Notes from Sankar Meeting

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This weeks TODO:

- Fit sin curve to monthly intercepts: $m = \beta_0 + \beta_1 \times sin(\omega t)$
  - Each of the parameters above are fit for each reservoir

Reservoir	β_0	β_1	ω	R^2
Wilbur	0.0011	0.0002	0.5003	0.0052
Nikajack	0.0023	-0.0042	0.3508	0.2731
Wilson	0.0019	0.0215	0.6620	0.2777
MeltonH	0.0004	0.0268	0.8642	0.2899
FtPatrick	0.0047	-0.0094	0.3763	0.3584
Apalachia	0.0076	-0.0155	0.5369	0.5402
Kentucky	0.1036	-0.1680	0.3074	0.7817
Douglas	0.1096	-0.2436	0.4129	0.7997
Hiwassee	0.0857	-0.2175	0.4460	0.8129
Fontana	0.0547	-0.1583	0.5058	0.8138
Watauga	0.0329	-0.1195	0.5703	0.8213
Ocoee1	0.2640	-0.3900	0.2753	0.8255
Chatuge	0.0602	-0.1806	0.4628	0.8345
Guntersville	0.0767	-0.1189	0.2954	0.8493
Norris	0.0422	-0.1361	0.5054	0.8535
WattsBar	0.2402	-0.3646	0.2675	0.8646
Wheeler	0.1567	-0.2488	0.2991	0.8649
Cherokee	0.0551	-0.1881	0.4966	0.8752
FtLoudoun	0.1956	-0.2985	0.2628	0.8767
Pickwick	0.0942	-0.1484	0.3028	0.8787
Chikamauga	0.2051	-0.3164	0.2817	0.8832
SHolston	0.0524	-0.1773	0.5052	0.8890
Boone	0.0475	-0.1750	0.4454	0.8981
TimsFord	0.1180	-0.2249	0.3447	0.9079
Nottely	0.0472	-0.1718	0.5131	0.9244
BlueRidge	0.0299	-0.1319	0.5447	0.9279
Ocoee3	0.0290	-0.0494	0.2966	0.9686

