Climatic Data for Agricultural Applications
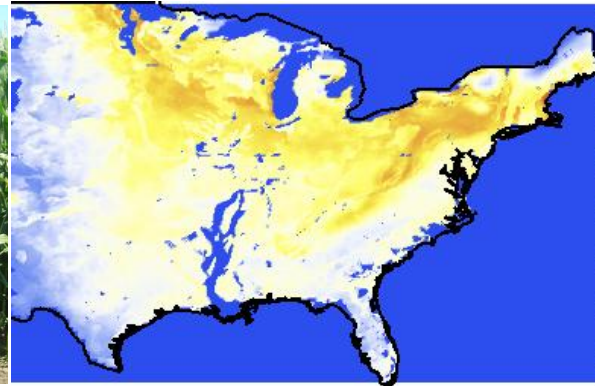
Impacts of Climate Variability and Change

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Happening now…

Affecting us for years to come…

U.S. Seasonal Drought Outlook
Drought Tendency During the Valid Period
Valid for July 19 - October 31, 2012
Released July 19, 2012

KEY:
- Drought to persist or intensify
- Drought ongoing, some improvement
- Drought likely to improve, impacts ease
- Drought development likely

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events — such as individual storms — cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

GRAINS-Corn and soybeans hit record highs, stir food crisis fear

* Soybeans set record high

* Corn front-month hits record top, off peak

* Wheat nears four-year high

* U.S. govt forecasts hot, dry weather to continue (Adds analyst quotes, updates market action at the close)

By K.T. Arasu

CHICAGO, July 19 (Reuters) - Corn and soybeans soared to record highs on Thursday as the worsening drought in the U.S. farm belt stirred fears of a food crisis, with prices coming off peaks after investors cashed out of the

FAO Food Price Index

Reuters; July 19, 2012
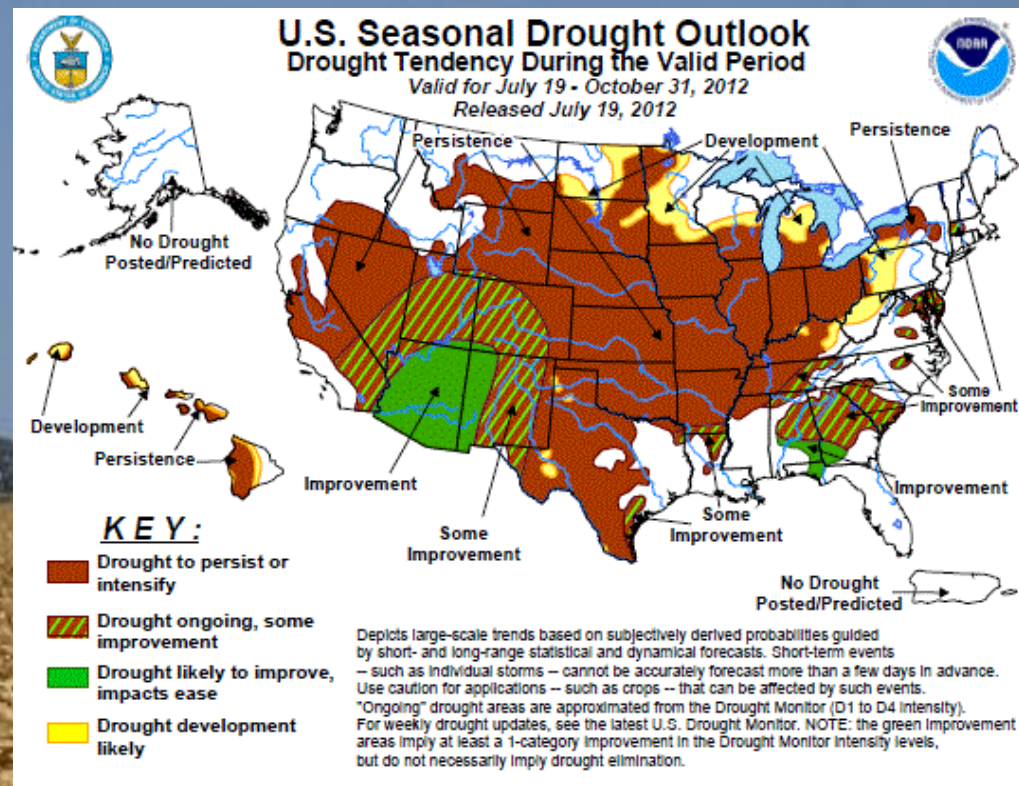
UN FAO; July 5, 2012

