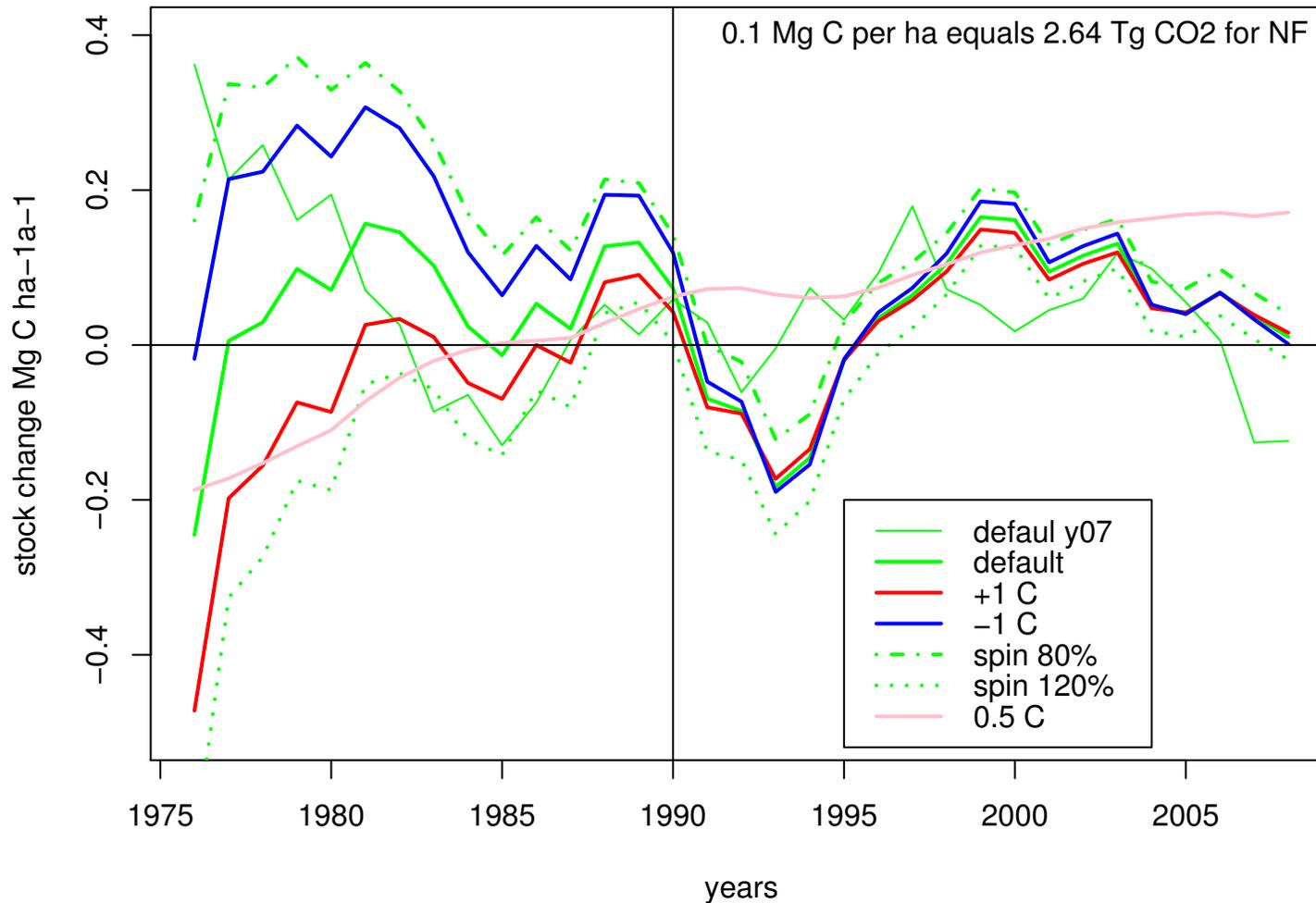
Testing Yasso versions, Old Yasso

Southern Finland, y old



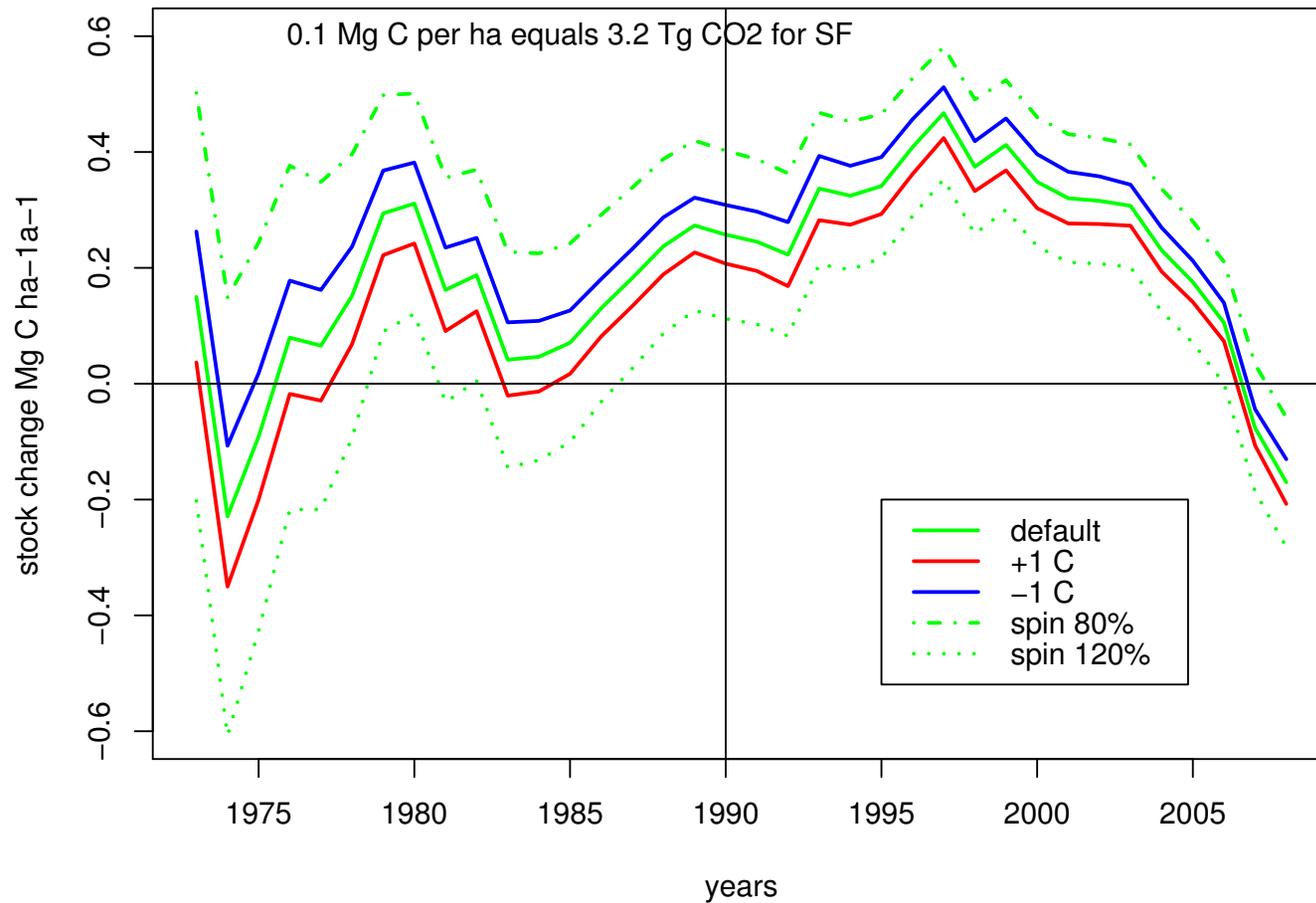
