

4D: Overview of current work

Bay Oxygen Research Group

July 1, 2026

Rebecca Murphy (UMCES/CBP) for development team:

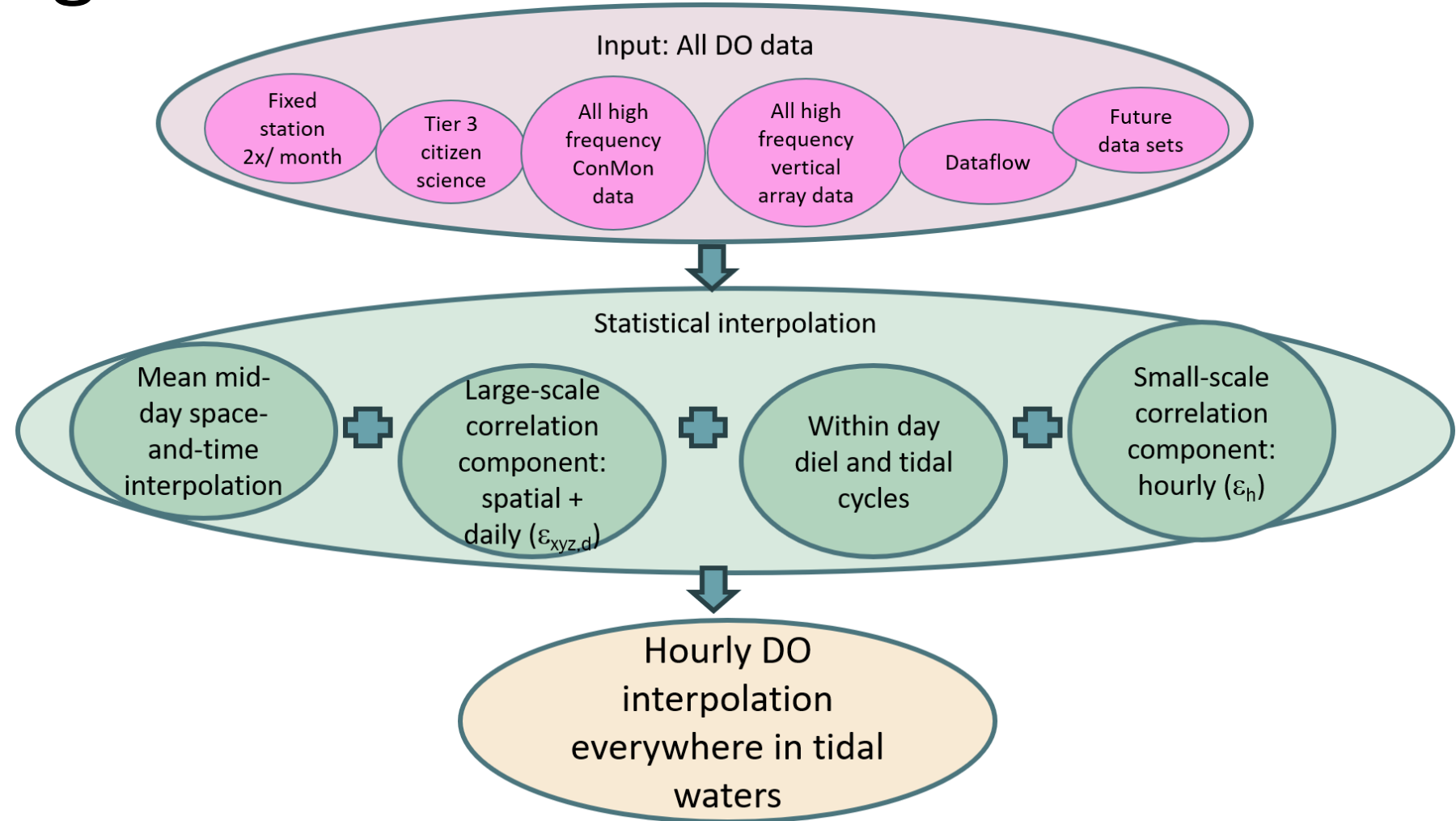
Jon Harcum (Tetra Tech), Elgin Perry (statistics consultant), Breck Sullivan (USGS), Peter Tango (USGS)

Outline

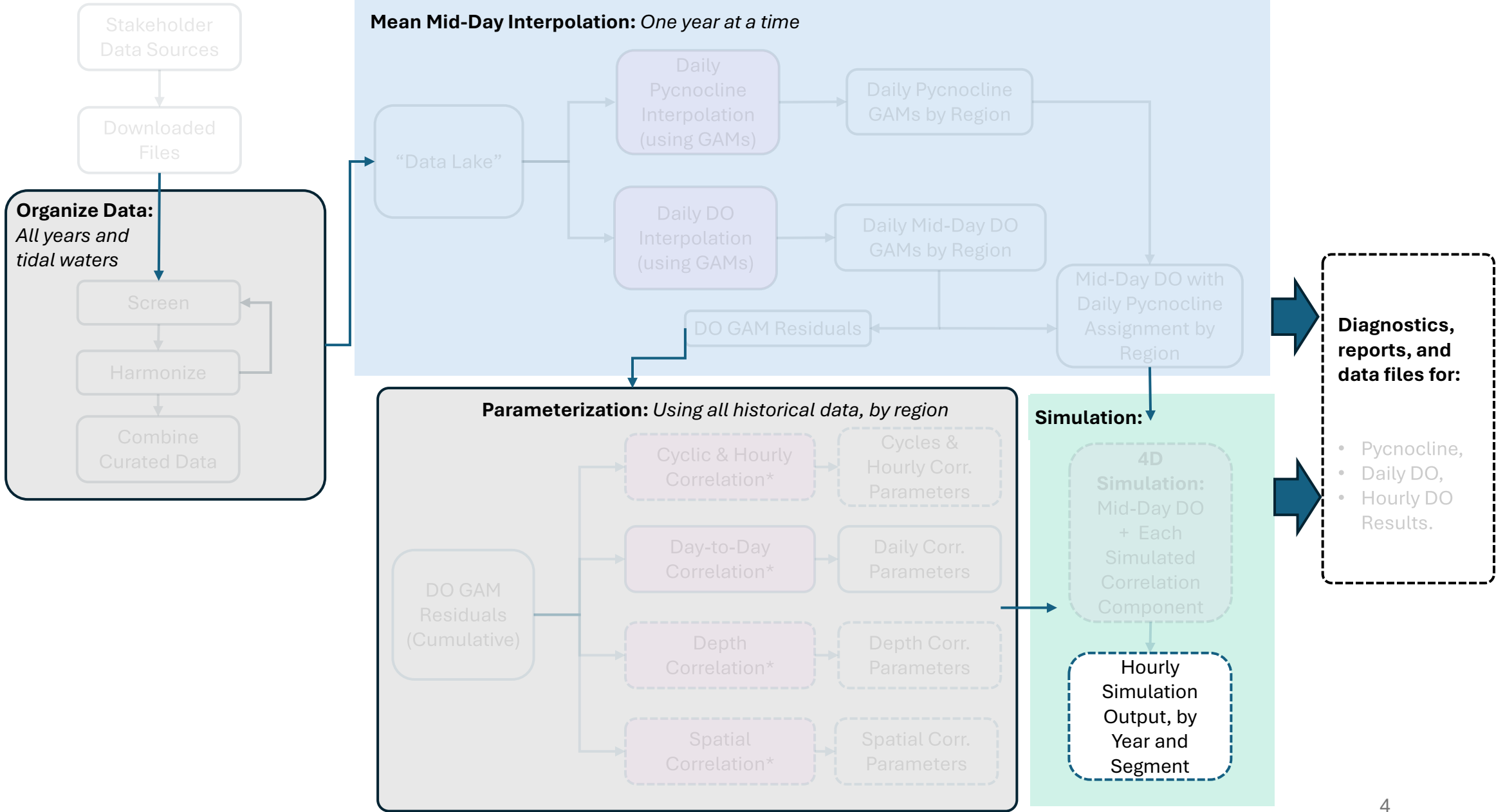
- New workflow diagram of the 4D tool:
 - Grew from diagram of the code.
- Update on recent work.
 - Data compilation,
 - Residual database,
 - Parameterization, and
 - Simulation.
- Jon: Zoom-in on details for one correlation parametrization:
 - Day-to-day correlation.

