



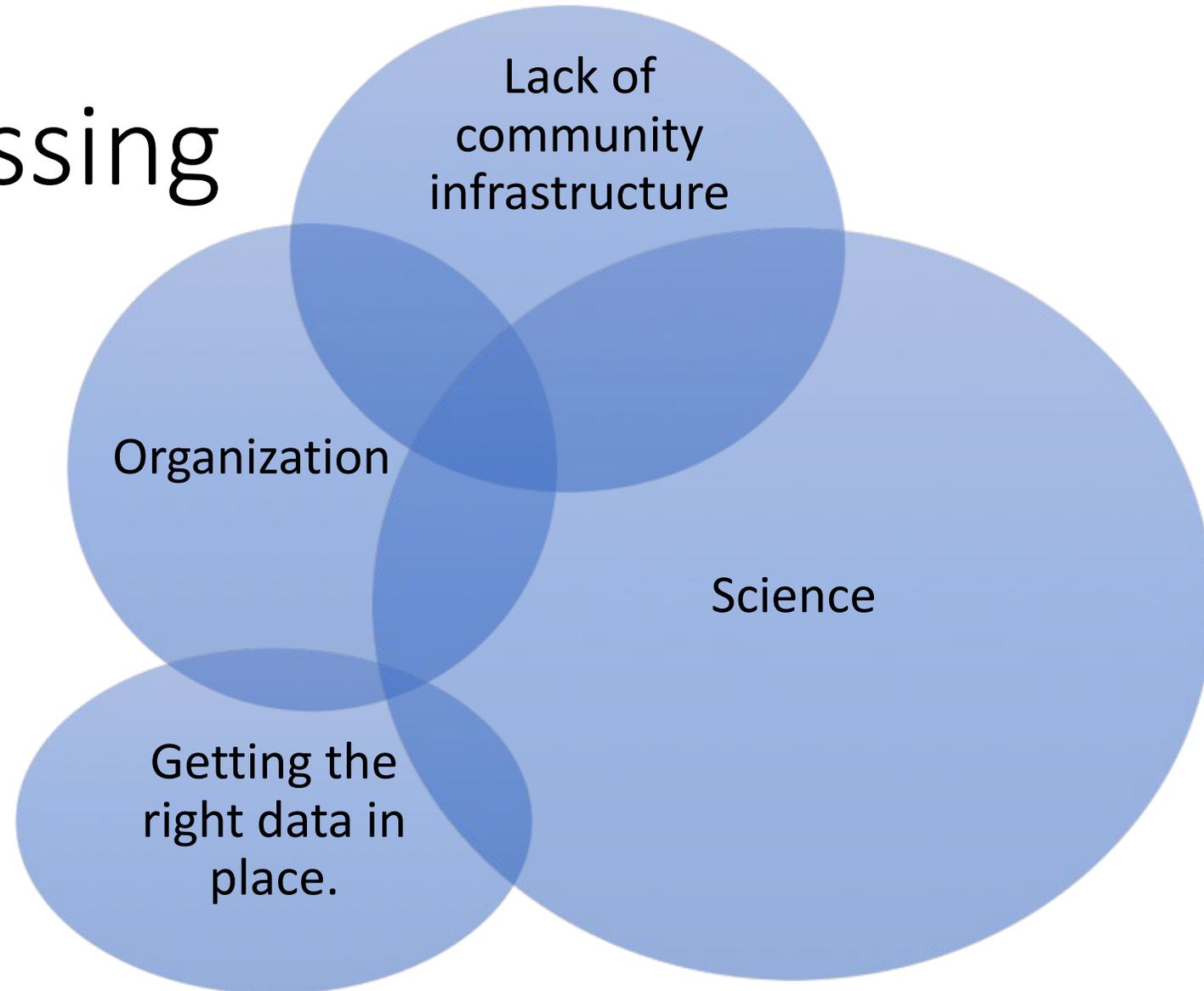
Developments needed to generate high-quality S2S products through statistical postprocessing

