6B.2 Using WRF in the coupled Regional Arctic System Model (RASM): Sensitivity to atmospheric processes

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A fully coupled regional Earth system model has been developed for the Arctic: the Regional Arctic System Model (RASM). The RASM atmosphere (WRF) is coupled to the ocean (POP), sea ice (CICE), and land (VIC) with the CESM CPL7 coupler. Comparison of RASM-WRF and uncoupled WRF output show that over the same domain and time period using WRF in a coupled framework improves near surface temperature and circulation patterns due to more realistic energy exchange, particularly over the ocean during winter. However, modifications to the WRF surface layer scheme are necessary to prevent decoupling between the land surface and atmosphere in stable conditions that would otherwise result in unrealistically cold temperatures over land. The modeled sea ice cover was found to be sensitive to radiation (CAM) and microphysics (Morrison) parameterizations. In particular, coupling the radiation scheme to the microphysics scheme by passing the cloud droplet size was found to improve sea ice relative to observations. Additionally, the cloud droplet size is dependent on cloud droplet number concentration, which must be modified for Arctic conditions. A modeled radiation budget for a fixed droplet concentration and a seasonally and latitudinally varying droplet concentration are compared, and implications for sea ice are discussed.