Previous diagram

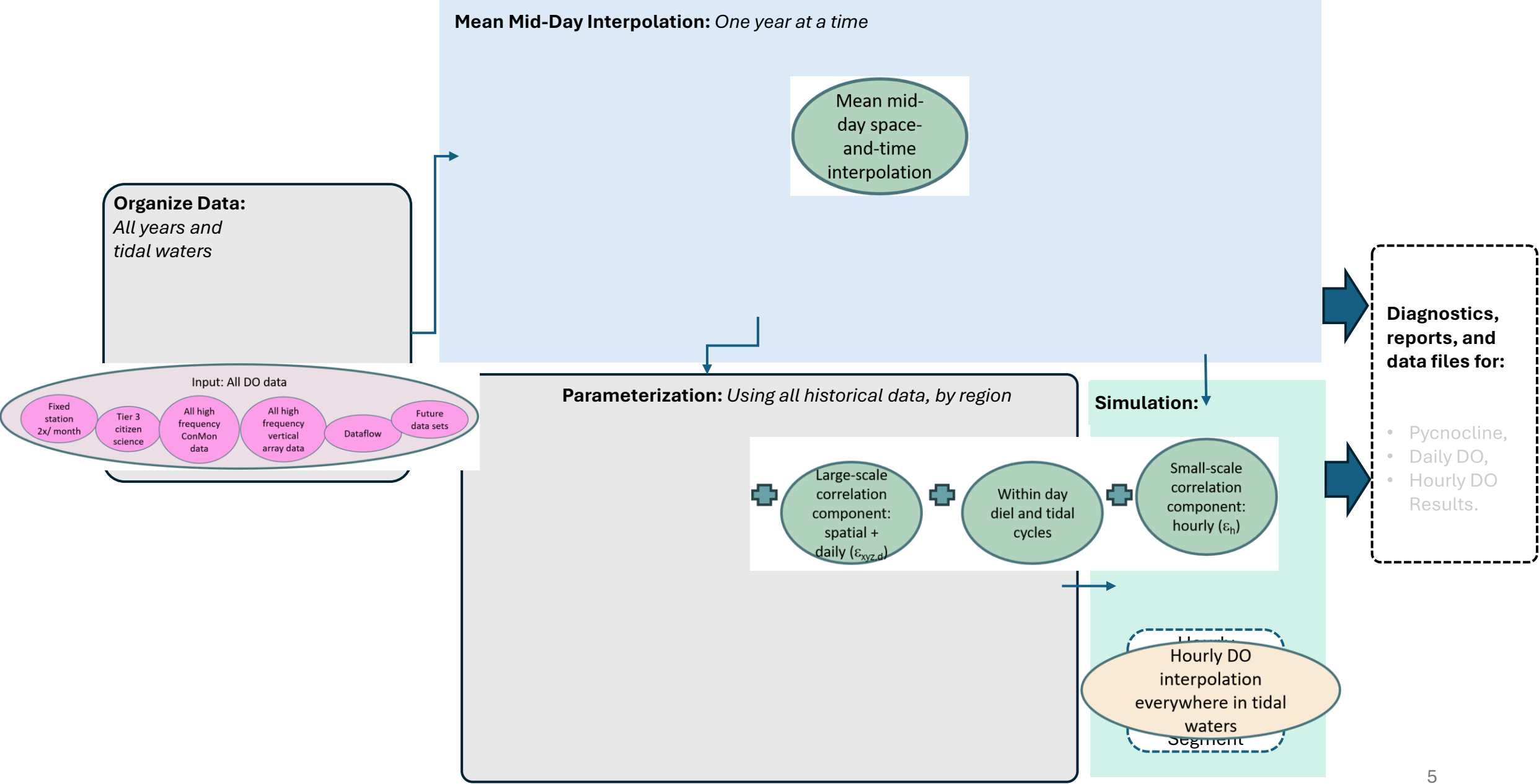
- This one you've seen before was fairly conceptual.
- The new diagram follows the workflow with a bit more detail.
- We'll try to connect them.