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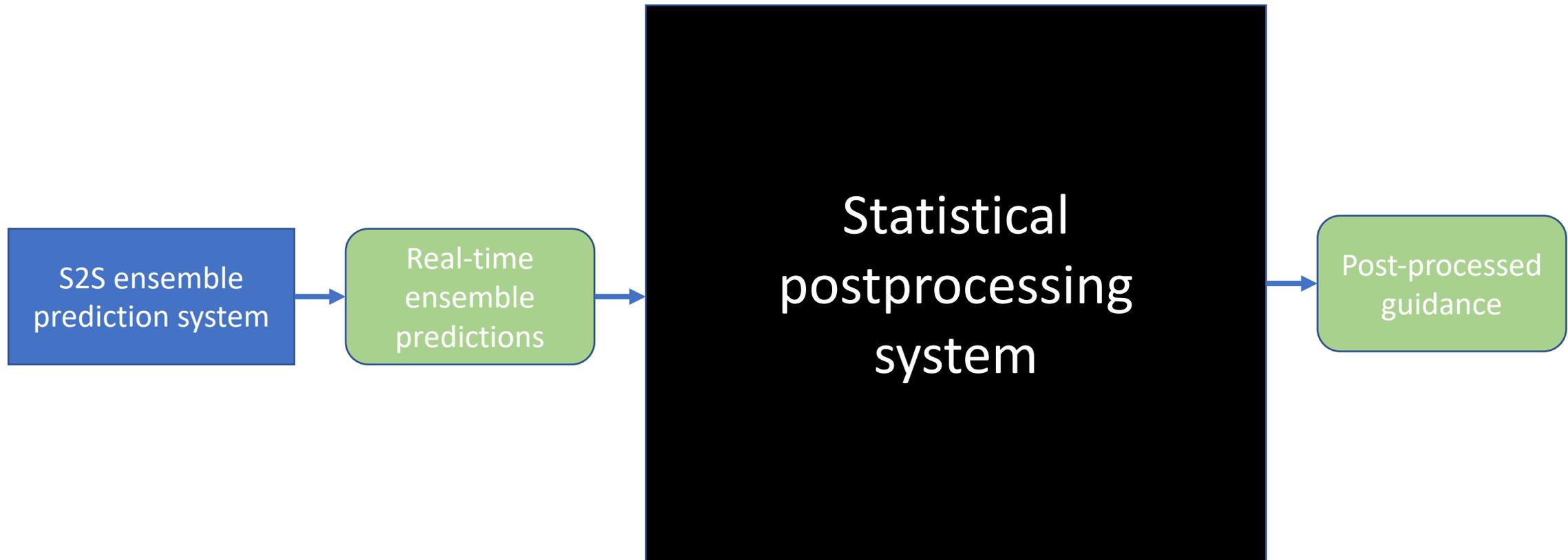
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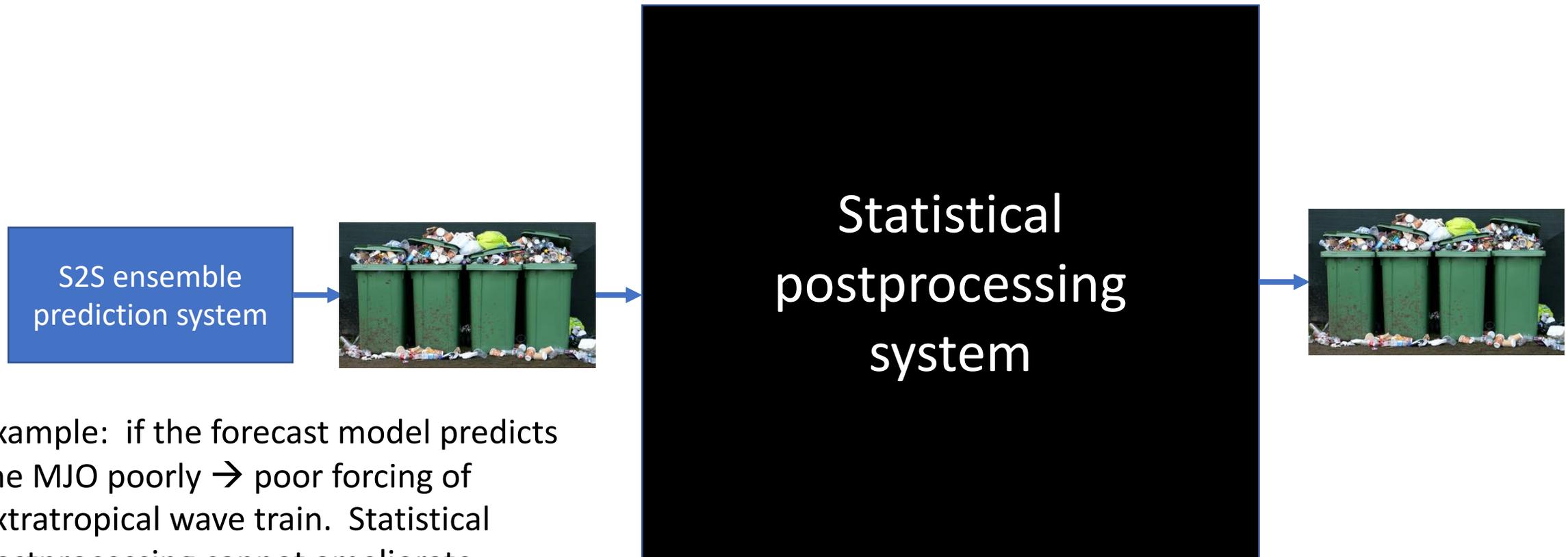
Statistical postprocessing challenges