Testing Yasso versions, Old Yasso

Northern Finland, y old



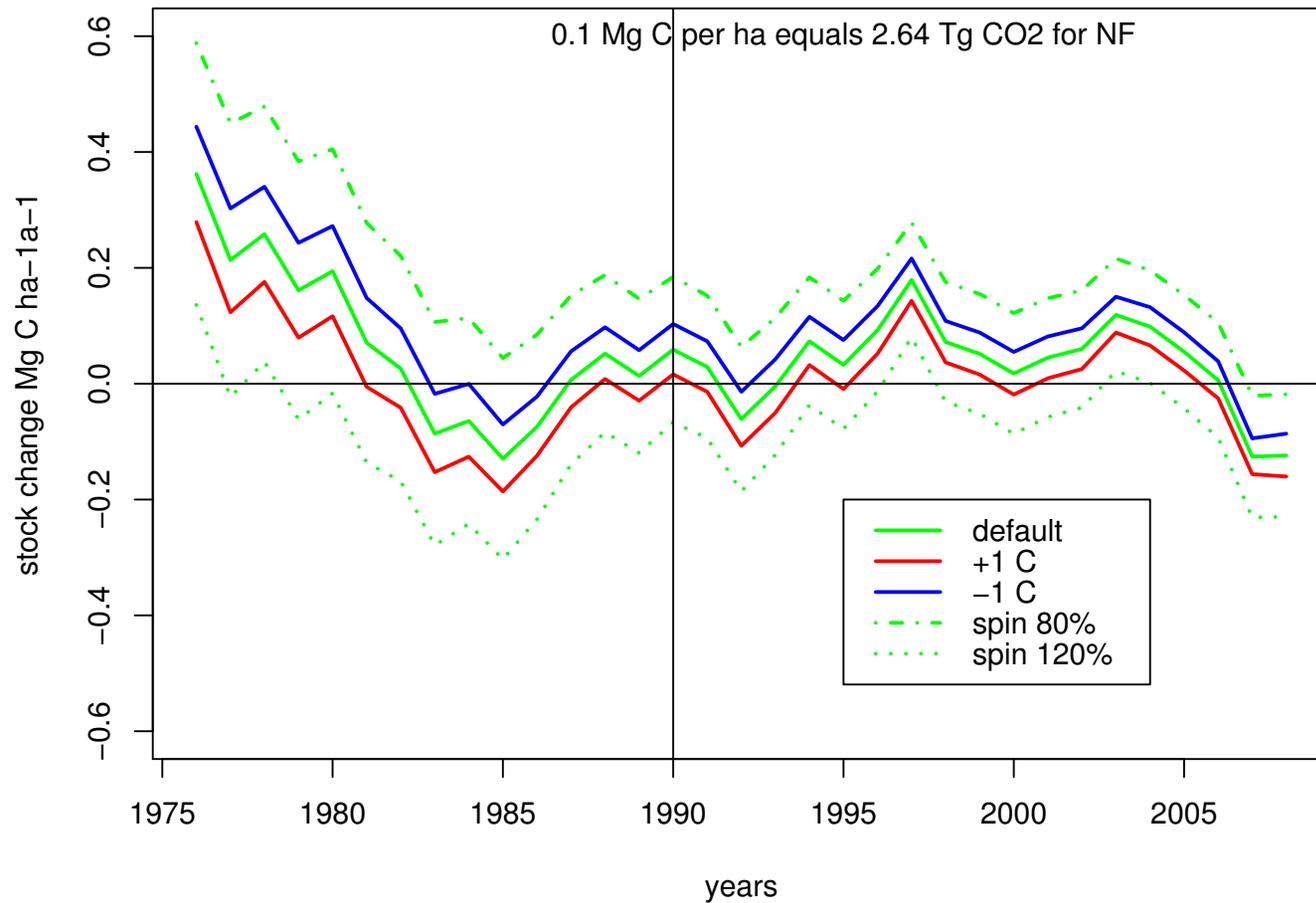
Testing Yasso versions, y07 sensitivity

Southern Finland, y07



