

Supplement

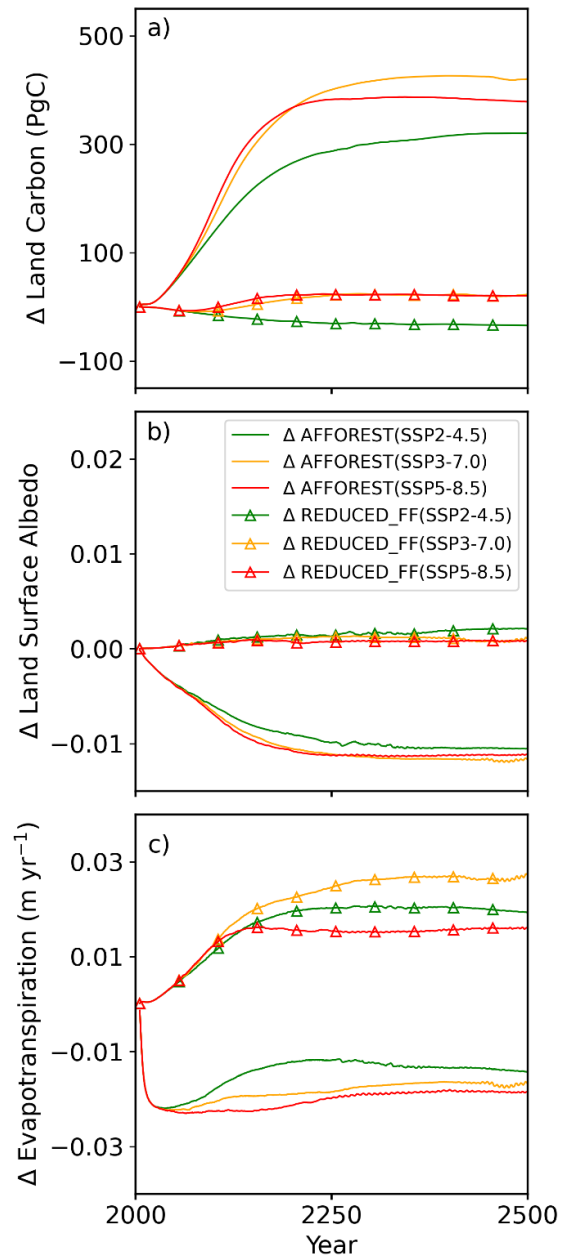


Figure R1. Changes in a) global total land carbon stock and b) land surface albedo and c) evapotranspiration in the AFFOREST (solid lines; Δ AFFOREST) and REDUCED_FF (solid lines with triangle markers; Δ REDUCED_FF) cases relative to the FIXED_AGR case in the SSP2-4.5 (green), SSP3-7.0 (orange) and SSP5-8.5 (red) scenarios. In the AFFOREST simulations, the amount of carbon additionally stored in land (between 2006-2500) are 319.84 PgC, 418.93 PgC, and 379.21PgC in the SSP2-4.5, SSP3-7.0, and SSP 5-8.5 scenarios, respectively, while the

difference between land carbon stock in REDUCED_FF and FIXED_AGR is nearly zero in the three SSP scenarios. The land surface albedo in the AFFOREST case is smaller by 0.011 (averaged over 2471-2500) in the three SSP scenarios compared to FIXED_AGR case, while the REDUCED_FF case has similar land surface albedo as in the FIXED_AGR case in the three SSP scenarios. The evapotranspiration is smaller (larger) in the AFFOREST (REDUCED_FF) case compared to the FIXED_AGR case due to increase (decrease) in water use efficiency of vegetation at higher (lower) atmospheric CO₂ levels.