Process flow for S2S numerical product generation

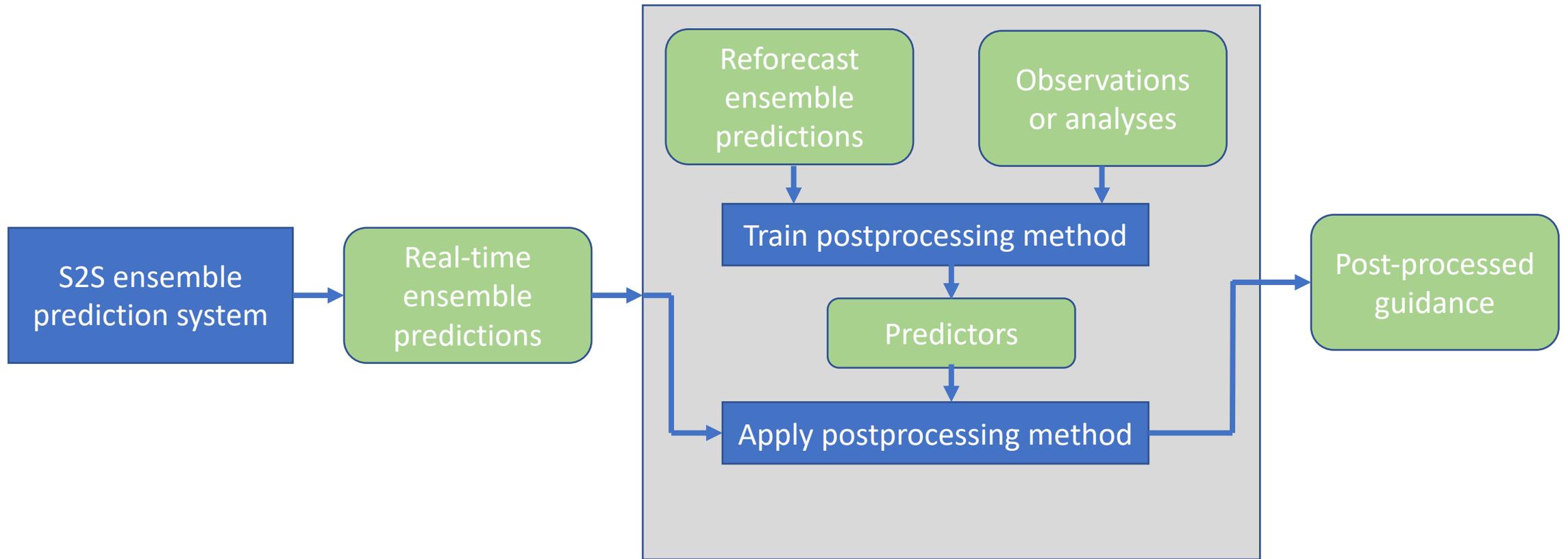


Issues: (1) garbage in, garbage out
(improve the underlying prediction system).

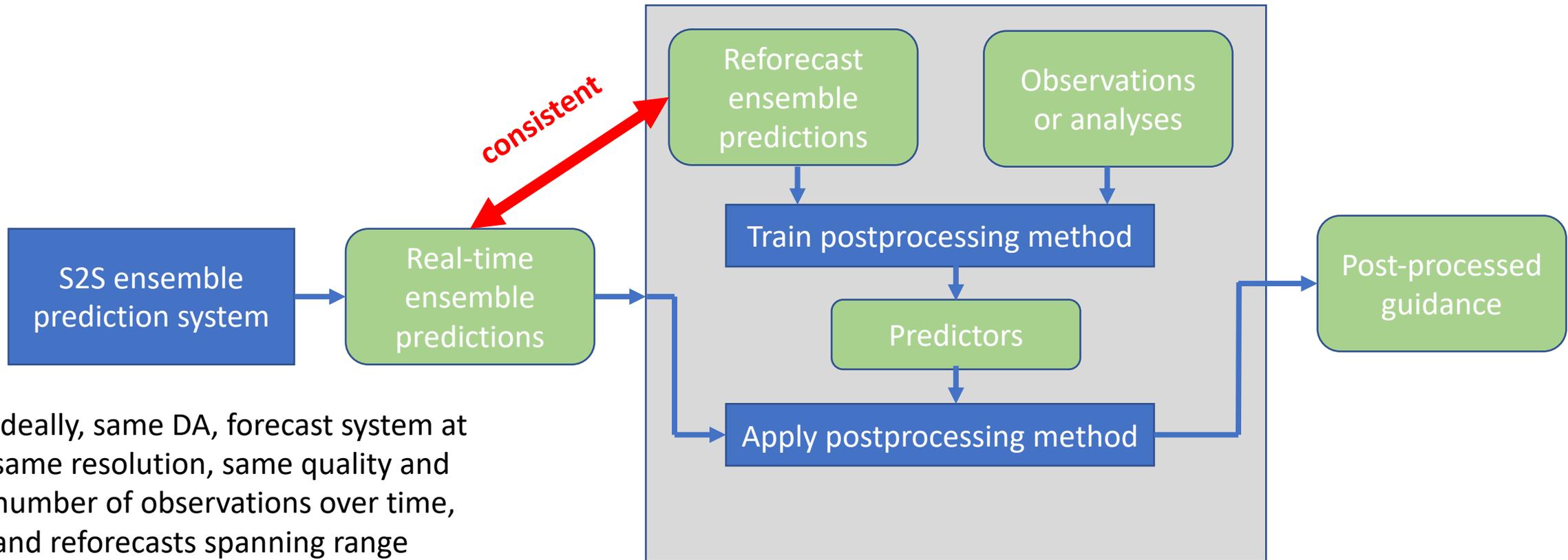


Example: if the forecast model predicts the MJO poorly → poor forcing of extratropical wave train. Statistical postprocessing cannot ameliorate such complex model errors. Must improve forecast system.

Inside the black box.