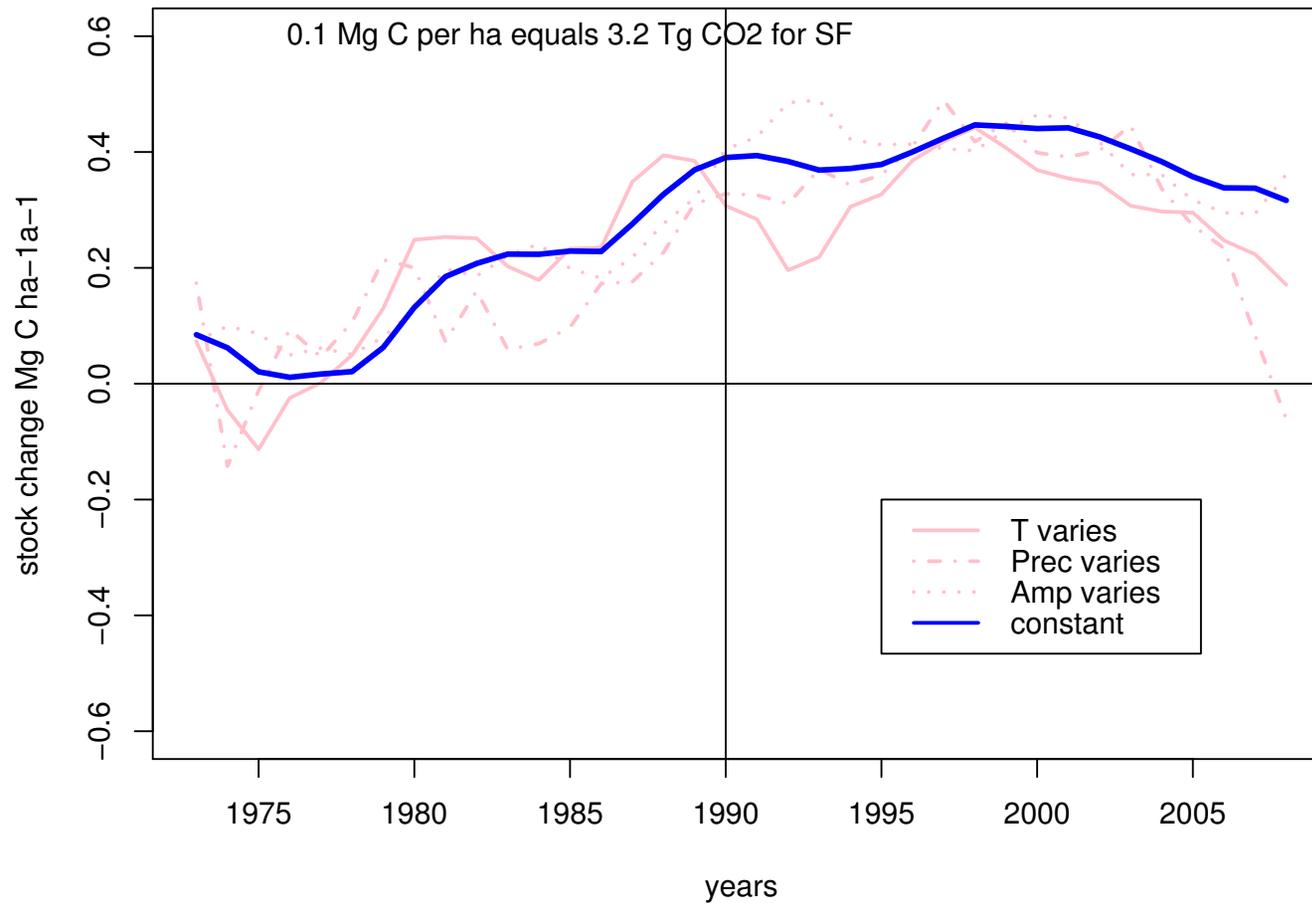
Testing Yasso versions, y07 sensitivity

Northern Finland, y07



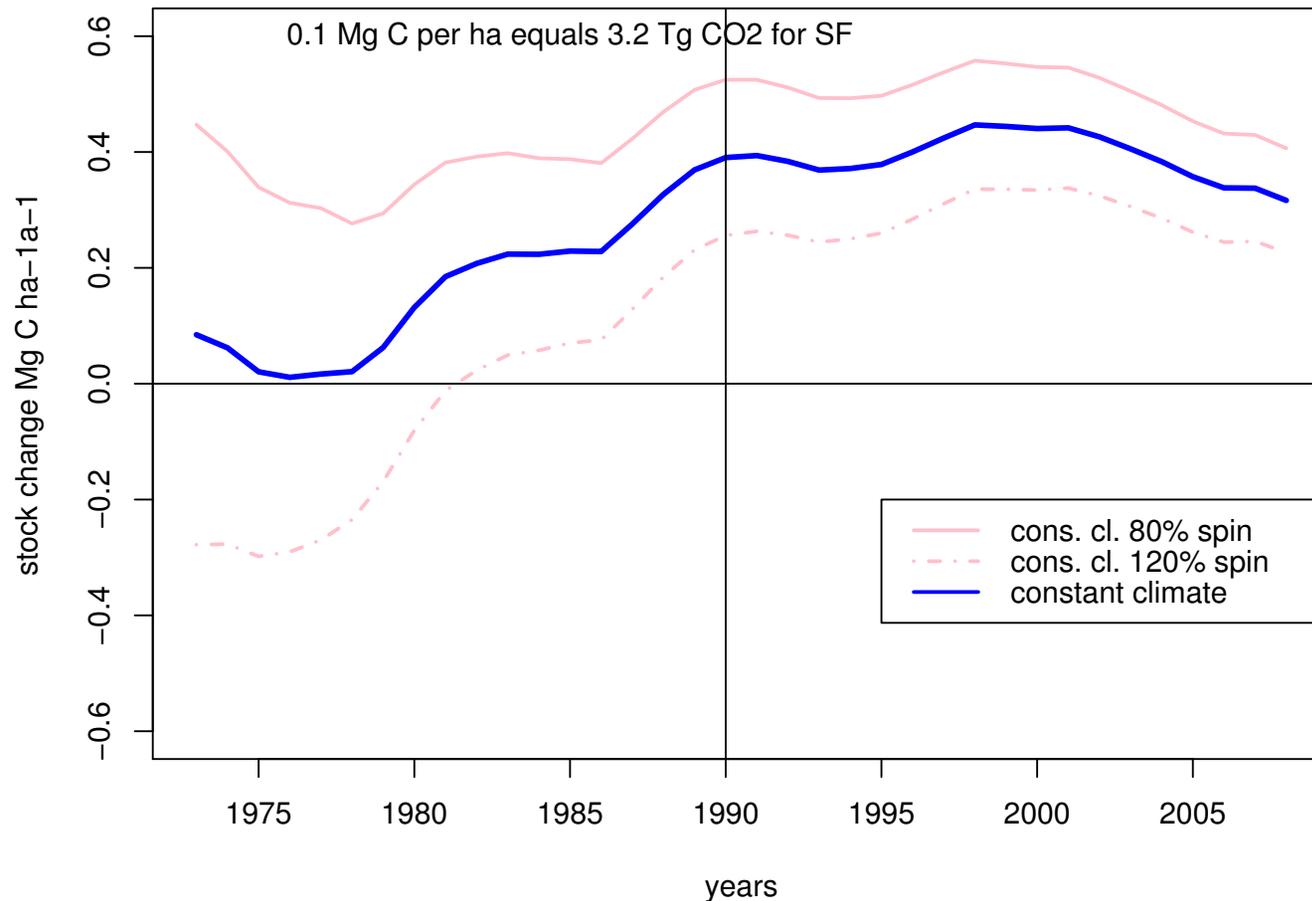