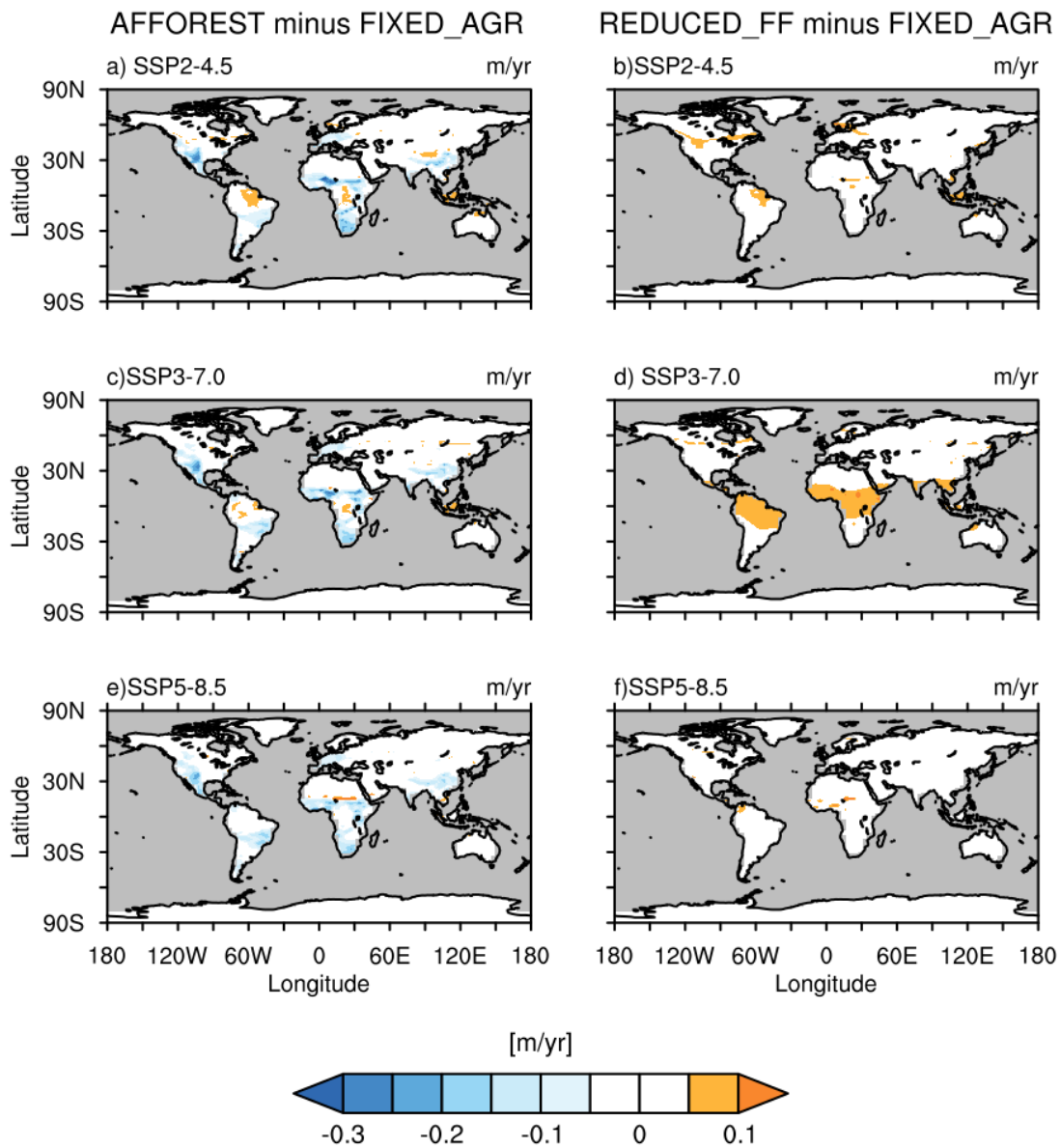


Figure R2. The left (right) panel shows the spatial pattern of the difference in evapotranspiration (averaged over 2471-2500) between the AFFOREST (REDUCED_FF) and FIXED_AGR simulations. The top, middle and bottom panels correspond to the SSP2-4.5, SSP3-7.0 and SSP5-8.5 scenarios, respectively. The AFFOREST case has smaller evapotranspiration compared to the FIXED_AGR case in regions where forest regrow, while the REDUCED_FF case has larger or similar evapotranspiration compared to the FIXED_AGR case in different regions in the three SSP scenarios.