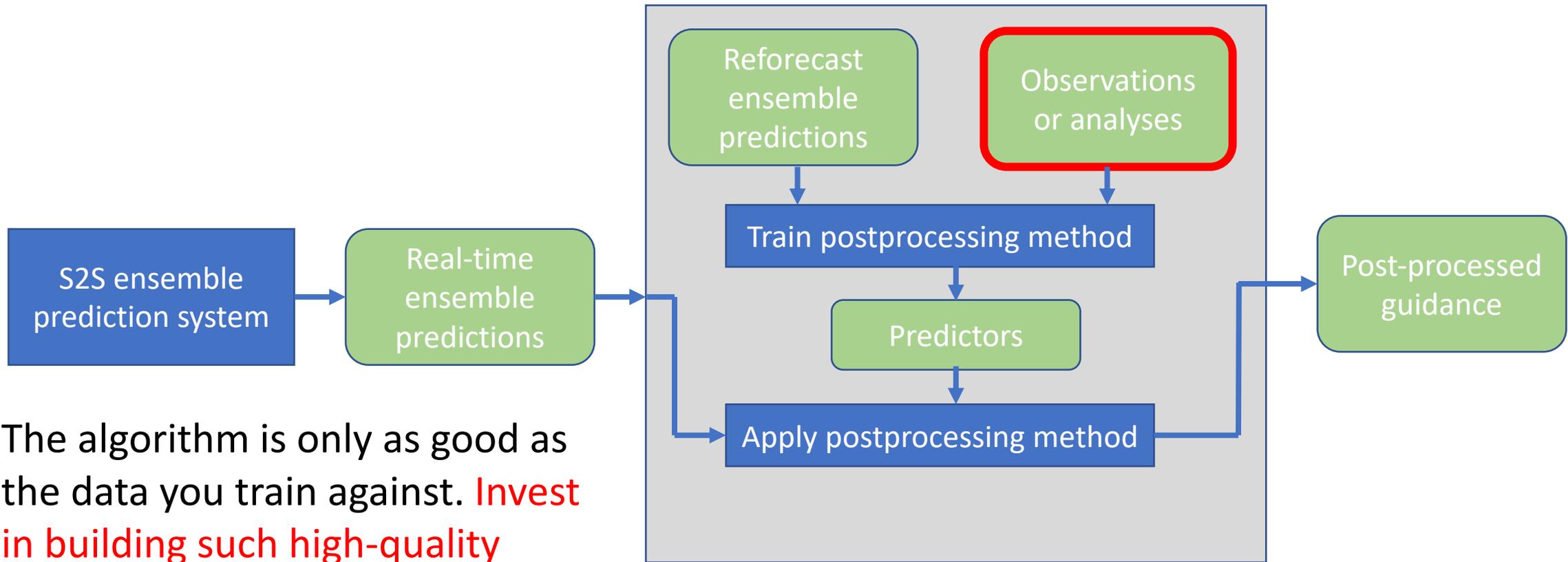
Issues: (2) High-quality ensemble reforecasts with statistical characteristics like real-time ensembles



Ideally, same DA, forecast system at same resolution, same quality and number of observations over time, and reforecasts spanning range of possible weather scenarios.