Testing Yasso versions, y07 sensitivity

Southern Finland, y07



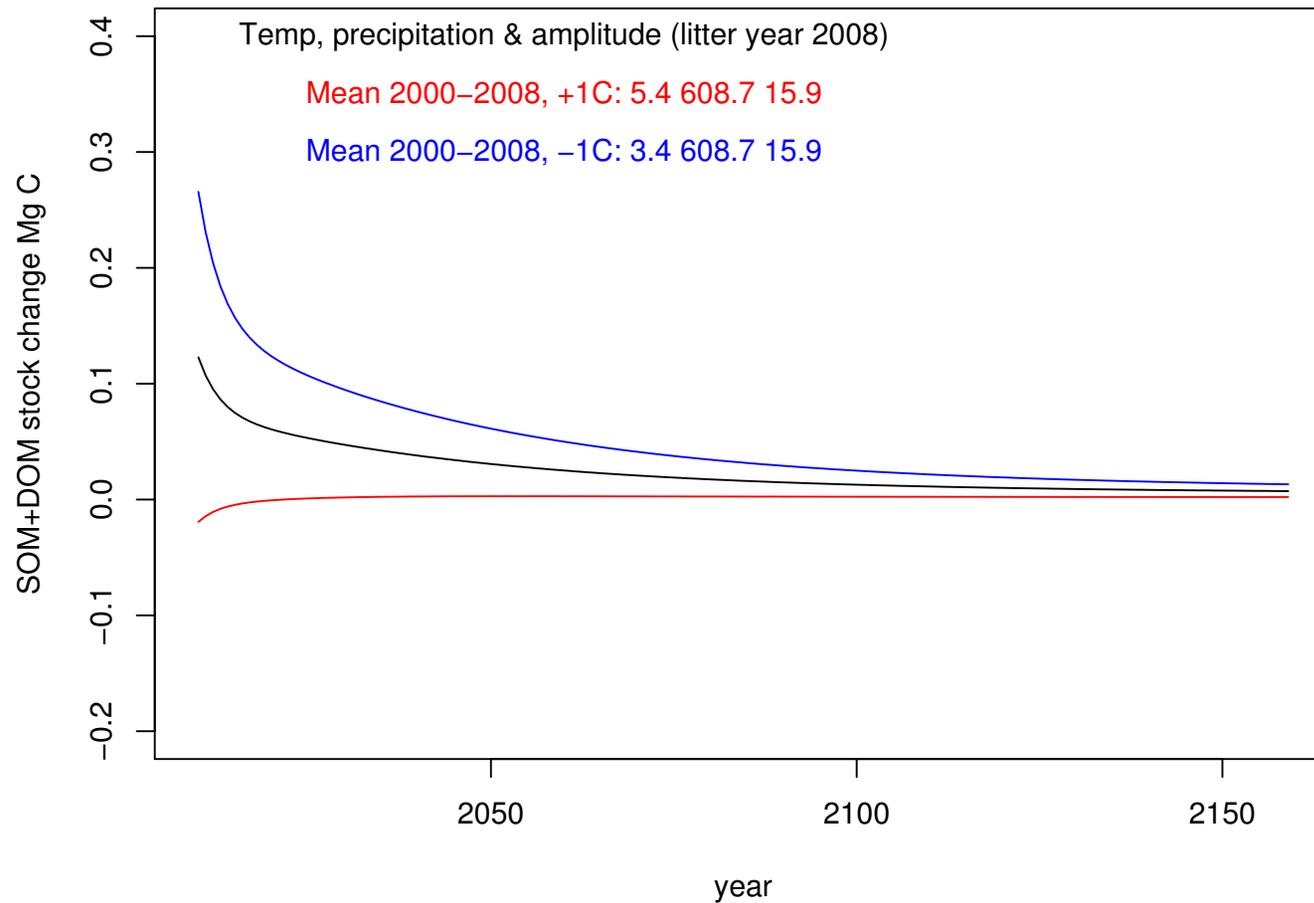
Testing Yasso versions, y07 initial stock