Climate Data Needed for Agricultural Applications

- ## …right now!!
  - **Agricultural Model Intercomparison and Improvement Project (AgMIP; www.agmip.org) is a major international effort to assess climate change impacts on the agricultural sector and the implications for food security and international trade.**

  > **Climate data → Crop models → Agricultural Economic Models**

  - **AgMIP is undertaking model intercomparison and robust uncertainty assessment.**

- ## Key climate variables for agricultural modeling
  - **Daily precipitation, maximum and minimum temperature, and solar radiation are most important.**

  - **2-meter wind speed and moisture information (vapor pressure, dewpoint temperature, relative humidity at time of maximum temperature) also allow more detailed evapotranspiration routines**

Growing need for gridded datasets and long, continuous records

- **Many agricultural areas are not near in situ meteorological stations**
  - **Particularly in developing world**
  - **Gridded crop modeling feeds integrated assessment models and global economics models**

- **Solar radiation and precipitation readily available from satellites (need temperature and humidity)**
  - **NASA/GEWEX Solar Radiation Budget solar radiation is widely used via the NASA POWER platform (White et al., 2011, even recommended it over in situ observations for ag applications)**
  - **GPCP 1-degree-daily precipitation from 1997-2009 also served on NASA POWER**
  - **After 1998 there are many additional products (e.g., TRMM 3B42, PERSIANN, CMORPH), but many agronomists are not clear on their strengths/weaknesses and none have widespread traction**
  - **Monthly datasets (e.g. CMAP, GPCP) useful prior to 1997**

# Growing need for gridded datasets and long, continuous records

- **Gridded observational datasets and Reanalyses used to fill in gaps and create suitable climatology**
  - Provide continuous records and broad coverage
  - Gauge-based precipitation datasets (e.g., CPC (in US), GPCC, CRU, University of Delaware, WorldClim)
  - Gridded temperature station datasets (e.g., CRU, University of Delaware Temperature, WorldClim)
  - Reanalyses (NCEP/NCAR and NCEP/DOE Reanalyses, MERRA, CFSR, ERA-INTERIM, NARR, NLDAS, GLDAS, others)
    - Many reanalyses have substantial biases, particularly in data sparse regions

- **Monthly datasets can drive a weather generator to estimate daily time series**

Lots of datasets to sort through…

PRECIPITATION [mm/day] ANN (2001)