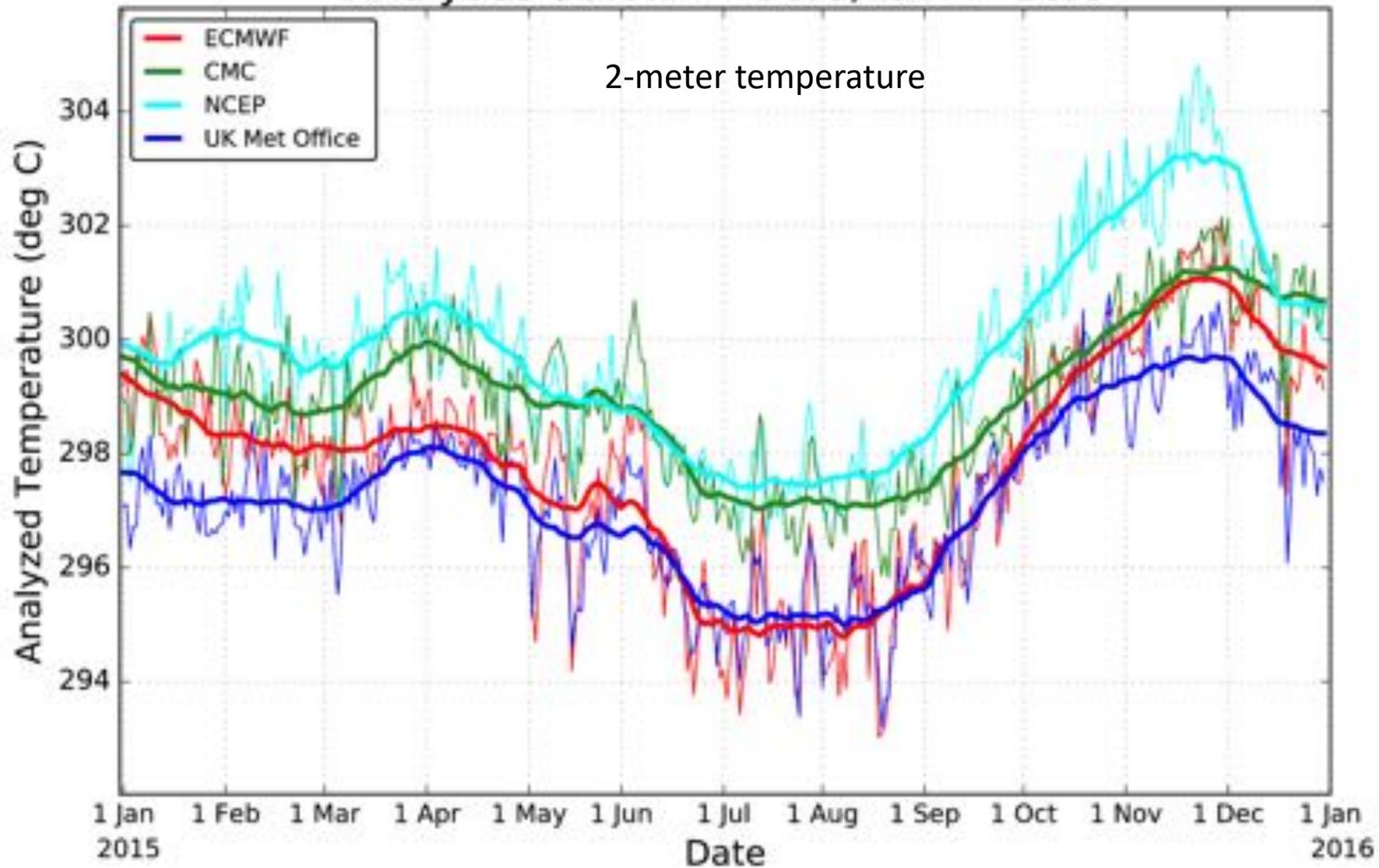
Expensive, will need HPC, data storage planned into procurement.

Issues: (3) Sub-standard analysis data.



