Seasonal Streamflow Forecasting in Central Arizona: Recent Improvements and Future Opportunities

2019 S2S Precipitation Forecasting Workshop

May 22-24, 2019

Bohumil M. Svoma Surface Water Resources



Outline

- Salt River Project Overview
- Seasonal Streamflow Forecasts
 - Snow Water Artificial Neural Network (SWANN)
 - S2S Value
- Potential FIRO opportunity
- Summary



Salt River Project

- Salt River Valley Water Users Association
- Established 1903
- A Federal reclamation project
- Private corporation
- Delivers approximately 987 million m³ (800,000 acre-feet) per year





- SRP Agricultural Improvement and Power District •Established 1937-operates power side •Over 35,500 million kWh sold
- Over 1,000,000 accounts









Salt River Project Reservoir System



Delivering water and power"

10/27/1999 RESERVOR-1.PP





Horseshoe Dam January 2010





Tempe Town Lake



Horseshoe Dam and Reservoir

Roosevelt Lake







Seasonal Streamflow Forecasts

Future Weather



Current Snowpack







Streamflow Forecasts Chase the Weather





ECMWF EPS anomalies initialized <u>Jan. 14 2019</u> Feb 3-7 500 hPa Height Anomaly (m)

Feb 1-7 Precipitation Anomaly (in)

 ECMWF EPS 500 hPa Geopotential Height [dm] & Anomaly [m] | 5-day Ensemble Mean 00203FEB2019 & 00208FEB2019
 Day 20 - Day 25

 Init: 00Z14JAN2019 -- [600] hr --> Valid Fri 00Z08FEB2019
 MIN |MAX: -94.5 | 100.7 m



ECMWF M-EPS Precipitation Anomaly [inch] | 7-day Ensemble Mean 00Z01FEB2019 & 00Z08FEB2019 Init: 00Z14JAN2019 -- [600] hr --> Valid Fri 00Z08FEB2019







ECMWF EPS anomalies initialized Jan. 14 2019

Feb 22-26 500 hPa Height Anomaly (m)

Feb 20-26 Precipitation Anomaly (in)

 ECMWF EPS 500 hPa Geopotential Height [dm] & Anomaly [m] | 5-day Ensemble Mean 00Z22FEB2019 & 00Z27FEB2019
 Day 39 - Day 44

 Init: 00Z14JAN2019 -- [1056] hr --> Valid Wed 00Z27FEB2019
 MIN|MAX: -112.3 | 139.4 m







CPC's Experimental Week 3-4 Forecast





Forecast Skill from Snowpack



Decision Support with the UA / SWANN model



 In a prototype decision support system, snow maps are visualized (along with other snow / precipitation products) using web mapping as well as watershed analytics

UA / SWANN SWE



% of Normal SWE

SNODAS SWE



Comparison between Different Years

PRISM Precipitation



% of Normal Precipitation













Snow Mapping with the SWANN model

SWANN Snow-Water Artificial Neural Network

• ANNs are trained to reproduce LiDAR snow distribution using various input predictors





- Elevation, Solar Forcing Index (SFI), and Canopy Cover tend to be most important for our AZ field sites
- These variables (mapped across the entire model domain) used to generate adjustment factors, which are applied to the coarse SWE data



SWANN vs SNOTEL



SWANN vs SNOTEL

Salt near Roosevelt Discharge Prediction 3/15/1985 (no weather forecast included)



—Obs —PRED_SNOTEL —PRED_SWANN





SWANN vs SNOTEL

SNOTEL SWE fairly representative of distributed SWE in <u>2019</u>













Potential Forecast Informed Reservoir Operations

Roosevelt Dam



Modified Roosevelt Dam Storage Allocations (1995 Silt Survey)



Delivering water and power™







Summary

- SRP delivers about 800,000 AF yr⁻¹ to the Phoenix Area.
- Seasonal Streamflow Forecasts
 - Snowpack provides predictability
 - 1-month forecasts potentially highly valuable
- Potential to store late season Roosevelt spills (35 KAF yr⁻¹)