From MERRA Atlas
(https://gmao.gsfc.nasa.gov/ref/merra/atlas/)
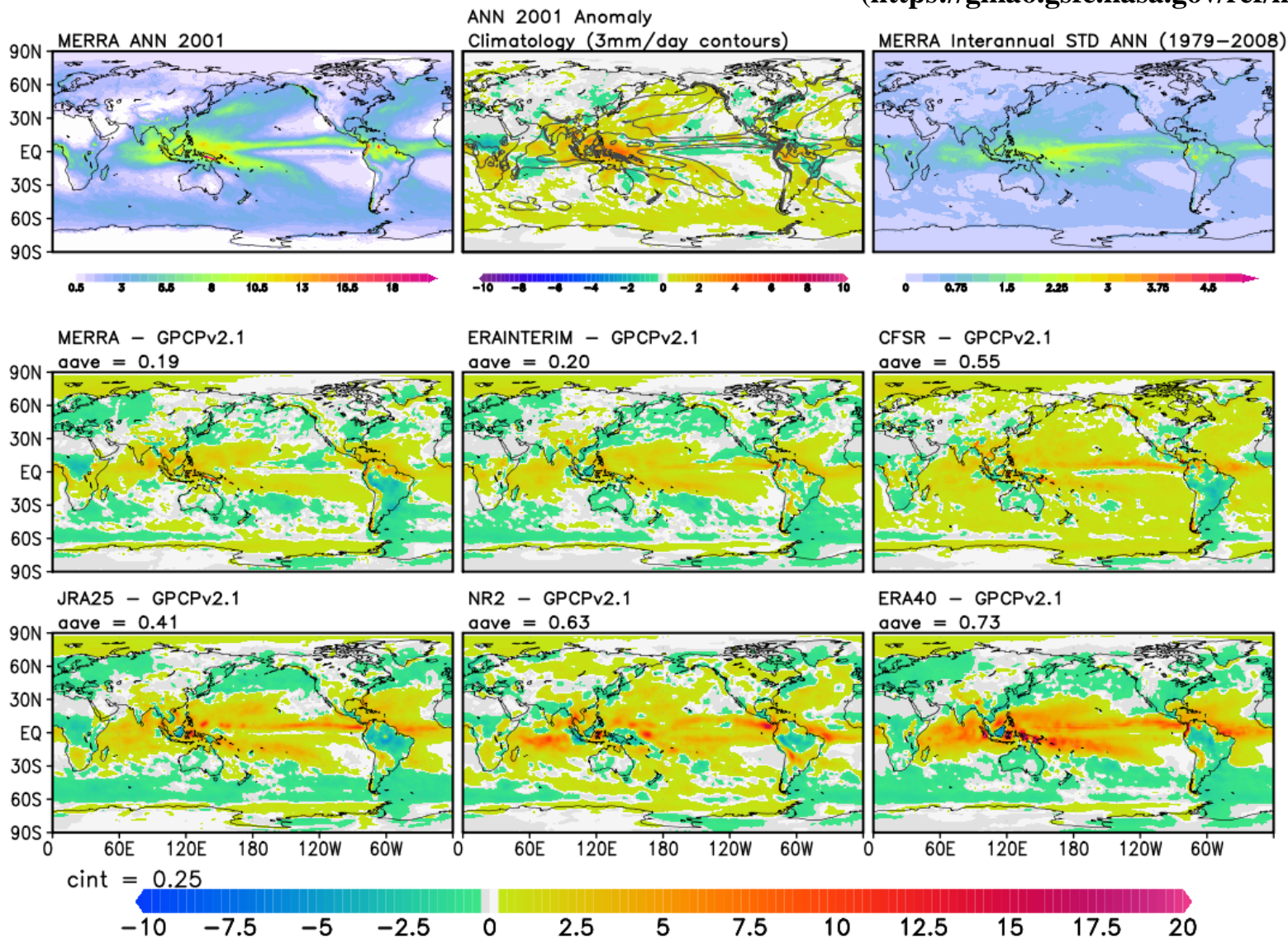
Need to understand current climate to generate realistic scenarios for future

- **Crops will respond to changes in inter-annual and intra-seasonal variability and extremes**
  - Baseline period comparison between observations and climate models, various downscaling methods, and bias-correction techniques helps us understand biases and uncertainties
  - Agricultural community particularly interested in:
    - ➢ the nature of precipitation (e.g., number of wet days, dry spell durations, distribution of extreme events)
    - ➢ temperature series in relation to key thresholds (e.g., frosts, days above 32˚C, growing degree day floor)

- **Need solid dataset as a target for statistical downscaling**
  - Nearly all future scenarios are based upon historical time series
  - Currently bias-correcting MERRA with means from gridded observational datasets and distributions from SRB and high-resolution precipitation products (CMORPH, PERSIANN, 3B42)

Need to facilitate access to climate data for agricultural applications

- **There would be great interest in online tools to pull particular time series with key variables**
  - **NASA POWER's Agrometeorology Resource is good example**
    - **User provides latitude, longitude, variables, units, and time periods**
    - **Receives formatted time series**