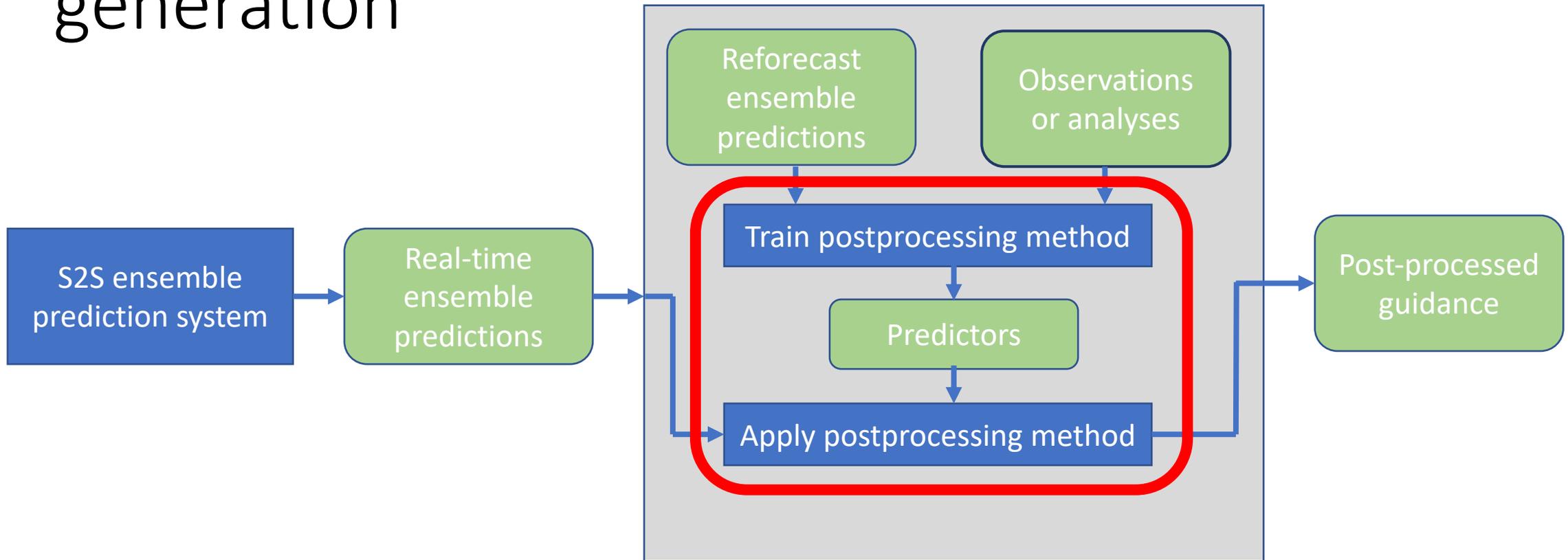
The algorithm is only as good as the data you train against. **Invest in building such high-quality retrospective analysis data sets.**

Analyses at lon = -60.0, lat = -10.0



In data sparse region of the Amazon Basin. Heavy lines with +/- 15 day smooth.

Process flow for S2S numerical product generation



There is no one postprocessing method that will work the best across all applications (temperature, precipitation, drought, fire weather, severe weather, hurricane track).

For some variables (e.g., precipitation) there are dozens of proposed methods. Which is best?

A first step would be to **develop a community postprocessing infrastructure**, use it to compare methods.

A community modular software and data library



Recommendations on building a community system in supplementary slides.

It's hard to determine whether someone has made an improvement when everyone tests with their own data set, or codes their own version of post-processing methods & verification methods.

Building and supporting a reference library would help our field immensely.

Conclusions and recommendations

- Provide resources for statistical postprocessing technique development and inter-comparison, since it is an essential component in the production of S2S forecasts.
- Resource the regular production needed data sets, with some remaining challenges.
 - HPC sized to allow this.
 - Regular production of reanalysis/reforecast data, not one-offs.
 - Improved or new analysis data needed for training.
- Resource the development of a community infrastructure for postprocessing, a la JEDI for data assimilation.

Suggested reading

- Hamill, T. M., 2017: [Practical Aspects of Statistical Postprocessing](#). Chapter 7 in the upcoming book *Statistical Postprocessing of Ensemble Forecasts* (Elsevier Press).
- Recommendations from 2016 postprocessing workshop ([here](#)).

Supplementary slides

Challenge	Potential workaround
<p>Real time forecast and reforecast should have same error characteristics (→ same high-resolution, same coupled, same DA methodology).</p>	<p>(1) Reanalysis for reforecast initialization at somewhat reduced resolution acceptable for S2S, with loss of memory of atmospheric initial condition?</p> <p>(2) Reanalyses may not be necessary with every model change; “replay” the observation increments to the updated prediction system’s control forecast.</p>
<p>Past research suggests reforecasts should span 20-30 years.</p>	<p>For many S2S applications, 1-2 x/week reforecasts enough, lowering computational expense.</p>
<p>Affording the same ensemble size in the reforecast</p>	<p>Smaller ensembles in reforecast may be acceptable compromise for training statistical post-processing algorithms.</p>