Southern Finland, y07

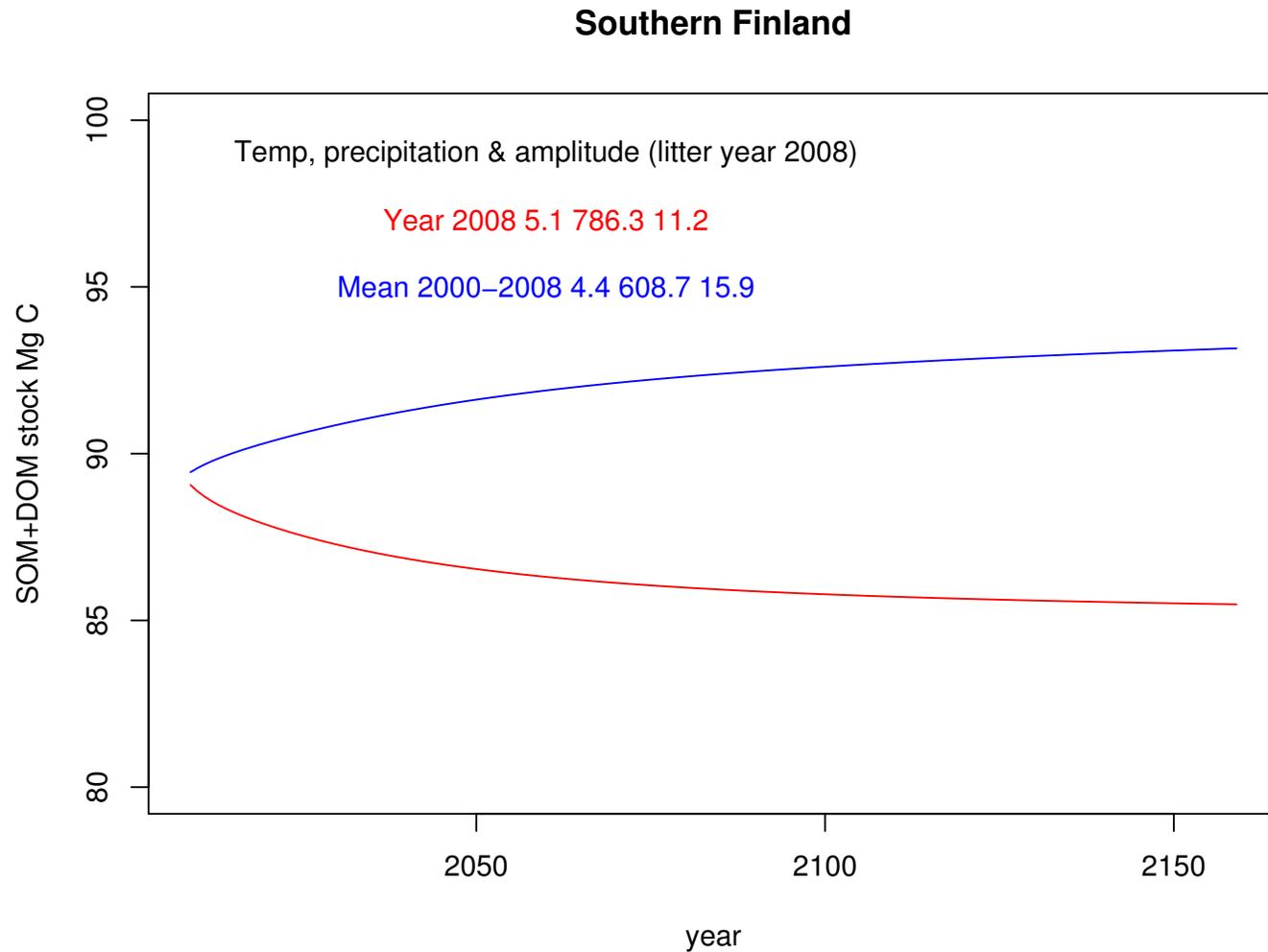


Testing Yasso versions, y07 future

Southern Finland



Testing Yasso versions, y07 future



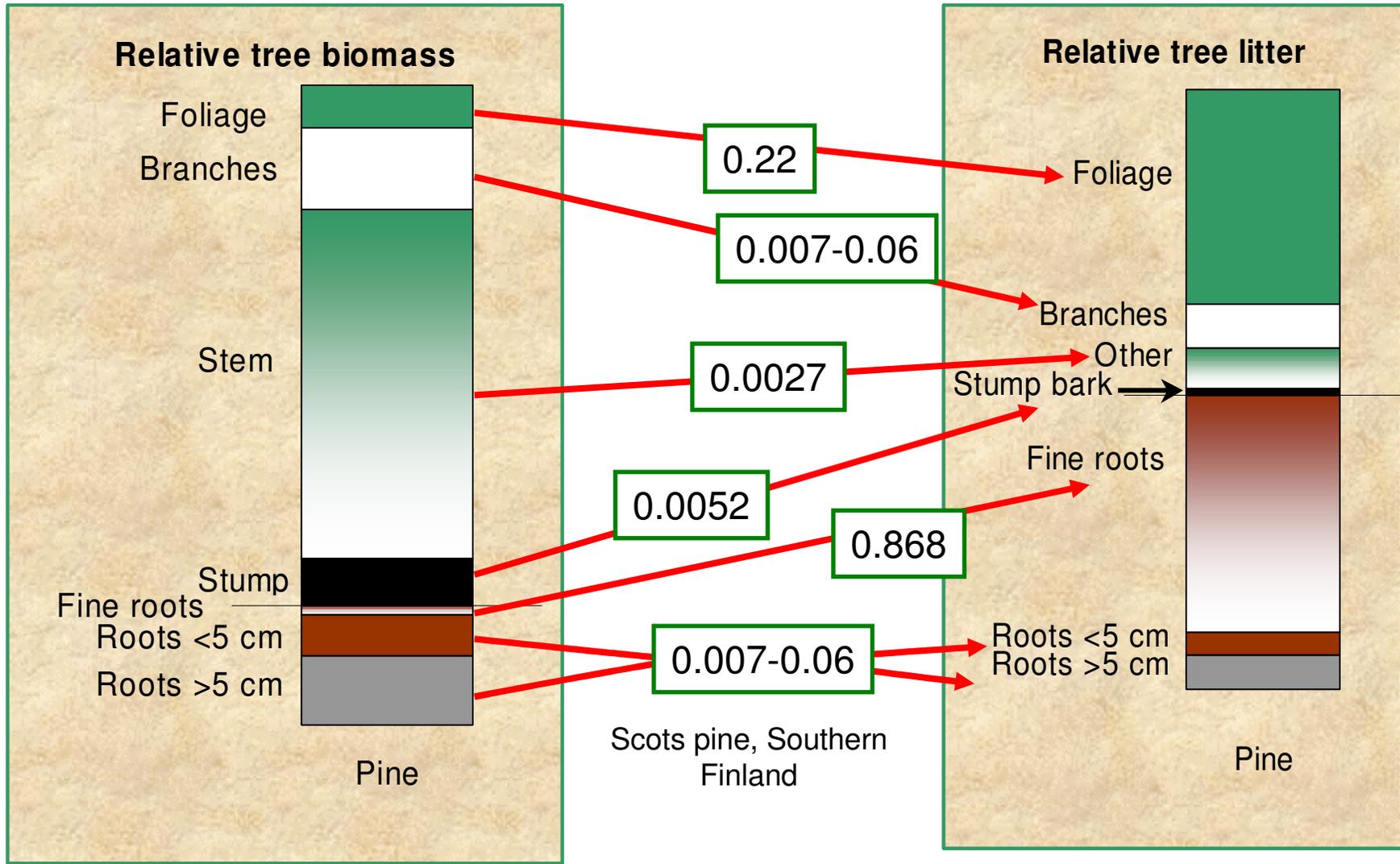
Soil model sensitivity - Conclusions

- Both models result a source of C if applied with annual weather data (yasso & yasso07)
- Mineral soils 2008 source of C due to unusually warm & moist conditions
- Impact of weather are included into inventory by NFI measurements (longer growing season → more biomass → more litter to the soil)
- In the older yasso version the impact of initial stock cancels out faster than in y07 version

y07 and uncertainty analysis

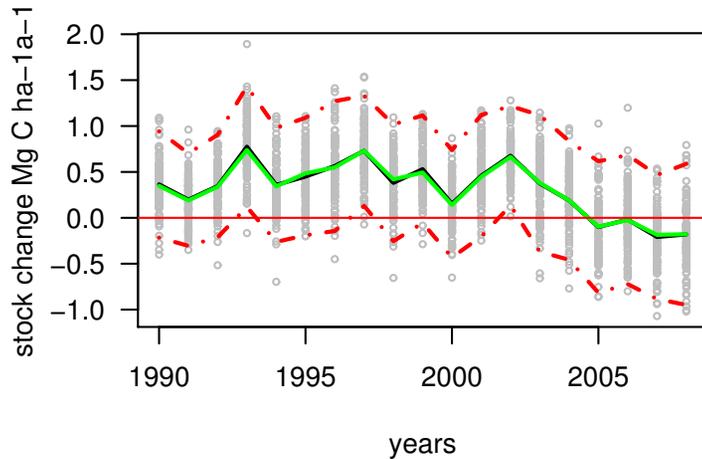
- Analysis with Finnish GHG data:
 - Uncertainty of biomass estimates
 - Covariance of parameters is missing -> overestimation
 - Uncertainty of AWEN composition (lab analysis)
 - Uncertainty of y07 parameter values