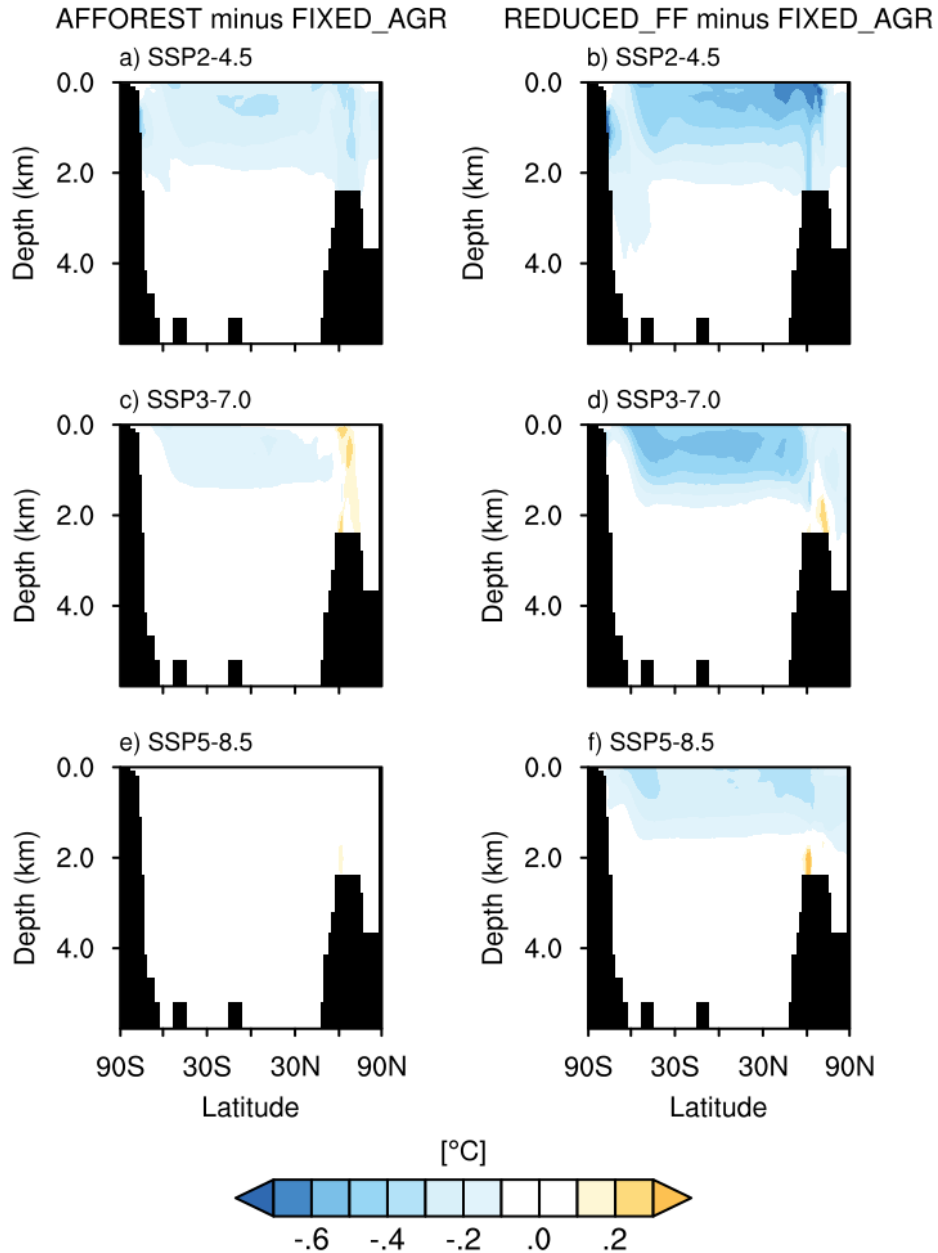


Figure R3. The left (right) panel shows the spatial pattern of the difference in zonal mean vertical ocean potential temperature (averaged over 2471-2500) between the AFFOREST (REDUCED_FF) and FIXED_AGR simulations. The top, middle and bottom panels correspond to the SSP2-4.5, SSP3-7.0 and SSP5-8.5 scenarios, respectively. The difference in ocean potential temperature between AFFOREST and FIXED_AGR cases is nearly zero everywhere (except in the surface ocean in SSP2-4.5), while the surface ocean is cooler in the REDUCED_FF case compared to the FIXED_AGR case in the three SSP scenarios.

