R: Runoff partitioning and its impact on water and energy budgets in the ACME land model

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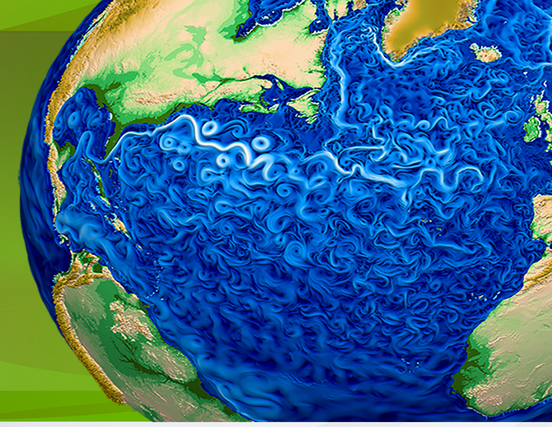
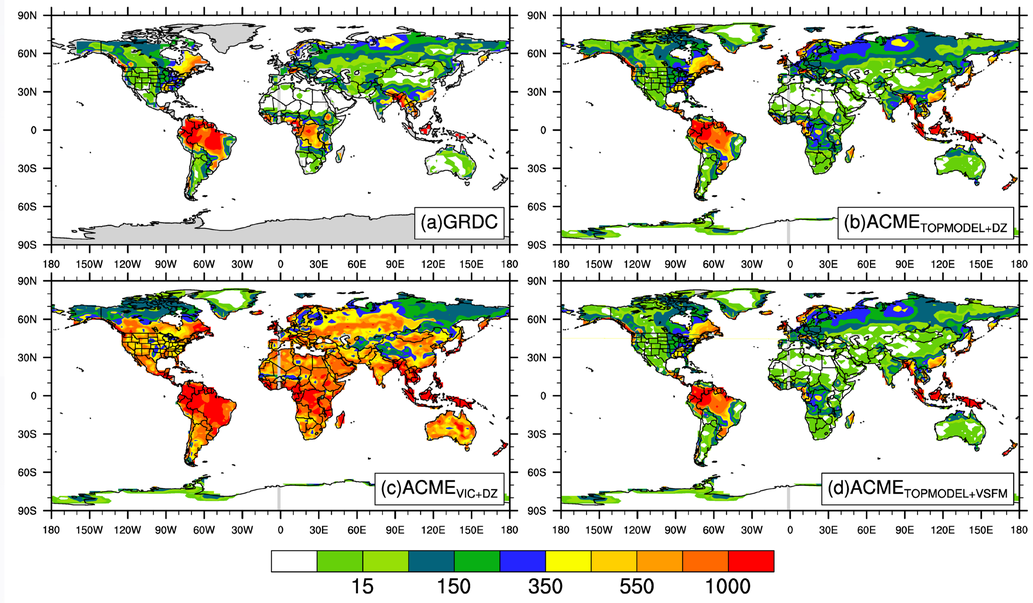


Motivation and Objective

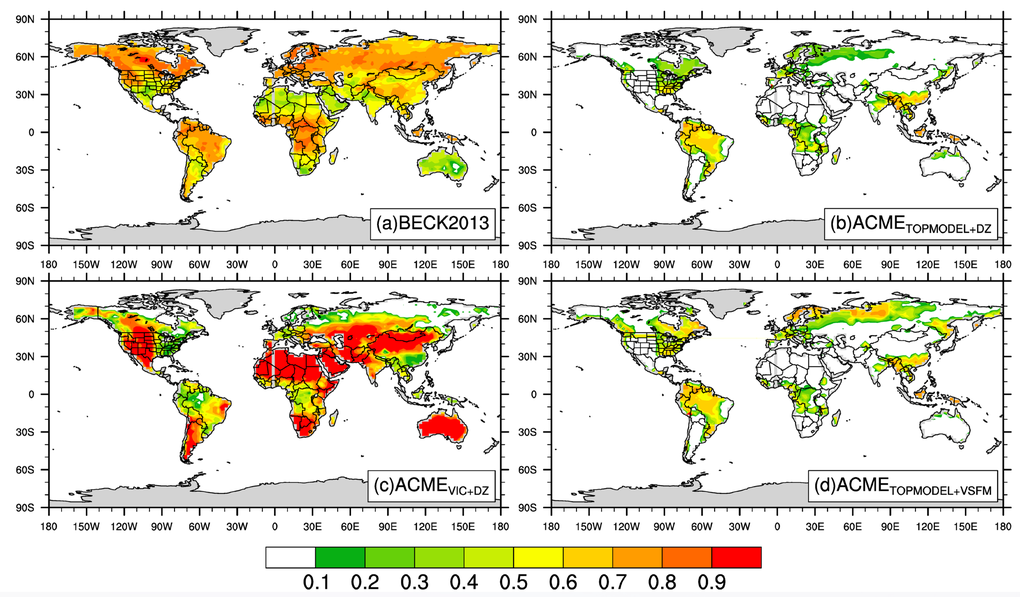
- Soil moisture plays an important role in the coupled water, energy, and carbon cycles. Surface and subsurface runoff are important boundary fluxes that influence soil moisture directly.
- The performance of a LSM in simulating runoff and its partitioning is highly dependent not only on the implementation details of the runoff scheme, but also on its non-linear interactions with other LSM parameterizations.
- Hence, structural differences in the runoff parameterization alone can also lead to large uncertainty not only in simulated hydrologic budget;, but also energy and biogeochemical simulations.
- In this study, we aim to conduct ALM simulations with different combinations of runoff parameterizations (TOPMODLE and Variable Infiltration Capacity(VIC)) and 1-D Richards Equation solvers (DZ and VSFM), and benchmark the results against global datasets.

