USING CLIMATE INFORMATION TO DETERMINE IRRIGATION REQUIREMENTS FOR CITRUS IN FLORIDA

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• Justification
  - Florida ranks first in citrus production with nearly 68% of all U.S. citrus (2005-2006).
  - The Southwest Florida Water Management District (SWFWMD) regulates the citrus irrigation permits. New strategy implemented in 2006 to help address water supply problems, so that permitted amounts were more representative of actual water use.
  - The use of climate information is crucial for permitting calculation. However, the presence of missing data is often a constant characteristic in all historical databases and scientists need to deal with this problem.

• Objectives
  - To compare the actual irrigation water use with permitted values as well as theoretical consumptive use values calculated by a daily water balance (Highlands, Hillsborough and Polk counties).
  - To measure the uncertainty generated by a weather generator when estimating missing meteorological data.

• Materials and Methods
  - Water use by growers: provided by the SWFWMD from 1994 to 2005. Also provided the permitted citrus irrigation amounts for each county per year (Fig. 5).
  - Weather station network: Maximum and minimum temperature (°T), incoming solar radiation (ISR), maximum and minimum relative humidity (RH), wind speed (WS), and rainfall (R) were available for two main weather stations from SWFWMD (Fig. 1). Rainfall data were available for 48 sites, from 1994 to 2005 (Fig. 1 and 2).

  Table 1: Number of farms, mean monthly reported pumped water and mean production area

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<thead>
<tr>
<th>Year</th>
<th>Highlands</th>
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- Soil data:
  - Highlands and Polk: Astotula sand (ENTISOL), 7% field capacity, 4% permanent wilting point, 3% available water holding capacity.
  - Hillsborough: Basinger (ENTISOL), 12% field capacity, 5% permanent wilting point, 7% available water holding capacity.

• Results
  - The interannual average water consumption from 244 mm in Hillsborough to 406 mm in Highlands and the multiannual average irrigation requirement permits ranged from 295 to 507 mm.
  - The annual simulated gross irrigation requirements followed the trend of the actual pumped water by growers. Pumped water by growers fell within the range of the simulated gross irrigation requirement.
  - The results showed a range of simulated irrigation values per year, all probably equally, as a result of using the ensemble technique. This technique takes into consideration the uncertainty due to the use of the probabilistic method of filling missing values, therefore avoiding under- or overestimation of irrigation requirements since all possible variability is simulated and reported as probabilities.


- Rainfall balance equation used:

\[ \text{SR} = \text{SR}_{\text{ETC}} + \text{R} - \left( \text{D}_{\text{T}} + \text{D}_{\text{L}} + \text{D}_{\text{R}} \right) \]

where \( \text{SR} \) is the soil water on day \( T \), \( \text{SR}_{\text{ETC}} \) is soil water content, \( \text{ETC} \) is the crop evapotranspiration, \( \text{D}_{\text{T}} \) is the rainfall, \( \text{D}_{\text{L}} \) is net irrigation, \( \text{D}_{\text{R}} \) is runoff and \( \text{D}_{\text{L}} \) in runoff.

- Considerations: Soil depth: 0.9 m; Runoff and drainage: assumed as zero. \( K_r \) dataset from Morgan et al., (2006). Two wetted areas tested: 40 and 60%; Irrigation efficiency (microsprinkler Irrig): 80%.

• Conclusions
  - The interannual average water consumption from growers ranged from 244 mm in Hillsborough to 406 mm in Highlands and the multiannual average irrigation requirement permits ranged from 295 to 507 mm.
  - The annual simulated gross irrigation requirements followed the trend of the actual pumped water by growers. Pumped water by growers fell within the range of the simulated gross irrigation requirement.
  - The results showed a range of simulated irrigation values per year, all probably equally, as a result of using the ensemble technique. This technique takes into consideration the uncertainty due to the use of the probabilistic method of filling missing values, therefore avoiding under- or overestimation of irrigation requirements since all possible variability is simulated and reported as probabilities.

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