4-D Interpolator Workflow

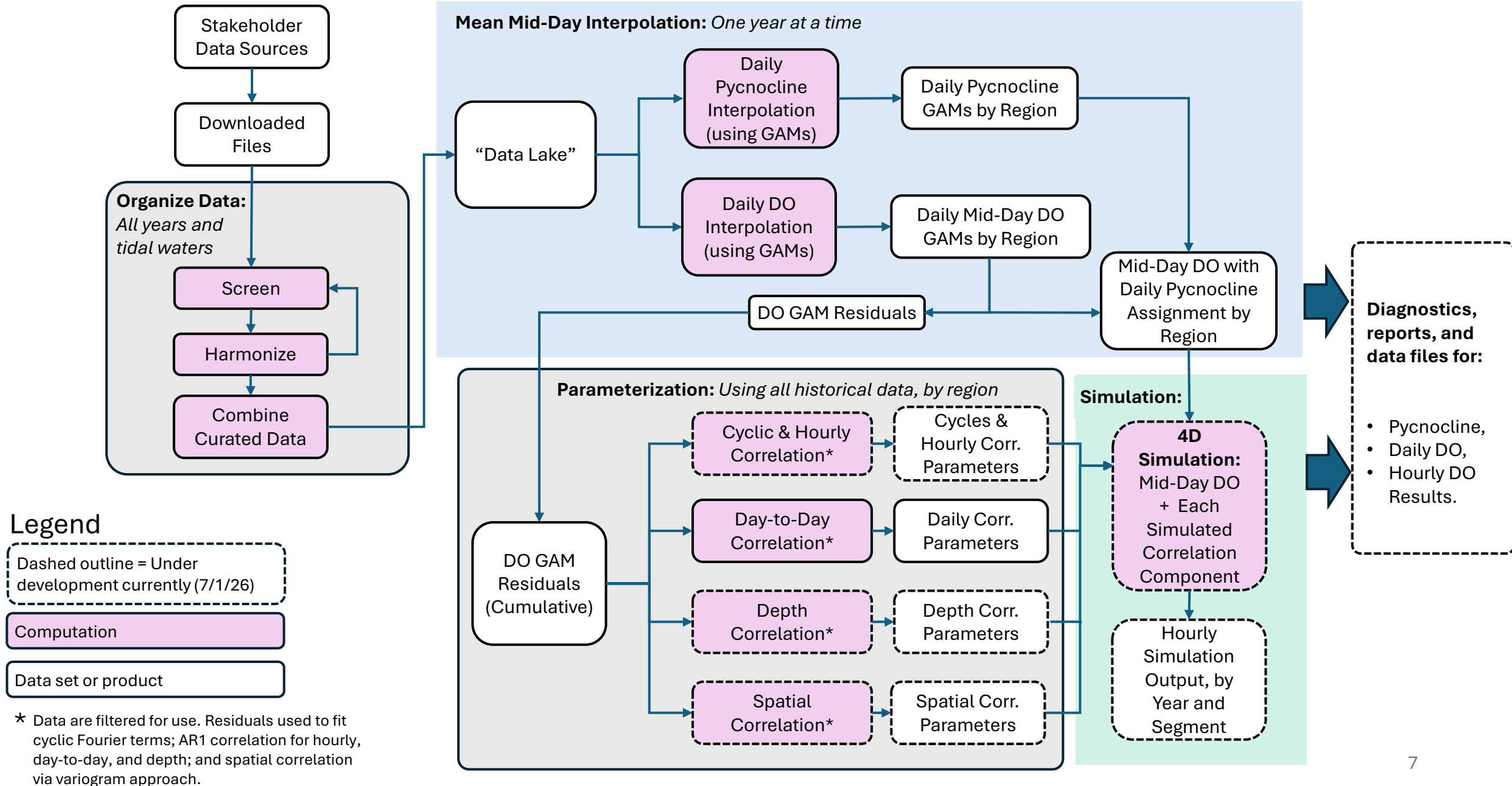


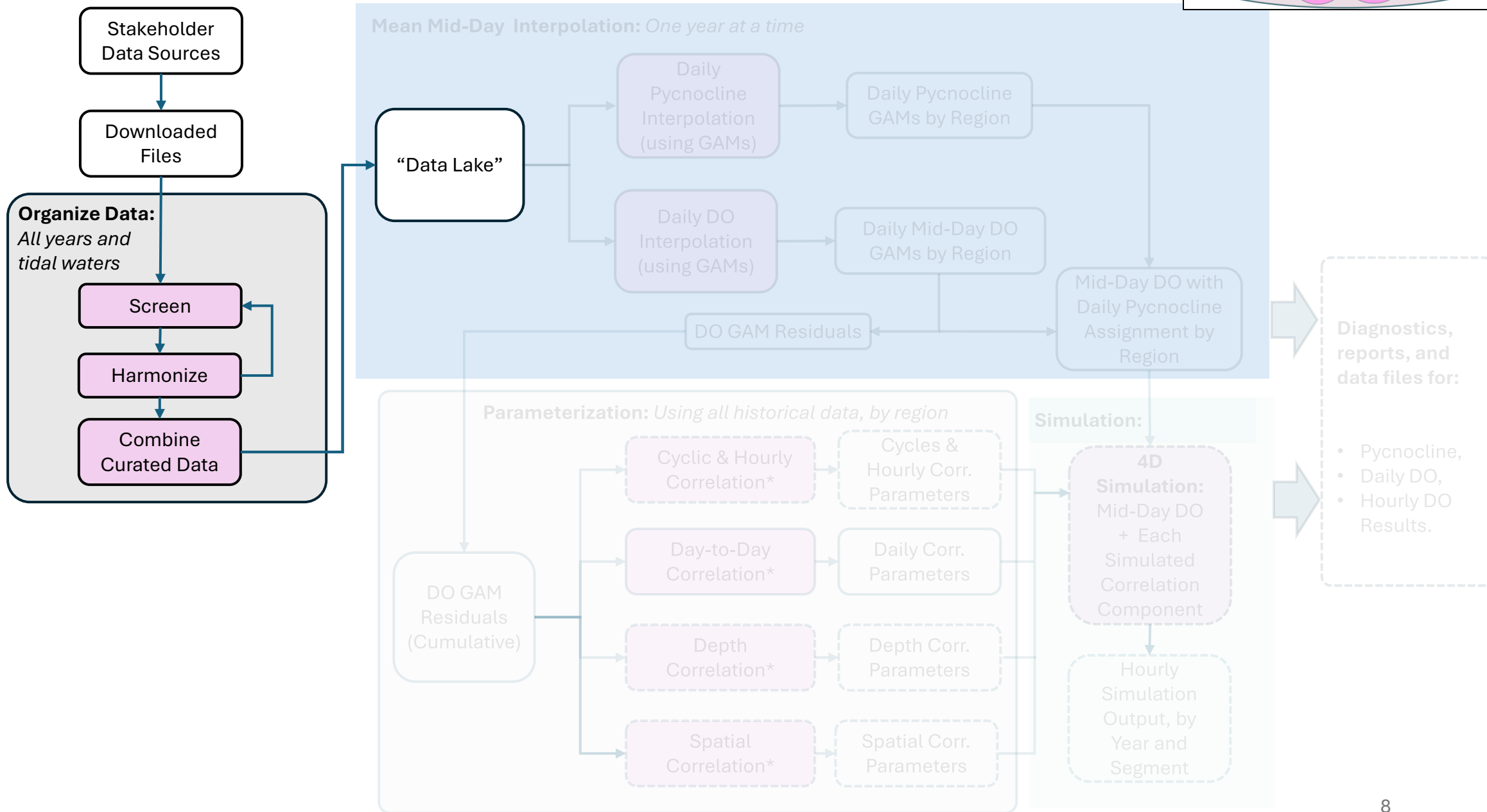
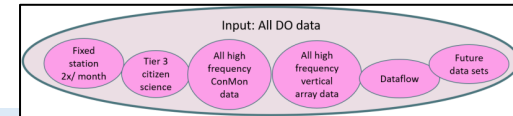