y07 with input data

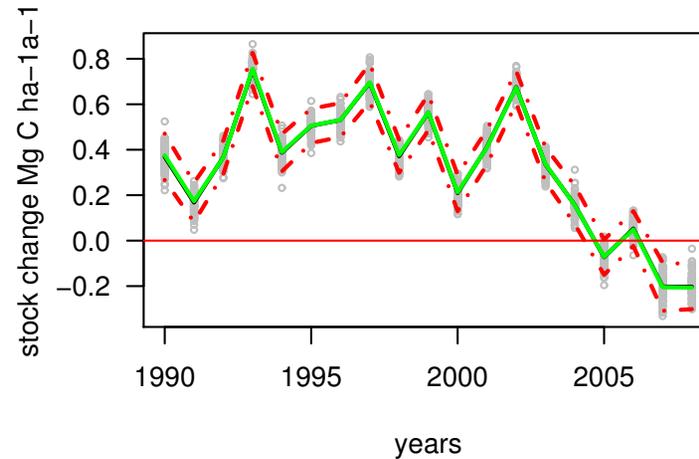


y07, Results of uncertainty analysis, SF

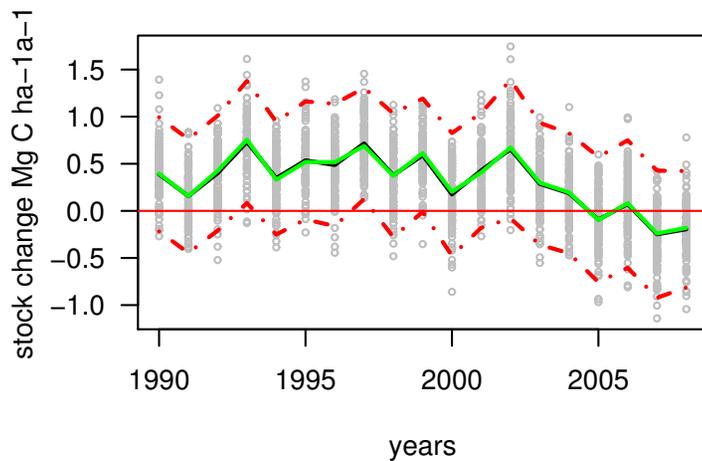
SF, uncertainty of biomass + lab & model par.



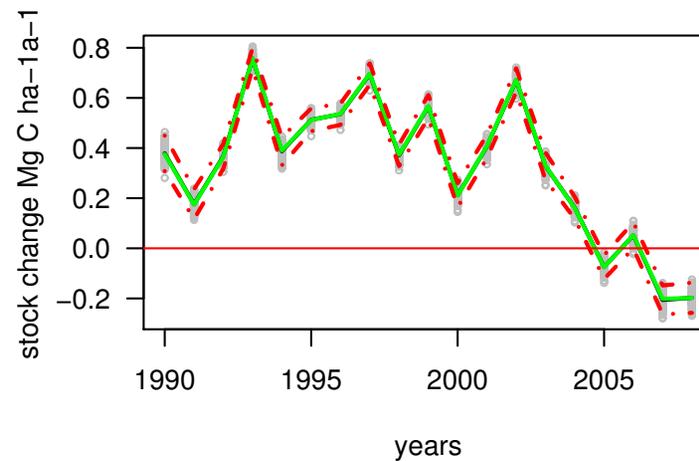
SF, uncertainty of lab & model par.



SF, uncertainty of biomass & model par.

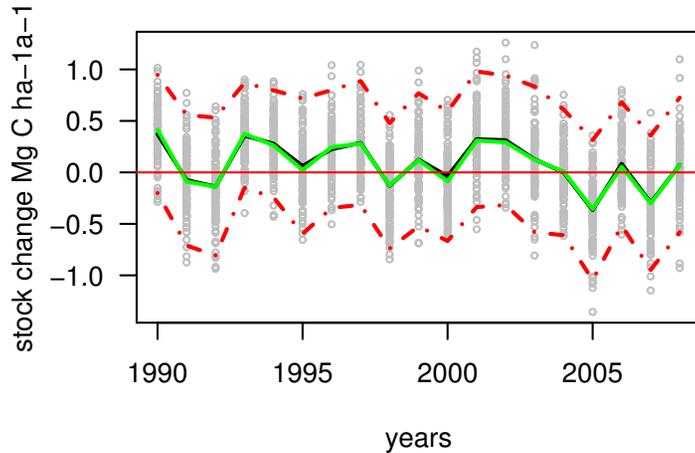


SF, uncertainty of model par.

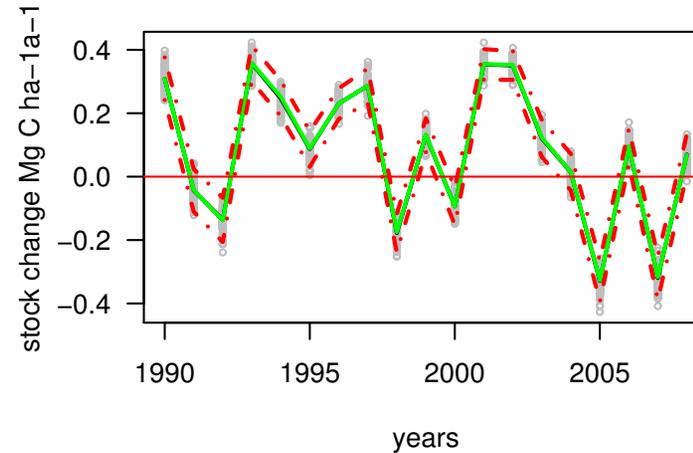


y07, Results of uncertainty analysis, NF

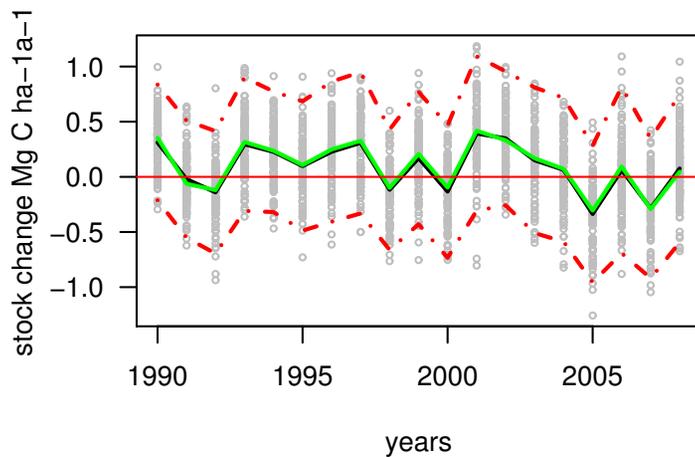
NF, uncertainty of biomass + lab & model par.