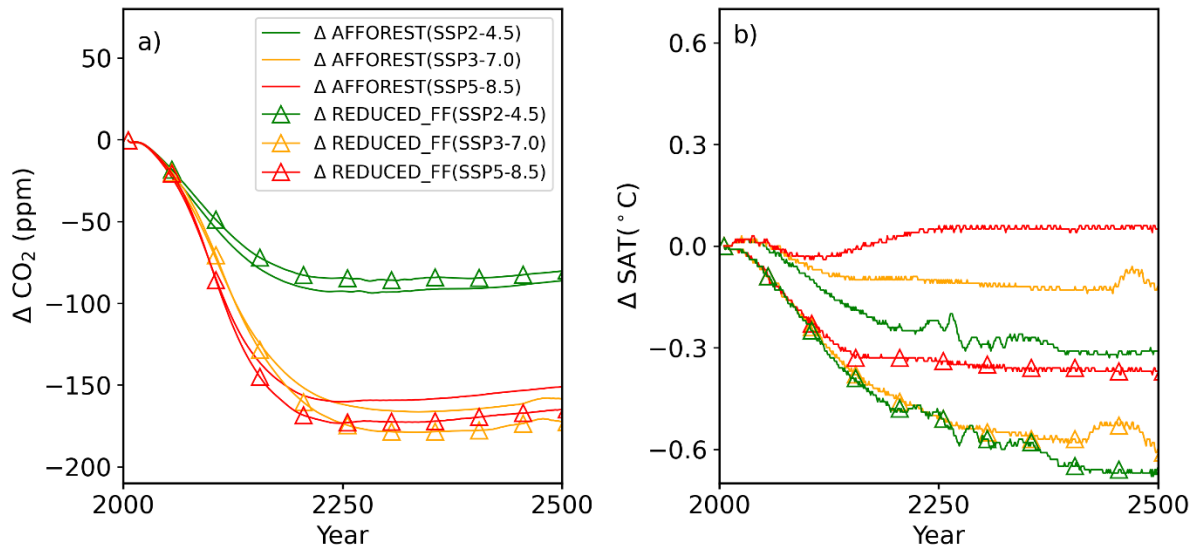


Figure R4. Changes in a) global mean atmospheric CO₂ concentration and b) global mean surface air temperature in the AFFOREST (solid lines; ΔAFFOREST) and REDUCED_FF (solid lines with triangle markers; Δ REDUCED_FF) cases relative to the FIXED_AGR case in the SSP2-4.5 (green), SSP3-7.0 (orange), and SSP5-8.5 (red) scenarios. The decrease in atmospheric CO₂ because of afforestation or reduced fossil fuel emissions is almost twice in SSP3-7.0 and SSP5-8.5 compared to SSP2-4.5 due to two reasons: i) amount of carbon removed by land is larger in the SSP3-7.0 and SSP5-8.5 scenarios because of larger CO₂-fertilization effect as discussed in Sect 3.1 ii) larger ocean carbon uptake in the FIXED_AGR case relative to the AFFOREST and REDUCED_FF cases in the SSP3-7.0 and SSP5-8.5 scenarios compared to SSP2-4.5 (Table S2). The REDUCED_FF case has lower SAT than the FIXED_AGR case in the three SSP scenarios case because of reduced fossil fuel emissions. In the AFFOREST case, the cooling effect of removal of CO₂ is partially or