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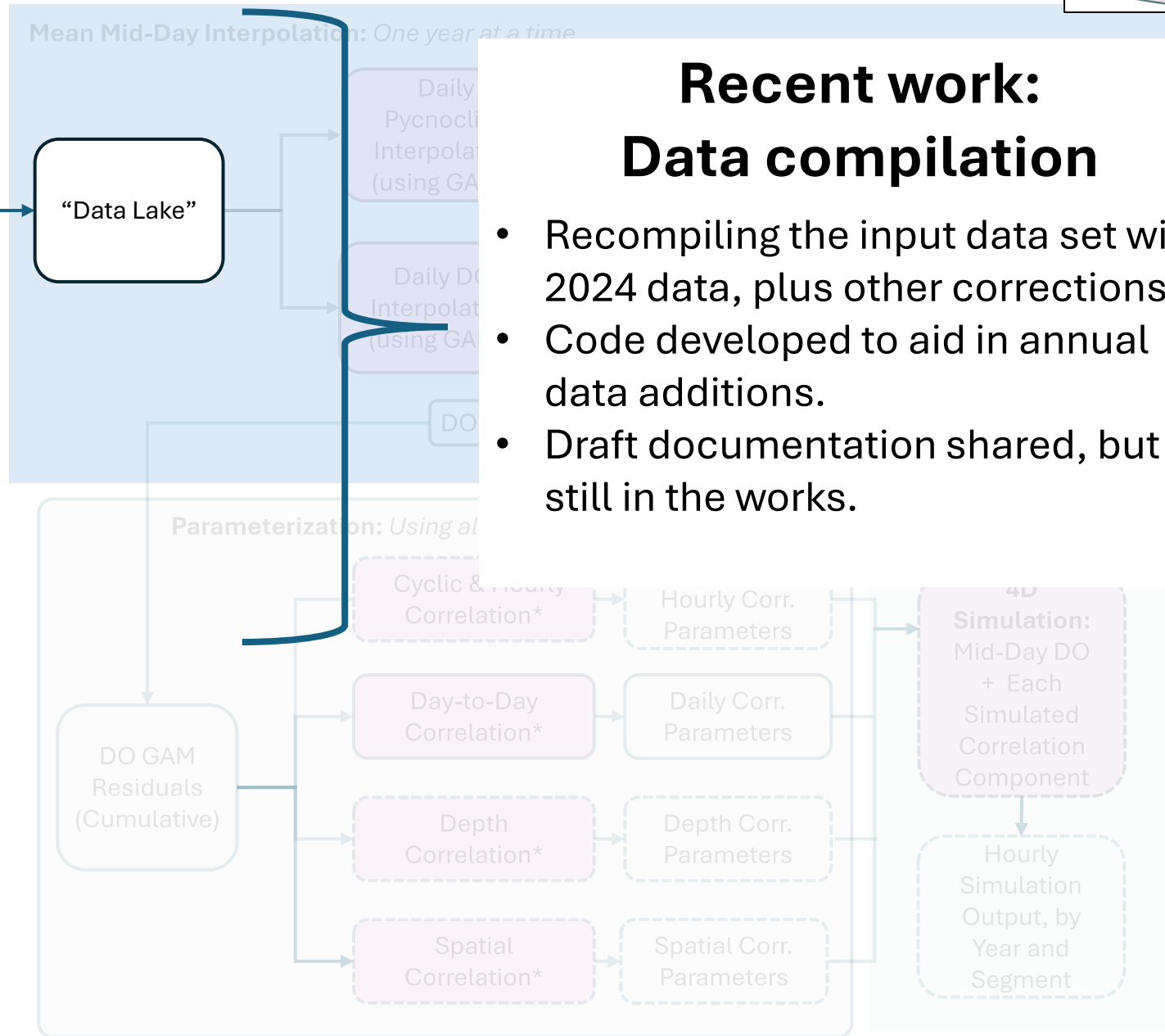
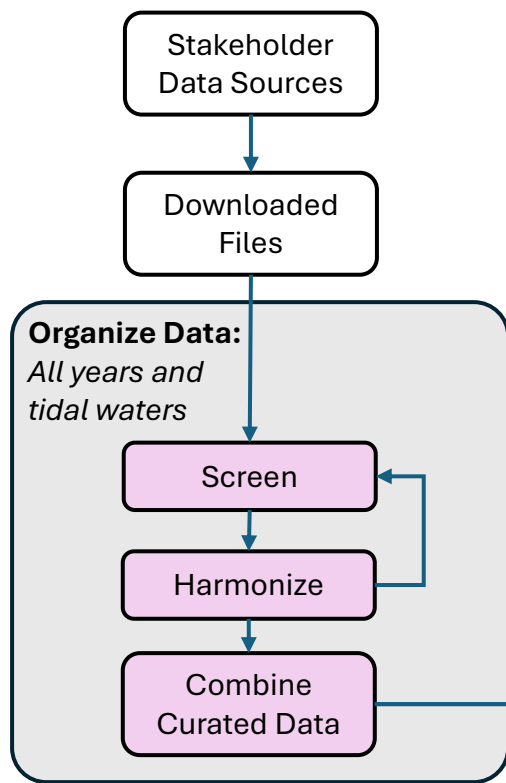
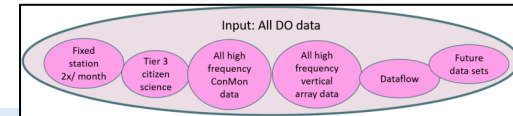


