Integrating Climate Data Into Forecasting Hydrologic Inflow

Forecast Informed Reservoir Operations Workshop

UTA

September 12-13, 2019

Tarrant Regional Water District

in collaboration with Hydros Consulting
Climate Reanalysis Data

- MERRA-2 Data from NASA
  - Monthly Data (~70,000,000 Data Points)
  - “Assimilated” Observations from Ground, Air, & Space

Example: GPS Occultation

Image Sources: NASA Global Modeling and Assimilation Office & UCAR COSMIC
Atmospheric Variables Used at TRWD

<table>
<thead>
<tr>
<th>Parameter Description</th>
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<tbody>
<tr>
<td>Relative Humidity</td>
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<tr>
<td>Zonal (E-W) Wind</td>
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<tr>
<td>Meridional (N-S) Wind</td>
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<tr>
<td>Product of Wind Speed Anomalies</td>
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<tr>
<td>Covariance of Relative Humidity and Zonal Wind</td>
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<tr>
<td>Covariance of Relative Humidity and Meridional Wind</td>
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<tr>
<td>Geopotential Height</td>
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<tr>
<td>Temperature</td>
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- Wide range of predictors available for each month that correlate to the inflow at TRWD’s Reservoirs
- The number of predictors vary from 15 in September to 246 in May
Correlations to the North Atlantic Oscillation (NAO) Found in the Predictors

May Predictors

Geopotential Height

Zonal (W-E) Wind

Image Sources: Google Earth & Ideo.Columbia.edu
Correlations to ENSO Found in the Predictors

- Covariance of Relative Humidity & Zonal Wind
- Meridional N-S Wind
- Wind Speed Anomalies
- Covariance of Relative Humidity & Zonal Wind

Image Source: Google Earth
RiverWare Implementation

- Generate Forecast
  - Climate State Probability Distribution
  - Dry, Avg, Wet, Very Wet binning
- Generate 100 Markov Chain Traces
  - Number of Traces for Each Bin Match Probability Distribution
  - Observed Hydrologic Data Resampled
  - Historical Transition Probabilities Used to Simulate Likely Climate Progression
  - 100 Runs Simulated in RiverWare Planning Model
- Review Results

MERRA-2 Data
Global Downscaling Forecasting Script
Dry/Avg/Wet/Very Wet
Markov Chain Trace Selection
RiverWare MRM Run
Thank You for The Opportunity

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