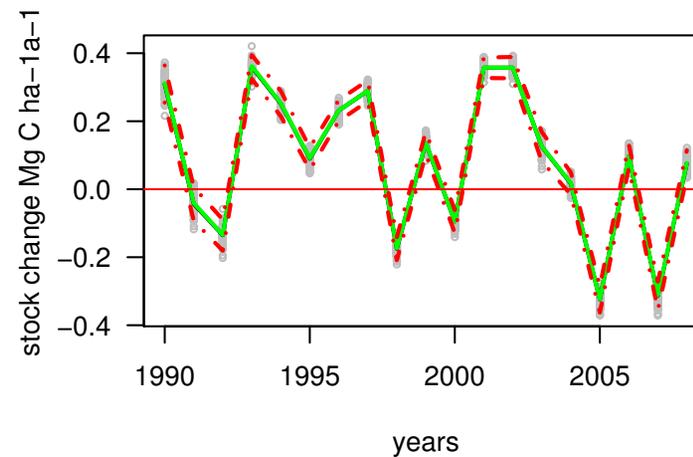
NF, uncertainty of lab & model par.



NF, uncertainty of biomass & model par.



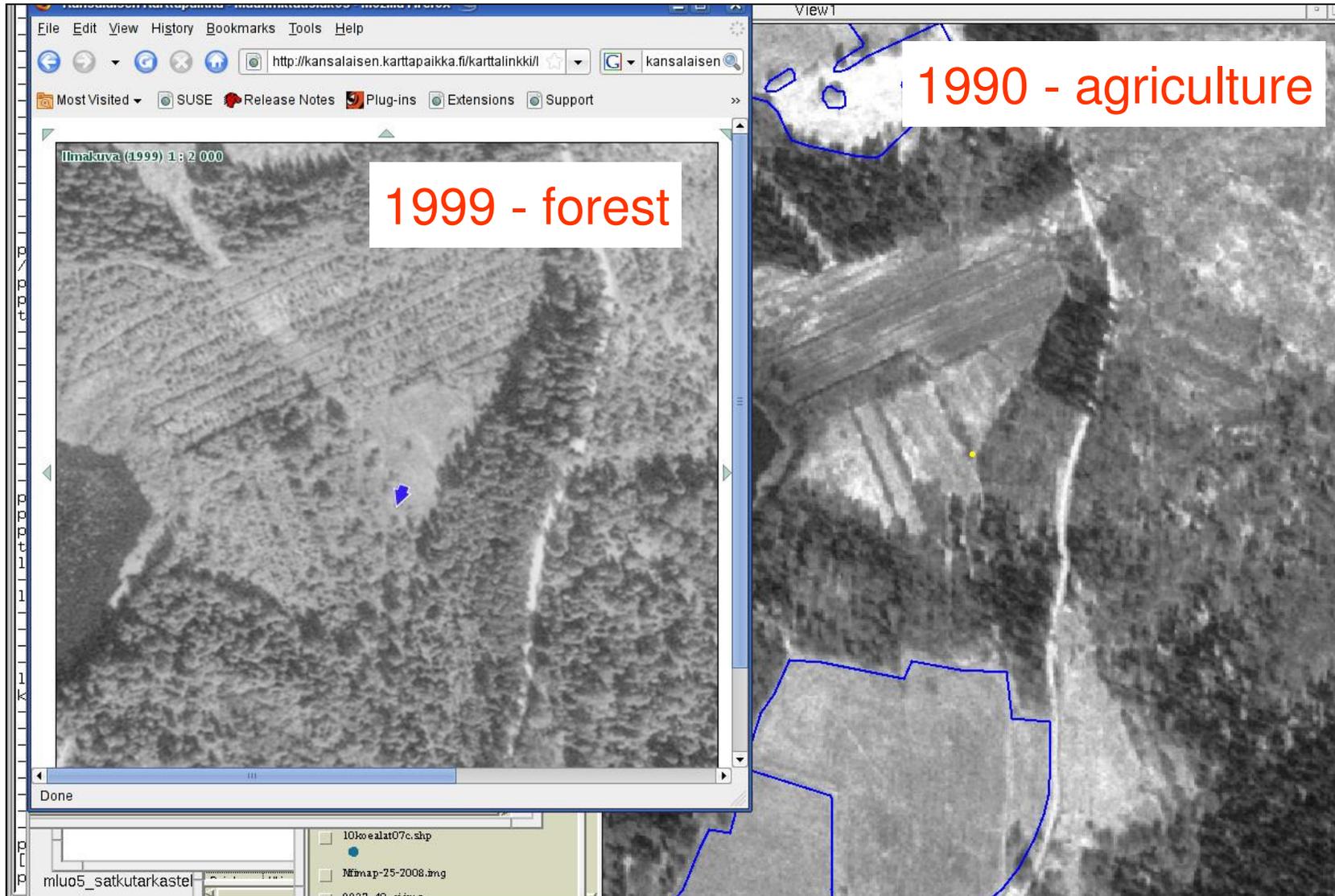
NF, uncertainty of model par.



Conclusions - uncertainty

- Uncertainty is high (estimates exclude uncertainty sources: turnover rates, model structure, initial stock....)
- Mineral soils in Southern Finland sink 3 times since 1990, other years we don't know, NF soil dC equals 0
- More reliable estimates for dC, more measurements of leaf- & fineroot biomass and turnover are needed

Land-use change - annual emissions for KP



Land-use change - land areas

Table 7.1-4 The land-use change matrix for IPCC land-use categories from 1990 to 2008 (1 000 ha) and the relative standard errors of some areas (%).