Agricultural Community can Help Evaluate Climate Datasets
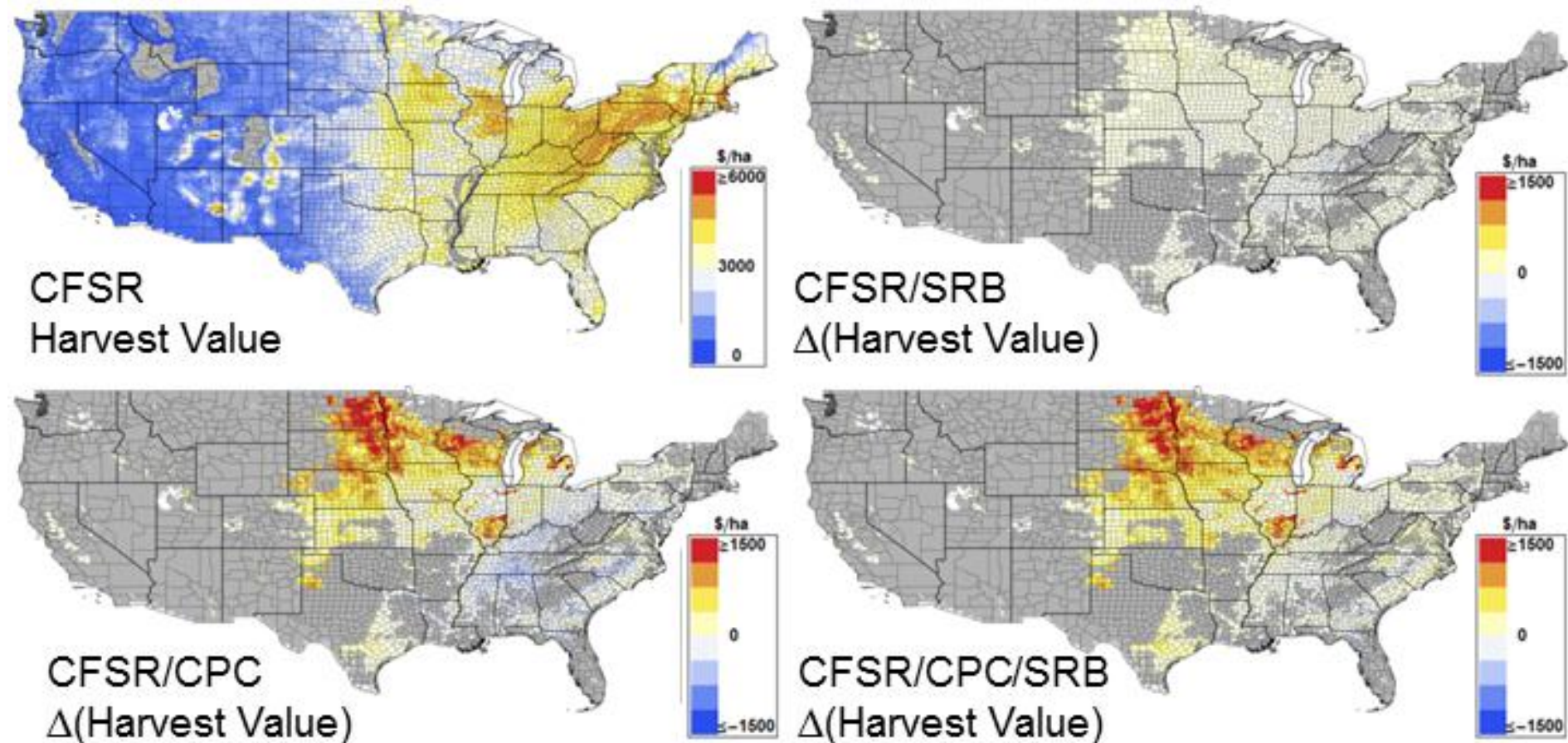
Per hectare corn value ($/ha) as simulated by the DSSAT crop model (using 2011 corn price from USDA; areas with low corn acreage are not shown).

Thanks!

Feel free to contact me at
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