With a few more details on the workflow →

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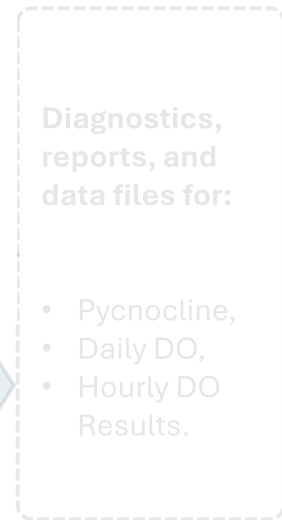


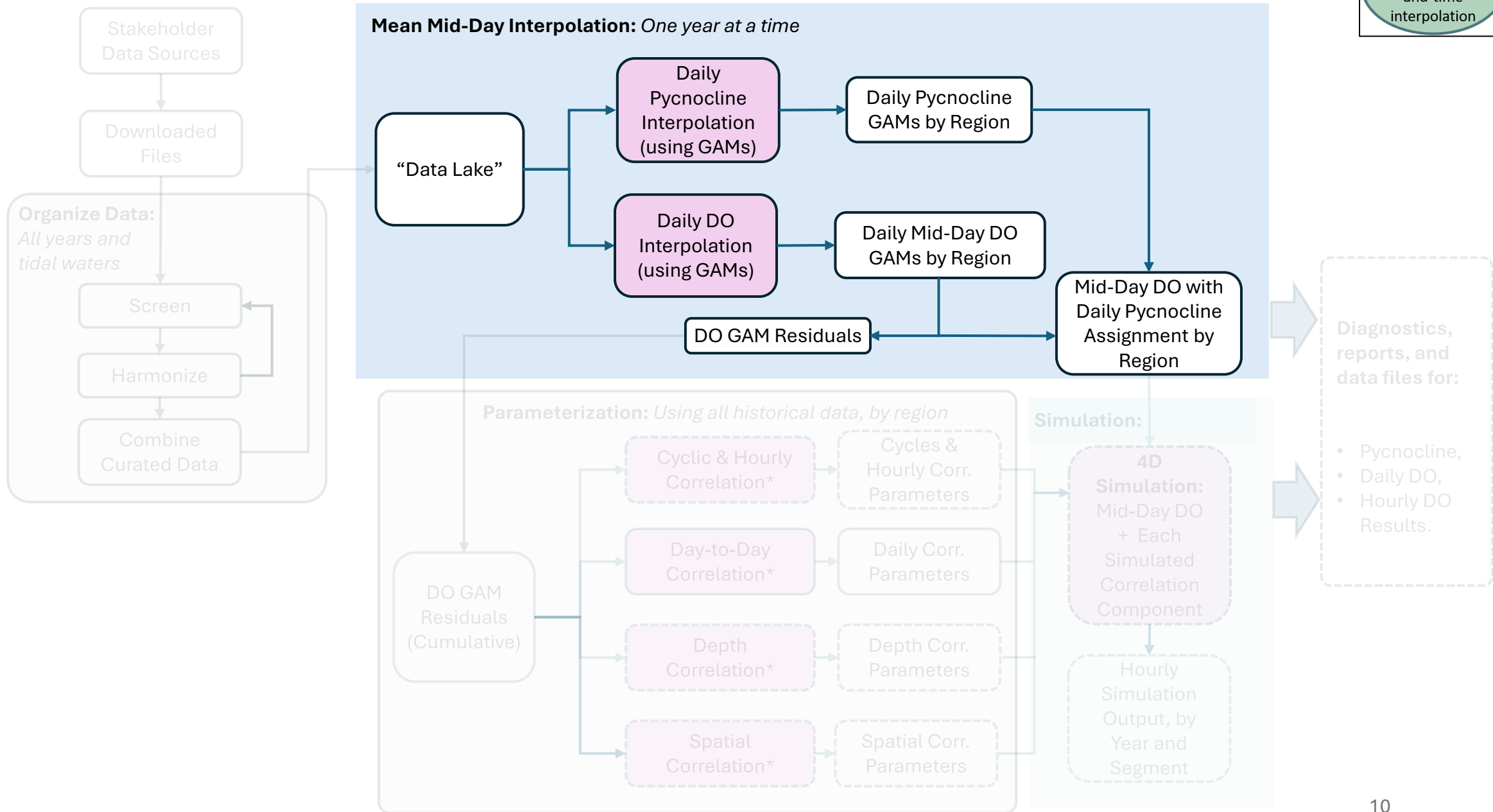




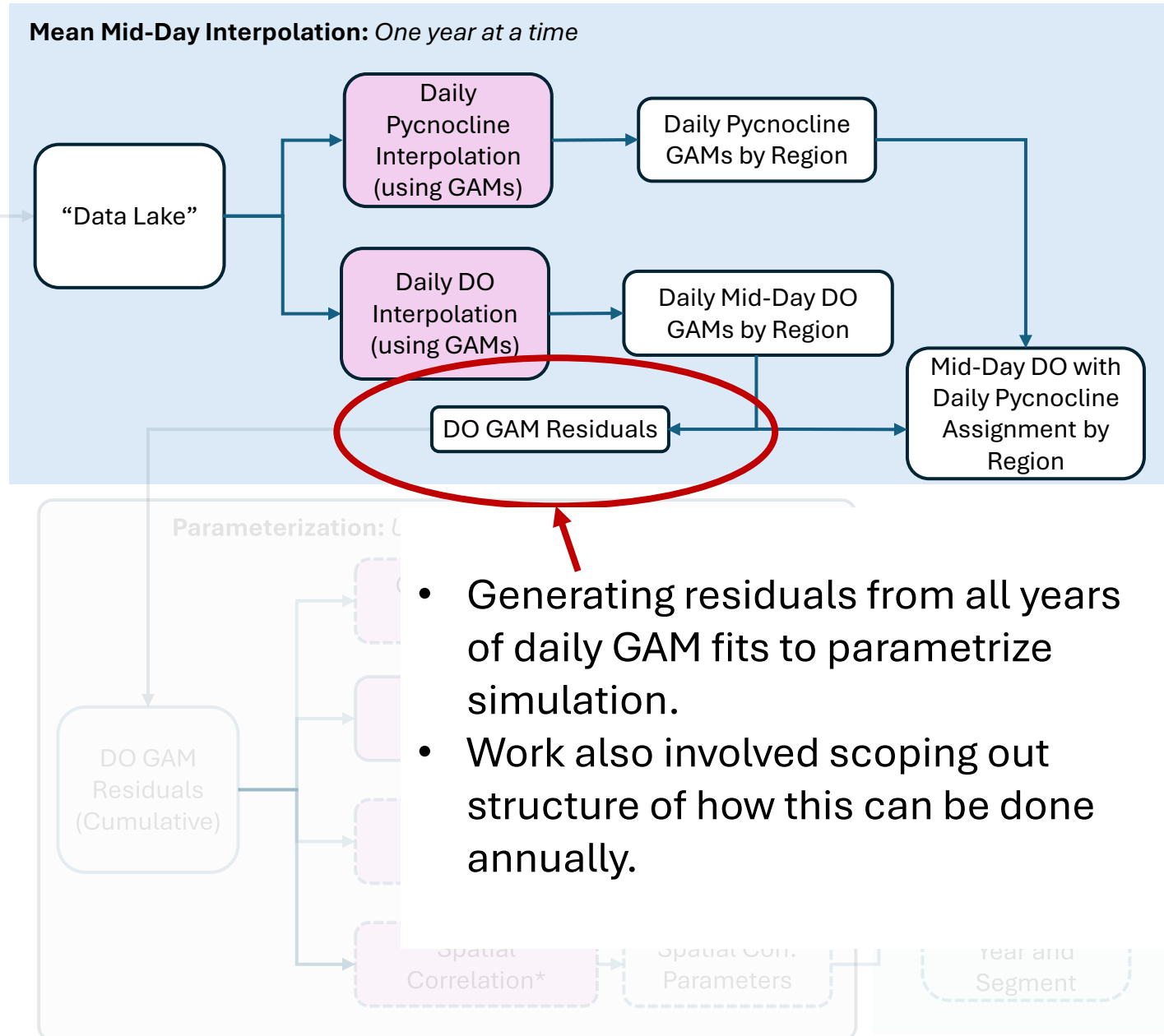
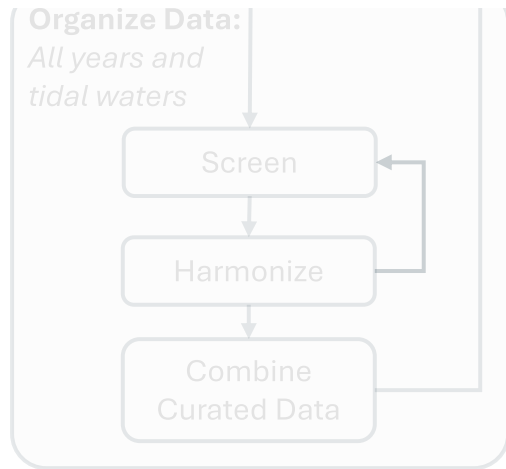
Recent work: Data compilation

- Recompiling the input data set with 2024 data, plus other corrections.
- Code developed to aid in annual data additions.
- Draft documentation shared, but still in the works.