Results

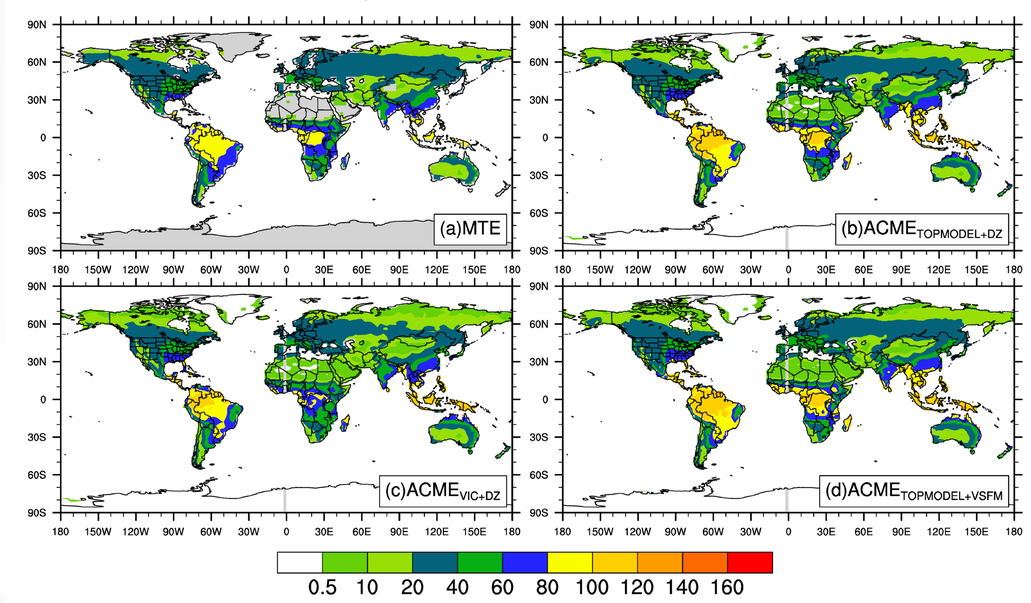
Comparison of annual runoff (mm/yr)



Comparison of baseflow index



Comparison of Latent Heat (W/m^2)



Discussion and Future work

- The VIC runoff parameterization implemented previously into CLM4.5 produces much higher total runoff and baseflow index compared to the benchmarking datasets. It needs to be refined and tested for better integration with the new ALM spatial structure, soil water and plant hydraulic modules. Work is underway to address these issues.
- The TOPMODEL runoff parameterization, even though reproduces global runoff volume reasonably well when compared to the GRDC dataset, also suffers from biases in regional runoff simulations. In addition, it significantly under-estimates baseflow indices globally when compared to the Beck et al. (2013) dataset derived from observed streamflow records.
- Uncertainty in simulated runoff and its partitioning propagates to the energy cycle simulations by directly affecting soil moisture, which modulates available water for evapotranspiration/latent heat.
- Results from this study will be used to guide sensitivity analysis and calibration of ALM runoff parameters in the near future.

ACME Accelerated Climate Modeling for Energy

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