Final	Initial						Final area
	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	
Forest land	21 913 (1.0%)	47 (5.1%)	60 (4.3%)	21 (9.3%)	20 (8.6%)	2 (25.0%)	22 063
Cropland	58 (4.5%)	2 405 (3.0%)	5 (8.9%)	12	1	1	2 483
Grassland	4 (9.9%)	23 (12.2%)	156 (6.0%)	0	1	0	184
Wetlands	10 (13.0%)	0	1	2 976 (4.0%)	1	2	2 990
Settlements	126 (3.3%)	11	8	4	1 278 (4.0%)	2	1 430
Other land	0	0	0	0	1	1 240 (6.0%)	1 241
Initial area	22 112	2 486	231	3 014	1 301	1 247	30 390
NET change	-49	-3	-47	-23	128	-6	0

Land-use change matrix

Land-use change with Yasso07

- Data needed
 - Initial carbon stock for the simulation
 - Litter input based the NFI plots under land-use change / typical agricultural litter input

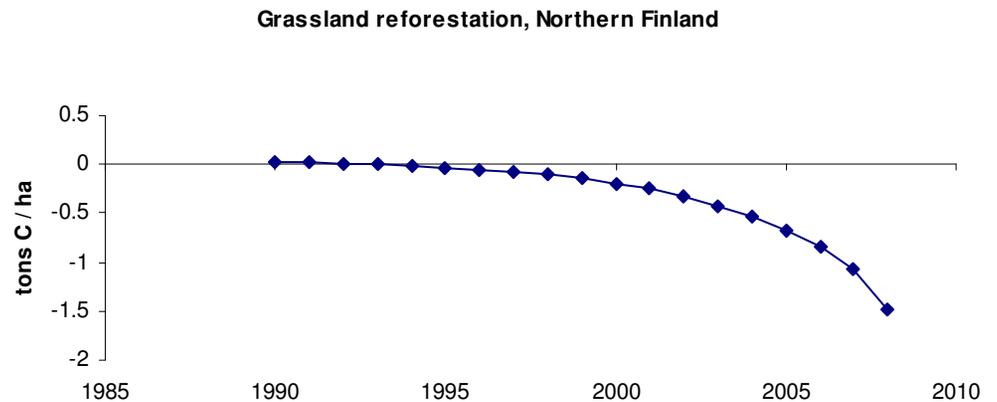
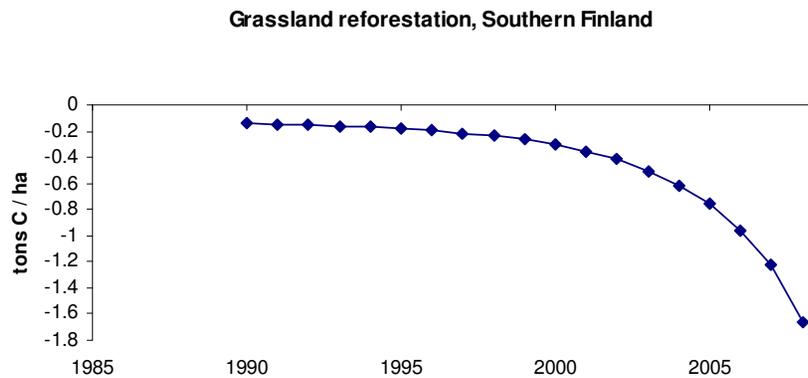
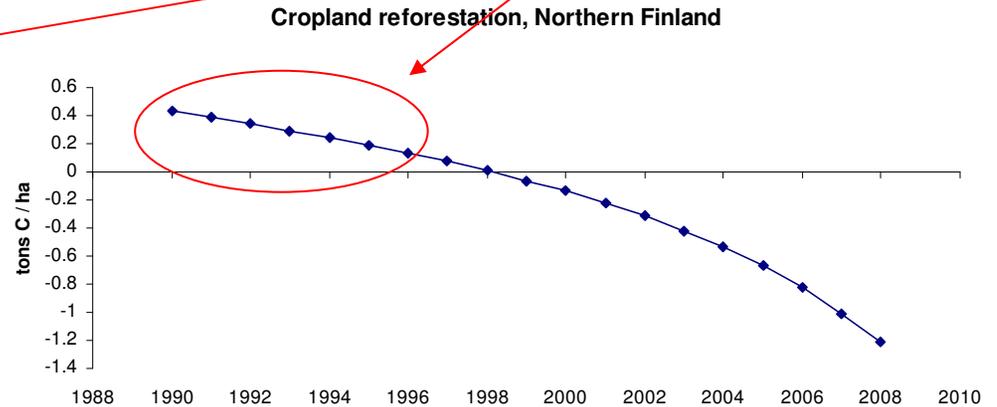
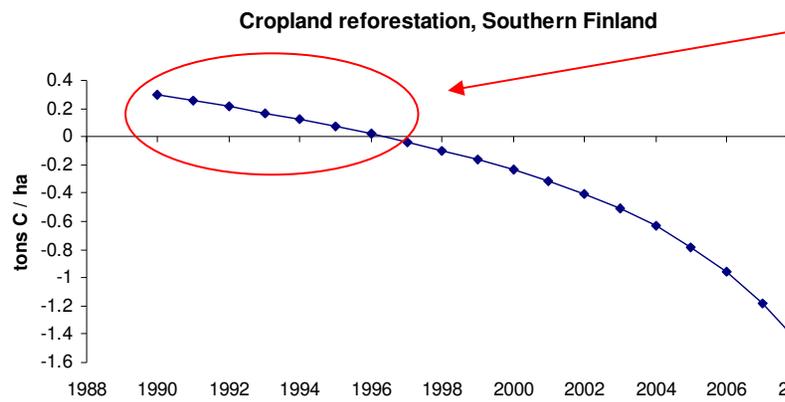
- Cropland → Forest land, Grassland → Forest land;
 - Original stock before land-use change obtained from MTT Agrifood, cropland 75-89, grassland 86-96 tons C / ha
 - Also distribution to AWEN compartments were provided
 - Litter input from the NFI plots where land-use was changed....

- Settlement → Forest land
 - Original carbon stock before equal to 0.
 - This assumption should be re-evaluated

- Forest land →
 - MTT Agrifood deals estimation with Yasso07, Metla provides original carbon stock

Results - soil carbon art. 3.3

Emissions



Soil C change on grassland and cropland reforestation

Conclusions - land-use change

- Comparisons to empirical data needed
- Re-evaluation of assumptions, e.g. settlement, C stock equal to 0
- 2010 submission, 1. with land-use change data concerning soils