**Introduction**

Changes in crop type and coverage can have a significant impact on regional weather and climate. Over the Northern Plains (NP), there has been a transition from grains to leafier crops such as corn and soybeans. This should increase the amount of evapotranspiration, which may then lead to other changes in the atmosphere. For this study, the Weather Research and Forecasting (WRF) model is used to downscale the Community Earth System Model (CESM). Simulations are performed using a standard configuration, and with the Noah-MP Land Surface Model (LSM) with a dynamic crop model such that feedback of crops can be further studied. The Noah-MP-Crop model has been tuned for southern regions of the U.S. Midwest and must be tuned for use in the NP region.

**Goal:** Show usefulness of using a coupled Atmosphere/Crop model and tune crop model for NP region.

**Vegetation Changes**

Crop Species Changes and Dominant Crops in North Dakota

- **Crop information for NP will be used to tune crop model.**
- **Analyze Changes Crop flux has on local climate**
- **Analyze Changes Crop flux on local climate**

**Methodology**

- **36 km/12 km grid spacing**
- **45 vertical levels**
- **2-way nesting**
- **Spectral nudging on outer domain**
- **W-Damping for model stability**
- **12 month simulation with 1 month spin-up**

Downscale

Couple Crop

Alter Crop Usage

- Crop Simulations: Noah-MP-Crop model coupled with standard WRF (2005 sim.)
- Compare Model differences between Crop and Baseline simulations

**Initial Results**

- **2005 June, July, and August 2-m max temperatures are compared between Crop and Baseline simulations**
- **The crop model is not tuned for the corn and soybeans in North Dakota. Note the Crop simulation produced warmer average max temps in that region**
- **Less water vapor mixing ratio was diagnosed from the crop simulation for same area**
- **Time-series from SE ND shows the largest amount of deviation from the Crop and Baseline simulations in mid-summer**

**Post Processing**

In order to make model data output useful for other groups within CRCS, an effort is being made to convert model output files (netCDF) into GeoTiff files. By using Python and Gdal, variables such as temperature, dew point can be saved to the new format style.

**Ongoing Work**

- The current Noah-MP-Crop model is tuned for areas outside of the Northern Plains
- The next step is to tune the model for the Northern Plains
- Different parameters must be changed for each crop type with model
- Analyze downscaling performance of Baseline
- Analyze Changes Crop flux has on local climate

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