

Simple Model of STAs (SMSTA)

Purpose: A simple method to mix daily inflows of water volumes and sulfate masses from all source waters flowing into an STA, and estimate the subsequent daily outflow sulfate concentrations. Developed specifically in support of the CERP ASR project, to evaluate among-Alternative, relative differences in downstream Everglades sulfate fate and transport. In this ASR project, the only relevant difference among Project Alternatives are Lake O sulfate concentrations, which may be propagated downstream to STAs and the Everglades.

Methods:

- Data- Inflow water volumes and their sources (EAA, reservoir/FEB, or Lake O) are from daily flow output of the SFWMM.
- Data- EAA source: Sulfate concentrations for all EAA sub-basin sources are fixed in time and space (i.e., a single EAA sulfate concentration for inflows to STAs).
- Data- Lake O source: Sulfate concentrations for Lake O sources are from either modeled or observed daily concentration data; current SMSTA application uses either daily output concentrations from the Lake Okeechobee Environmental Model (LOEM), or daily observed concentrations.
- Data- Reservoir source: a running 30-day bin of known (SFWMM) flows (Lake O or EAA sources) into a reservoir is used to calculate the running 30-day mixing ratio of EAA:Total reservoir inflow sources. This daily reservoir inflow mixing ratio is used to partition the source of daily water volume outflows from the reservoir to the STA, then applying the EAA and Lake O sulfate concentrations (see above) to calculate STA inflow loads from the reservoir (see Calculations below).
- Calculations: 1) Sulfate inflow mass: for each daily time step, the total mass of sulfate inflowing from all EAA, Lake O, and (mixed) reservoir sources are calculated (from known volumes and concentrations).
- Calculations: 2) Sulfate inflow concentration: for each daily time step, the inflow sulfate concentration is calculated (from known total mass and total water volume).
- Calculations: 3) Sulfate outflow concentration: for each daily time step, the outflow sulfate concentration is calculated, applying the long-term sulfate removal efficiency ratio for each STA.

Assumptions:

- Daily water flows output from SFWMM provide useful flow distribution estimates, relative among scenarios/alternatives.
- Daily Lake O sulfate concentrations from LOEM provide useful lake-wide sulfate concentration estimates, relative among scenarios/alternatives.
- Long-term mean sulfate concentration for the entire EAA provides a consistent basis for evaluating downstream effects of sulfate changes in Lake O, relative among scenarios/alternatives.
- Sulfate removal efficiencies for each STA are fixed in time, and independent of STA water depths or residence times.
- STAs and reservoirs are completely mixed.

Applications:

- **Make multi-decadal, relative comparisons of sulfate concentrations in the Everglades** among ASR Project Alternatives, for which the only among-Alternative differences (relevant to this evaluation) are in daily Lake O sulfate concentrations that may be the source for inflows to the STAs and Everglades.
- **Plans are being made to explicitly include STAs and FEBs as part of the active ELM domain**, thus considering the evolution of STA soils and vegetation, and concomitant phosphorus and sulfate removal dynamics.