completely offset by the biophysical warming effect of regrowth of forests. Hence, the AFFOREST case has similar SAT as that of FIXED_AGR in the SSP3-7.0 and SSP5-8.5 scenarios and smaller SAT in the SSP2-4.5.

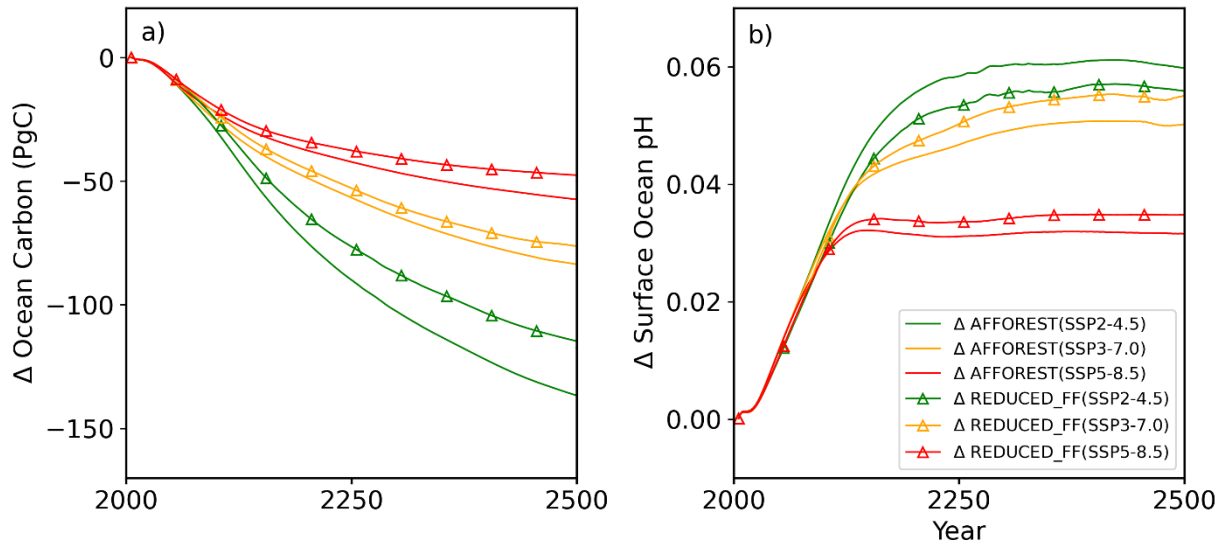


Figure R5. Changes in a) global total ocean carbon content and b) global mean surface ocean pH in the AFFOREST (green; Δ AFFOREST) and REDUCED_FF (blue; Δ REDUCED_FF) cases relative to the FIXED_AGR case in the SSP2-4.5 (green), SSP3-7.0 (orange), and SSP5-8.5 (red) scenarios. The AFFOREST and REDUCED_FF cases have smaller ocean carbon than the FIXED_AGR case in the three SSP scenarios because of the reduction of atmospheric CO₂ in the AFFOREST and REDUCED_FF cases by afforestation and reduced fossil fuel emissions, respectively, and the consequent reduction in ocean carbon uptake. The AFFOREST and REDUCED_FF cases have larger surface ocean pH than the FIXED_AGR case because of the smaller ocean carbon content in the AFFOREST and REDUCED_FF cases (Figure S6).

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