GE585 homework 10 - Particle Filter

Assignment

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Note: The nt was set to nrow(inputs) and the ne was set to 1000 for model run. The output of the original model is exported as Exercise\_10\_ParticleFilter\_hw\_original\_1000.html

In addition to getting this code to run, the goals of this assignment are:

1. Compare the results of the three projections in terms of their spread/accuracy around LAI.

In the ensemble projection, the uncertainty of projected LAI increases over time. The non-resampling particle filter projection and resampling particle filter projection have similar magnitude of uncertainty. The accuracy of non-resampling particle filter projection and resampling particle filter projection is higher than the ensemble projection. The accuracy of resample PF is slightly higher than non-resampling PF.

1. Compare the results of the three projections in terms of their ability to constrain the other fluxes and state variables that are output by the model (which should be updated in proportion to how much they covary with LAI)

The resampling PF projection has the best ability to constrain other fluxes and state variable. The non-resampling PF projection also has good ability to constrain other fluxes and state variable. The ensemble projection has weak ability to constrain other fluxes and state variable.

1. Which parameters were most constrained by LAI? Does this make sense?

Specific leaf area (SLA) was most constrained by LAI. This make sense, since the LAI (leaf area index) is defined as the projected area of leaves per unit ground area, and SLA is also a measurement of leaf area.

1. Rerun the resampling PF without parameter uncertainty – in other words, fix every ensemble member to have the same parameters but different initial conditions. Compare results to the prior run that contained parameter uncertainty. Qualitatively, how important was parameter constraint vs state constraint in terms of both the initial spread and the constraint of LAI over time.

The output of rerun was exported as Exercise\_10\_ParticleFilter\_hw\_rerunQ4\_1000.html. The parameter constraint is more important in terms of the constrain of LAI over time whereas the state constrain is more important in terms of the initial spread of LAI.

1. Extra Credit: For the no-parameter-uncertainty run, convert the analysis step of the resampling PF to an EnKF, rerun and compare to the previous run.