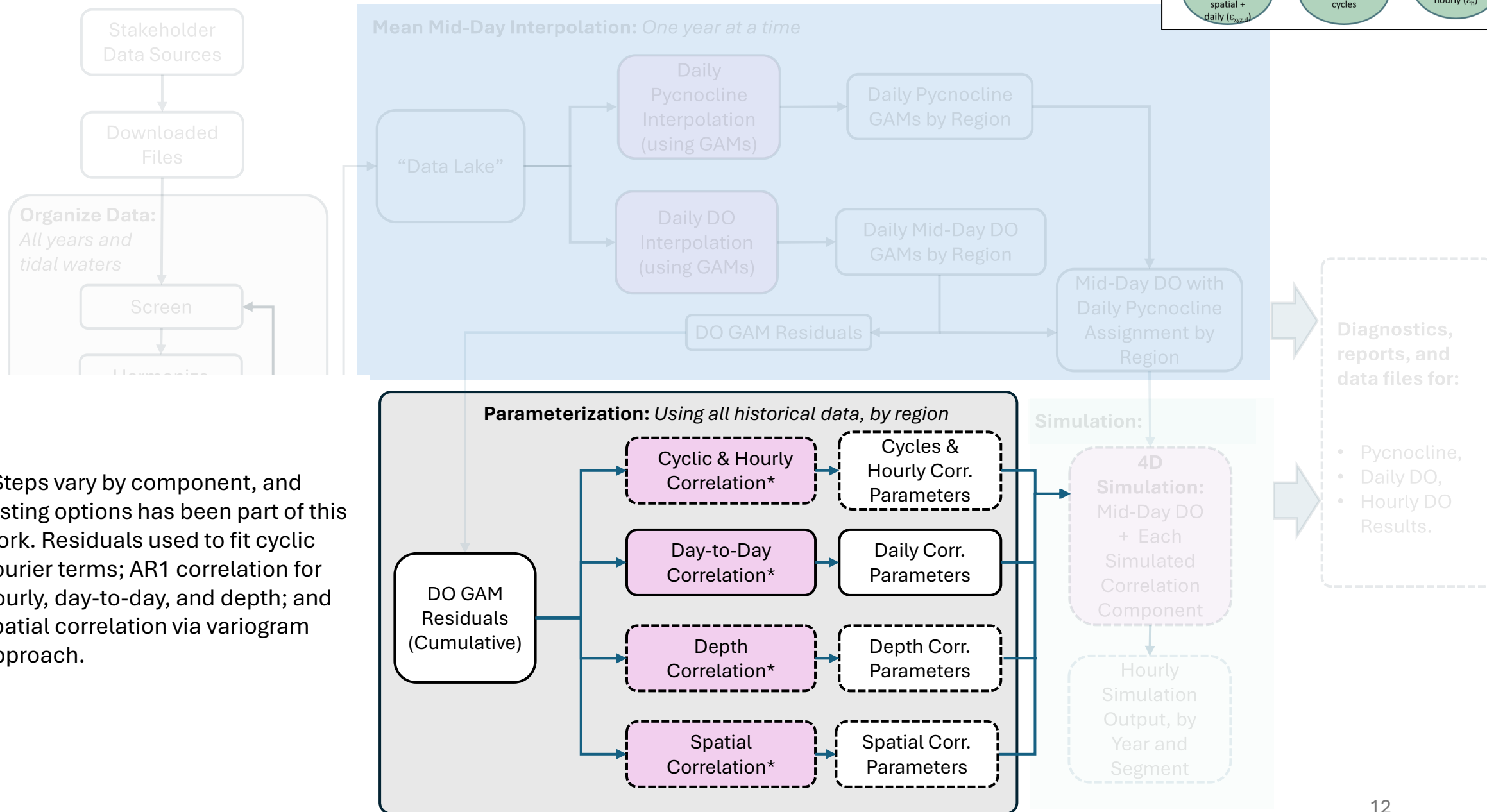
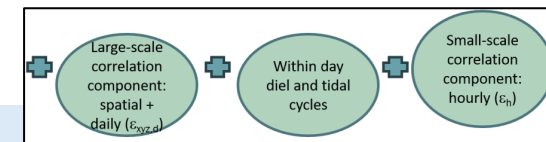
Recent work: Residual database and workflow



Mean mid-day space-and-time interpolation

Diagnostics, reports, and data files for:

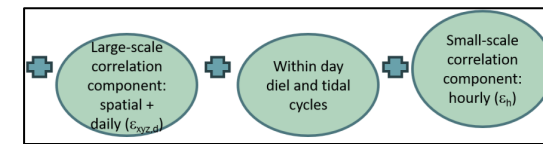
- Pycnocline,
- Daily DO,
- Hourly DO Results.



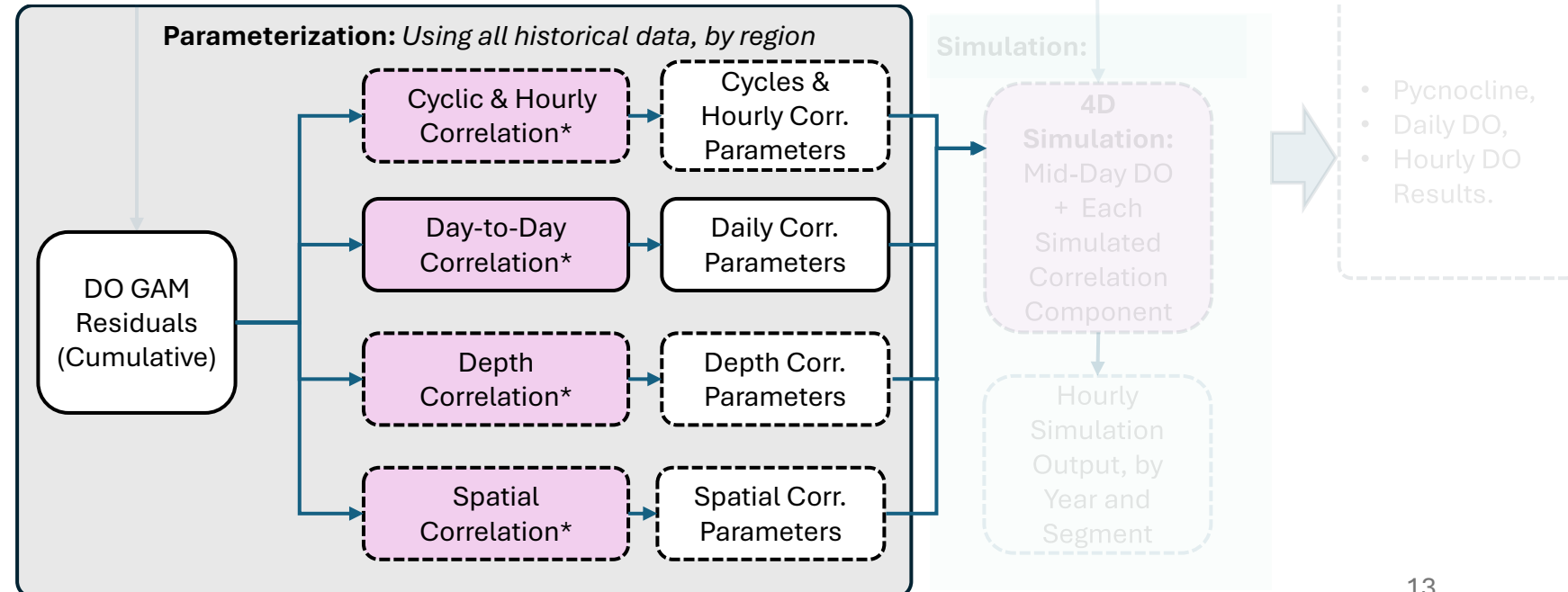
*Steps vary by component, and testing options has been part of this work. Residuals used to fit cyclic Fourier terms; AR1 correlation for hourly, day-to-day, and depth; and spatial correlation via variogram approach.

Ongoing work: Parameterization

- Compute parameters from all residuals;*
- Find appropriate explanatory variables (e.g., day of year, depth) and GAM structure;
- Fit selected GAM for each region (seg_interp_reg);
- Take the median of the GAM estimates to generate 1 representative parameter value for each segment, for each of the necessary parameters.
- Set up this workflow so parameters can be updated with new data.