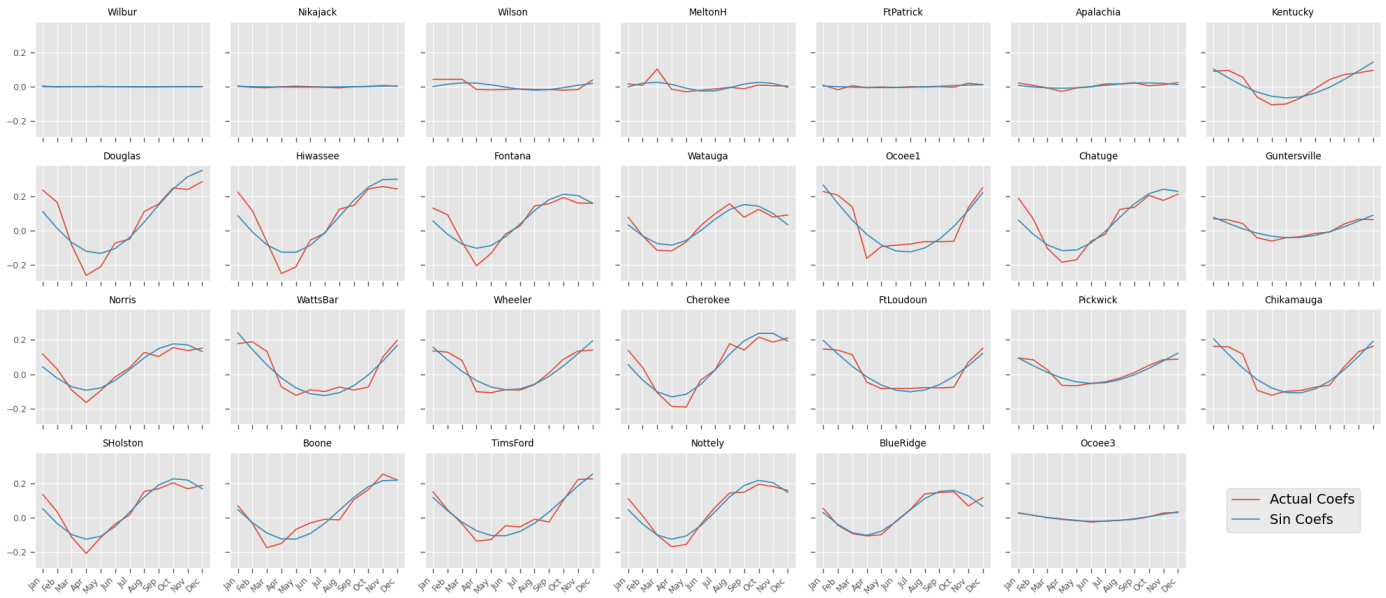

Figure 1: Wave Intercept Plots

- Create a road map for synthesizing what we have done:
  - 2 part series paper:
    * 1 - Synthesis
    * 2 - Prediction
  - Title: A Data-driven approach to quantify TVA's Reservoir Operation: Part I – Synthesis Part II: Validation
- Pull together some slides that show this projects process and get to Sankar
  - Sent to sankar Friday morning at 8:24
- Meet Sankar on Friday at 10 am
  - Decided to move meeting to Monday at 9 am so he can go over the slides over the weekend
  - Moved meeting to 10:30 am on Tuesday

Sankar Comments on Slide Deck

- Watts Bar should be upstream reservoir because its residence time is so high
  - This was actually just slip up on my part. Watts Bar and Watauga were just swapped
    * So were Wilbur and Wilson actually
- Calculate correlation between observed and predicted release values. This will let us know if we biased or if we are not capturing patterns.
  - Intercepts are there to capture temporal variability in reservoir operations that can not be captured by a simple day ahead parameterization.
  - Examining the plots on slide 20, we can see there are several reservoir that exhibit no monthly bias (as they have near zero intercepts throughout the year)
  - In this context (where we fit a model for each reservoir), no reservoir will have bias over the entire modeled period (BLUE)
    * This indicates that poor performance must be dictated by poor correlation.
  - I will check this to be thorough and we can discuss it.
- Estimate sin wave parameters as a function of residence time.
  - I regressed all wave parameters against RT, MStL, and MRel with an intercept (separately). None of the independent variables had any predictive power for any parameter.

  - To assess all their possible relationships at the same time, I checked the cross-correlation of all of those variables
  - None have a significant correlation with the wave parameters (>0.4)
  - The wave offset and amplitude modifier are highly negatively correlated
  - As are the offset and the frequency modifier ω
  - ω and the amplitude term are positively correlated
  - Score is positively correlated with offset, and negative with other two terms
    * As the changes in operation increase in frequency, the sin wave becomes worse
    * Same can be said for larger swings in amplitude
      · i.e. if the changes in operation are larger the sine wave is worse.
    * Both of these effects are not that strong though and there are definitely samples that do not fit this trend
      · Ocoee3 for example

	β_0	β_1	ω	R^2	$\bar{S}/\bar{R}$	$\bar{S}/S_{\text{max}}$	$\bar{R}$
β_0	1.00	-0.92	-0.67	0.49	-0.15	-0.01	0.25
β_1	-0.92	1.00	0.59	-0.69	-0.11	0.09	-0.04
ω	-0.67	0.59	1.00	-0.43	0.27	0.36	-0.37
R^2	0.49	-0.69	-0.43	1.00	0.37	-0.27	-0.06
$\bar{S}/\bar{R}$	-0.15	-0.11	0.27	0.37	1.00	0.04	-0.47
$\bar{S}/S_{\text{max}}$	-0.01	0.09	0.36	-0.27	0.04	1.00	-0.12
$\bar{R}$	0.25	-0.04	-0.37	-0.06	-0.47	-0.12	1.00

- Interpret each tree on page 12
  - I also need to rerun this model and get an updated tree and parameters.
  - I reran, and provided interpretation in the slides

Tuesday meeting

- Prepare slides 4-5 slides on what we have done and what we want to do
- Short and simple
- We have TVA stuff
- Want to evaluate the statistical model on reservoir model
- Implement it in LSM
- Work with Blue Waters on model NWM
- Meeting notes
  - Stop referring to upstream and downstream reservoirs
    * Instead label them as High RT and Low RT
  - Try to write release rules for tree.
    * Maybe fit tree with just release as a independent variable
  - Look at distribtion of storage, inflow, and release percentiles within each column
    * To try and understand what falls in what column