MapMaker v2

What we want

First, the name …

- MapMaker (in various forms) has been used by a number of companies
  - Google Map Maker (https://www.google.com/mapmaker)
  - National Geographic Mapmaker Interactive (http://mapmaker.nationalgeographic.org)
  - Map Maker Ltd. (www.mapmaker.com)
  - Map Maker (http://mapmaker.donkeymagic.co.uk)
  - Mapmaker (2001) (Ireland)
    - An imaginative thriller about a mapmaker who uncovers the body of an alleged informer while mapping a border beauty spot in Ireland. As local tensions are stirred by the discovery, the …

It doesn't describe our goals

- We want to be able to provide more than just maps; all through a single web portal
  - data downloads
  - model verification
  - data analysis
  - more … ?

~~MapMaker v2~~

What we want

Some already in place …

… Some to be developed!

Component 2.

- **Improvement of an interactive tool to analyze and visualize regional climate models' outputs.** This component will further develop, enhance and extend the capabilities of the existing web-based tool *MapMaker* for processing, analyzing, verifying, and visualizing model outputs. The tool will be improved based on recommendations received from national scientists participating in the meetings (Component 1) and who have experience in the use of the tool as well as IDB specialists over the course of the project.

~~MapMaker~~ Tasking

- In addition, a number of recommendations already received from participants will be incorporated in to *Mapmaker*. These recommendations include, but are not limited to:
  i. add additional data such as evapotranspiration, number of precipitation days, among others;
  ii. include the ability to download data subsets (specific variables, times, areas, points, etc.);
  iii. scale changes to intermediate times (i.e., < 50 years);
  iv. improve the user's manual section as well as the online help tool;
  v. make it have better integration so that only a single version needs to be maintained, rather than several project-specific versions;
  vi. assess new technologies for improving maps visualization options; and
  vii. include the possibility to visualize outputs from other climate models.

- The main objective is to make the current prototype fully operational and more user-friendly by adding new functionalities (to be determined accordingly based on the recommendations received) and giving users access to more information through better maps with high-resolution (12 km and 4 km specifically).

i. add additional variables

- beyond spatial and temporal variables (time, latitude, longitude, pressure levels and soil layers) 29 variables were included in original MapMaker datasets
  - 9 land-surface parameters
  - 10 surface climate variables
  - 6 atmospheric variables
  - 2 soil variables
  - plus a few derived variables

- monthly values only
  - multiple month and annual averages computed as requested

- WRF output has been reprocessed to make additional variables available
  - 5 additional atmospheric variables
    - cloud, rain, ice and snow mixing ratios; cloud cover
  - 12 additional surface climate variables
    - convective, shallow convective and non-convective precipitation
    - snow and ice, graupel, hail precipitation
    - snow depth and canopy water
    - surface and underground runoff
    - sea-surface temperature and surface skin temperature
  - 2 additional soil variables
    - soil liquid water and relative soil moisture
  - 8 surface and top-of-atmosphere energy and mass fluxes
    - downward shortwave and longwave radiation at ground surface
    - top-of atmosphere outgoing longwave radiation
    - ground heat flux, upward sensible and latent heat fluxes
    - upward moisture flux at surface and snow phase change energy flux

Plans and feasibility

- we plan to store all these data as daily values
- monthly, seasonal and annual values can be computed from the daily values, as needed
- additional parameters could be computed "on the fly"
  - number of days exceeding various thresholds (*e.g.*, T > 35°C; precipitation > 10 cm)
  - number of consecutive dry days
- will depend on having the computing power to do the necessary computations quickly

ii. download data subsets

- currently, only complete datasets can be downloaded
- plan to develop tools to subset available data by
  - time period
  - geographic region (latitude / longitude box)
  - specific location
- plan to develop tools to perform some computations prior to download

- investigate alternate output formats

iii. scale to intermediate times

- we have structured our present-day (PD) and future (FT) climate downscaling runs to make this possible
  - 50-60 years between time slices allows for linear scaling to intermediate times
  - already have done this for our Guatemalan colleagues
- can only be applied to climatologies
  - linear temporal scaling of differences between PD and FT endmembers, added to PD

$$\bar{T}_{INT} = \bar{T}_{PD} + (\bar{T}_{FT} - \bar{T}_{PD}) \left(\frac{t_{INT} - t_{PD}}{t_{FT} - t_{PD}} \right)$$

- other scaling methods could be implemented, but would require greater knowledge of future trends than are currently known

ii. & iii. feasibility

- should be relatively straightforward to implement "under the hood"
  - NCO (netCDF operators) is a fast, powerful and free suite of tools for manipulating netCDF (and other) datasets
  - CDO (Climate Data Operators) is a collection of tools to analyze climate and weather model data, including GriB and netCDF

- benefits
  - WRF output in netCDF format
  - netCDF format widely used in climate modeling community
  - GriB format used as international exchange format for numerical weather models
  - NCO and CDO include OPeNDAP (more later)

iv. improve manual and online help

- better descriptions of available data
- "best practices" for use of data

- this will be an evolving part of the project, as much cannot be done until the software system is built

- will require active involvement of users
  - will try to log as many questions and answers as possible to incorporate into the manual and help system

v. improve software integration

- already underway
  - database of runs
    - domains
    - historical periods
    - present-day and future periods
  - new portal will use this database to locate appropriate data
- will develop local naming standards for directories and files that will alleviate many issues
  - replace previous *ad hoc* naming of project directories
- integrate model verification and mapping functions into a single website portal

vi. improve map visualization

- need input from users here

vi. add additional data

- country-suppled observations for verification and other analyses
- additional model output
  - GCM climate runs
  - other downscaling results
- copies on UNL server hosting new portal or links to other servers – pros and cons
  - speed of access versus need for storage
  - use OPeNDAP-enabled software (http://www.opendap.org)
    - Open-source Project for a Network Data Access Protocol

Most importantly …

- We need your input on how to improve this tool