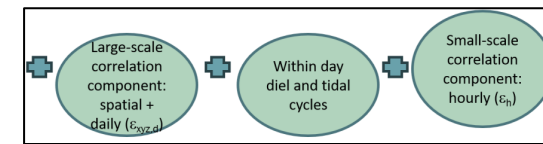


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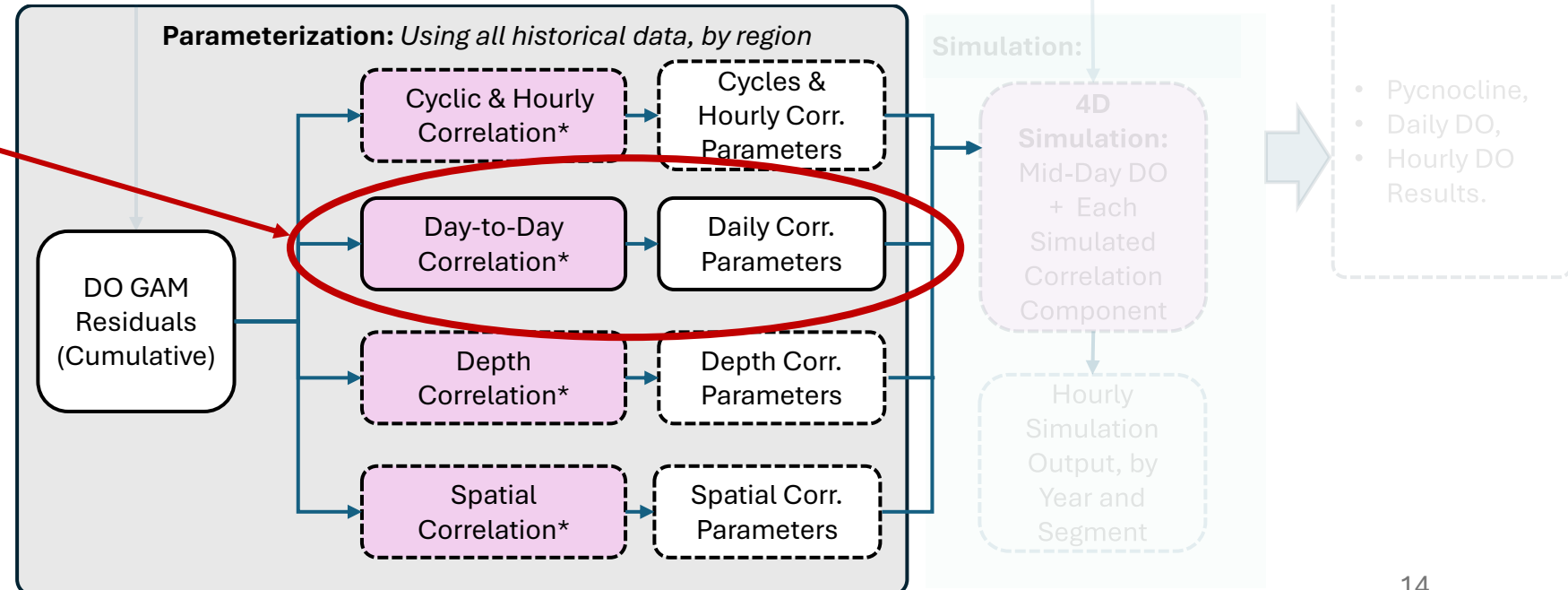


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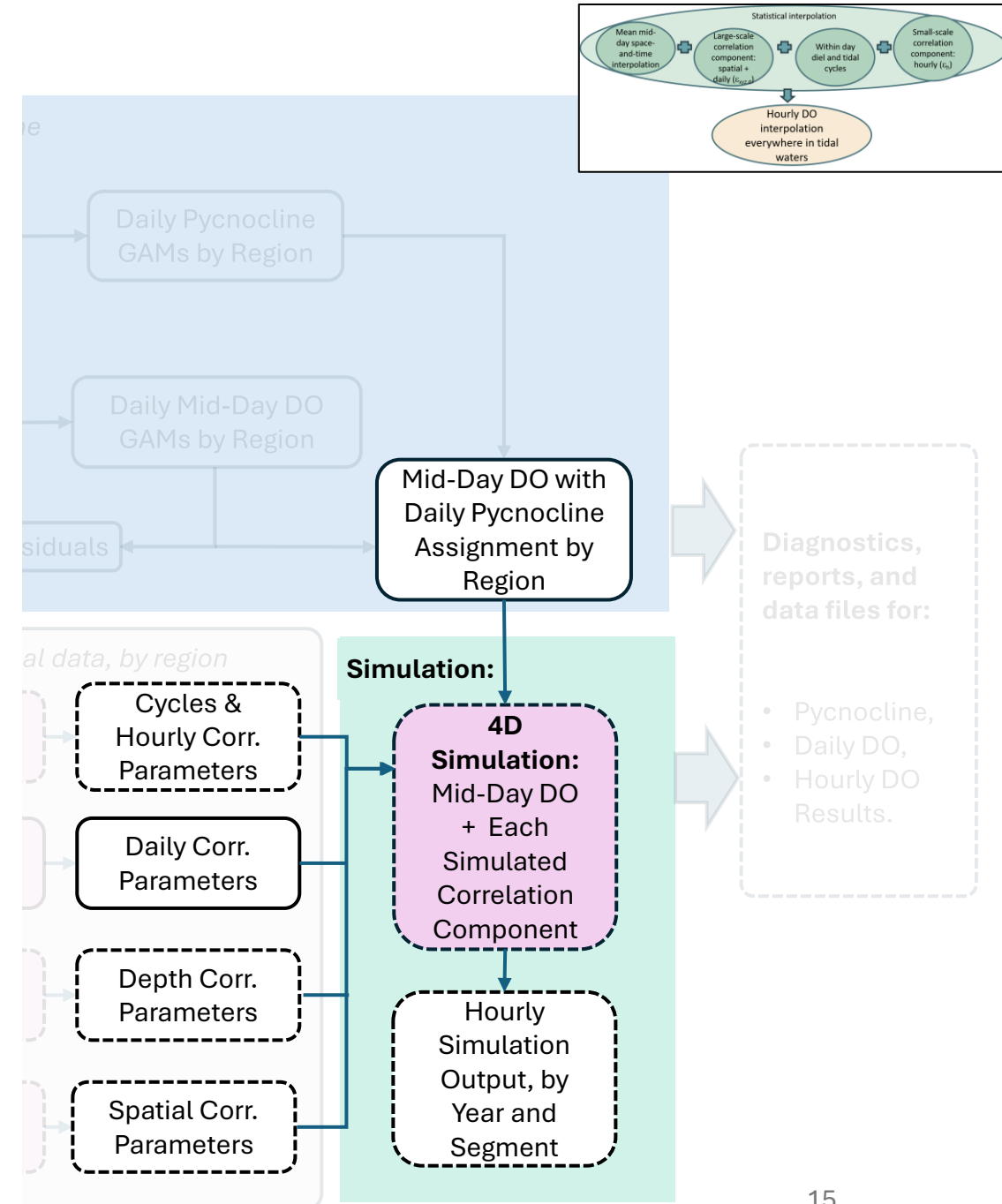


In the next presentation today, Jon will zoom in on details of setting day-to-day correlation parameters.



