EvapoTranspiration (FRET)

Outline

- FRET Background
- Participating Offices
- FRET Verification
The FRET Project

- Contributors:
  - Mike Hobbins (NOAA – ESRL)
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  - Bill Rasch (NWS – STO)
  - Wade Earle (NWS – PDT)
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- Verification Contributors:
  - Pamela Krone – Davis (CSU Monterey Bay)
  - Forrest Melton (NASA Ames Research Center)
What is FRET?

- Forecasted estimate of the amount of evapotranspiration for a 24 hour period
  - Penman Monteith (PM) equations (adopted by the Environmental Water Resources Institute of Civil Engineers) uses 12 cm grasses as reference crop.
  - Kimberly Penman (KP) (adopted by USBR in the Pacific Northwest) uses alfalfa as reference crop.
  - These equations assume a well watered surface.
FRET’s History

- Project started in 2008, following two years of drought and entering our third year of dry conditions.
- Project was in conjunction with California Department of Water Resources and the University of CA, Davis.
What’s our Current Drought Status?

U.S. Drought Monitor

January 14, 2014
(Released Thursday, Jan. 16, 2014)
Valid 7 a.m. EST
Why FRET? Every Drop Counts

Farmers can calculate how much water they need to maintain a depth of 6 inches of water for rice paddies.

Water Management Agencies can calculate how much water to release for downstream use.

Water Releases from Friant Dam in better times.
NWS Forecasts
Creation of FRET

Forecast Temperature, Sky Cover, Winds, and Relative Humidity

Penman-Monteith or Kimberly Penman Reference Evapotranspiration Equations
FRET Product Suite

- Daily FRET forecast
- Weekly Total FRET Forecast
- Daily Departure from Normal
- Climatology Grids
- Text Product- ETT
- Forecast Weather Tables
FRET running at 27 WFOs (4 with issues), 1 interested

- Billings, MT: FRET stopped on Awips II instal
- Pocatello, ID: ??
- San Antonio, TX: working with SR to get FRET to www
- Columbia, SC: $ET_{rc}$ climatology issues
FRET Web Page

http://www.wrh.noaa.gov/forecast/evap/FRET/FRET.php?wfo=sto
FRET Verification:
California Irrigation Management Information System

- CIMIS Stations – a DWR and UCD project (started in 1982).
- 48 of the 120 automated stations used for this statistical verification.
- Compared day 1, 3, 5, and 7 lead times, using bias, mean bias error (MBE), mean absolute error (MAE), and root mean square error (RMSE).
### Verification of FRET against CIMIS observations

Water year and summer period scatter plot comparisons of CIMIS station and FRET ET<sub>0</sub>.

#### Histograms of difference between FRET forecast ET<sub>0</sub> and CIMIS ET<sub>0</sub> for all stations

> 80% of FRET values within 0.05 in/day of CIMIS station ET<sub>0</sub> for all forecast periods.

FRET has slight +ve bias wrt CIMIS station ET<sub>0</sub>, increased bias in summer

#### Forecast Periods

<table>
<thead>
<tr>
<th>Forecast Period</th>
<th>2012 Water Year</th>
<th>2012 Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BIAS (in/day)</td>
<td>MBE (unitless)</td>
</tr>
<tr>
<td>FRET 1 Day Forecast</td>
<td>0.006</td>
<td>0.18</td>
</tr>
<tr>
<td>FRET 3 Day Forecast</td>
<td>0.006</td>
<td>0.18</td>
</tr>
<tr>
<td>FRET 5 Day Forecast</td>
<td>0.006</td>
<td>0.18</td>
</tr>
<tr>
<td>FRET 7 Day Forecast</td>
<td>0.004</td>
<td>0.17</td>
</tr>
</tbody>
</table>
Verification of $ET_{rc}$ Climatology

- Verification of climatology $ET_{rc}$ against agromet station-based observations across western US irrigated:
  - 990 stations: 671 irrigated areas; 319 non-irrigated areas
  - $ET_{rc}$ does not reflect ambient conditioning of dynamic boundary layer
    - ambient conditioning algorithms under development for Gen-2 $ET_{rc}$ product
Verification of $ET_{rc}$ Climatology

Summary

- All-year, all-season bias about -11% (NLDAS $ET_{rc} > agmet ET_{rc}$)
- Warm-season +ve bias; cool-season -ve bias
- Lower biases in non-irrigated areas (Counter intuitive)
- Growing season daily $r^2 \sim 0.64$
- July-Sept daily $r^2 \sim 0.6
Possible future for FRET

- FRET in Integrated Water Resources Science and Services (IWRSS) at National Water Center?
  - Create regional mosaic of FRET
  - Expansion beyond NWS Western Region
  - FRET in NDFD
  - Ability to select area to download data from grids
- Archive forecast or ongoing NLDAS-driven observations to display past 7-day values on web page
- Observed $ET_{rc}$ values
Any Questions?