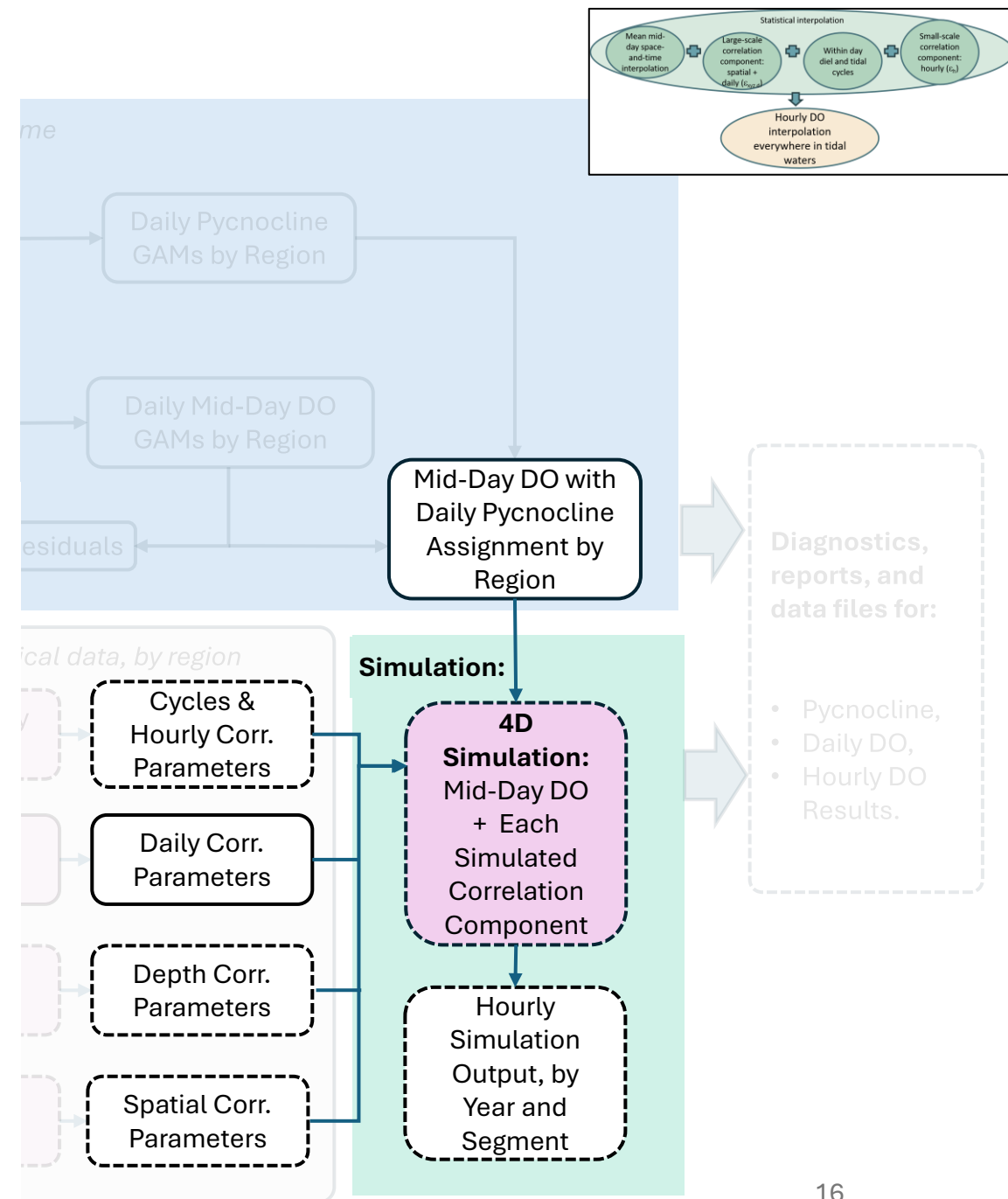
Simulations: a few notes

- After computing each simulation parameter, they are used to simulate correlated errors in space and time.
- From there, Hourly DO is obtained by summing:
 - Mid-day DO + daily cycle + spatial and temporal variability.
 - Because the parameters estimate the variability around a mean, we will get the most accurate picture of DO if we generate multiple simulations which will increase confidence when evaluating criteria.

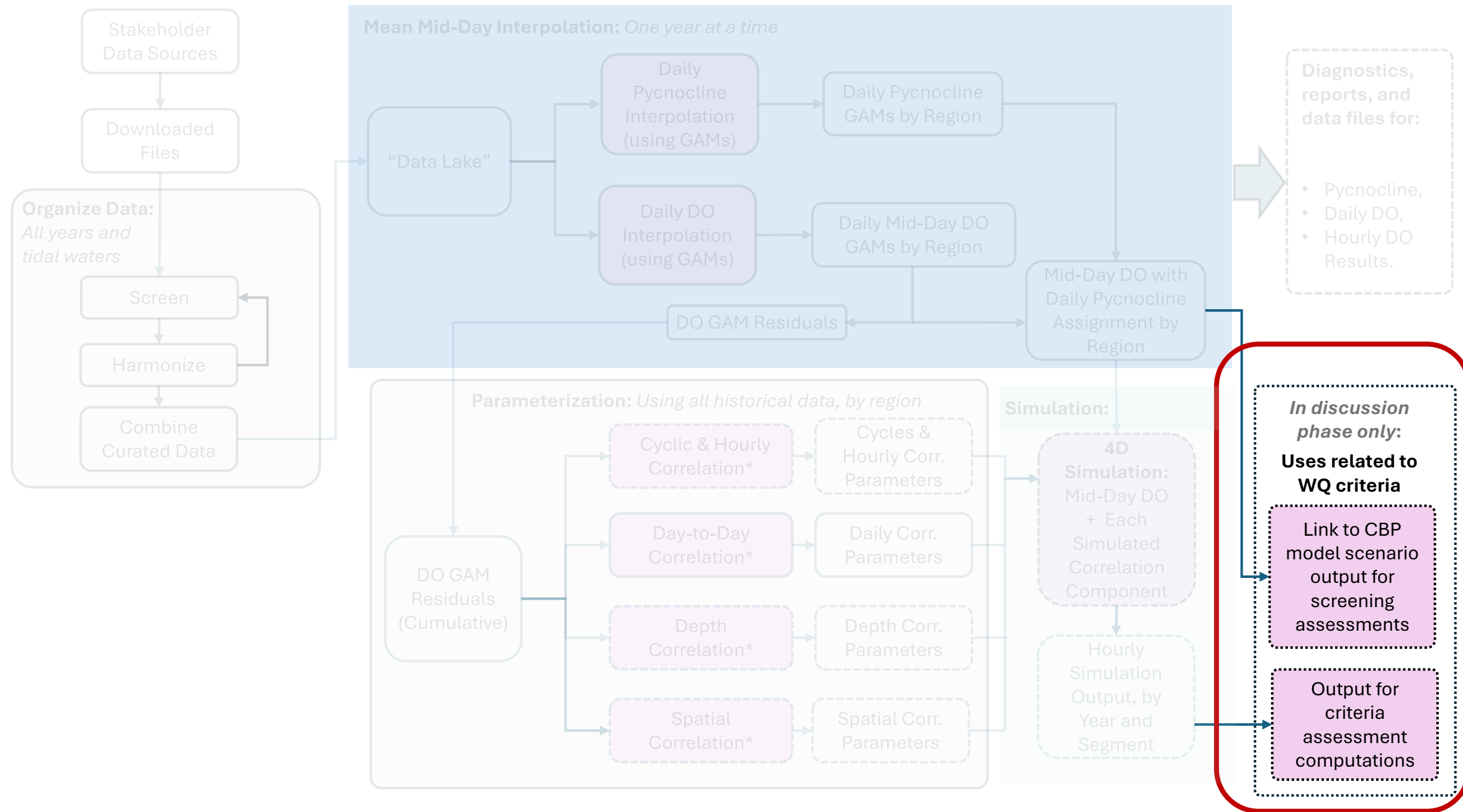


Ongoing work: Simulation testing

- Coding parameter structure so it can be annually updated,
- Testing optimal number of simulations,
- Comparing to data, testing for problems, and
- Developing diagnostics.



Future work: *Potential pathway for use in scenarios and assessments*



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