From: Koch et al., 2007
Conceptual model for seagrass die-off in Florida Bay: Links to biogeochemical processes

**Plant**
- High Nutrients (P)
- GOM Influence
- High Plant Biomass – July/August
  - High Plant Productivity Rates
  - High Plant Respiratory O₂ Demand
- Hypersalinity/High Temperatures – July/August
  - Accelerate Plant Respiratory O₂ Demand
- Shorter Day Length – September/October
  - Lower Temperatures
    - Shift in P:R ratios
    - Increase epiphyte load
- Shoot Density Decline
  - Release >DOC

**Sediment**
- High Decomposition Rates >DOC
  - High sediment O₂ demand
  - Increase sulfate reduction rate
- Hypersalinity/High Temperature
  - Accelerate sediment O₂ demand
  - Accelerate sulfate reduction rates
- September Peak – Hurricane – freshwater lens
  - Reduced hydrological mixing
  - Reduced O₂ lower water column
  - Sulfide oxidation consumes O₂
- Accelerate sulfate reduction rates
  - Reduced O₂ rhizosphere

**Nighttime Water Column/Plant Hypoxia**
- Seagrass Asphyxiation “Die-off” Event
Circa 1987
Before Die-off
From: Hall and Durako, 2010

Circa 2008
Circa 2000
Circa 2000
Circa 1995
Circa 1995
Circa 1997
Circa 1997
Circa 1990
Circa 1990
Circa 1988
Circa 1988
Circa 1987
Circa 1987

Johnson Key Basin

Thalassia
Halodule
Syringodium
Modeling

Scientific Knowledge Gained
South Florida Water Management Model (SFWMM)

- Restudy – version 3.5
- Version 7.0 release pending
  - 41 year simulation (1965-2005)
- Many improvement in version 5.5
  - Operational improvements
    - Model operation
    - Structures, gages, and canals
  - Changes/improvements
    - Topography
    - Inflow
    - Water supply
    - Basin demands
    - Rainfall and evapotranspiration
    - Land use
- Regional Changes
  - Lake Okeechobee
  - Everglades Agricultural Area
  - Water Conservation Areas
  - Lower East Coast
  - Tamiami Trail south through Everglades National Park
Natural System Model (NSM)

- Uses algorithms from the SFWMM
- NSM version 4.5 used in Restudy
- NSM version 4.6.2 – current version
- NSM versions 4.6.2 and Sens4 used in the Interim CERP Update (ICU)
  - Topography and subsidence differences
- Other versions
  - NSM ENP Mod1 – Fennema version
  - NSRSM – Natural System Regional Simulation Model
Discharge Viewing Window

- EPA Inflows (kac-ft)
  - NSM 4.6.2
  - ENP MOD1
  - NSRSM
  - SHG

- Shark Slough (Trans-C, kac-ft)
  - NSM 4.6.2
  - ENP MOD1
  - NSRSM

- Taylor Slough (Trans-D, kac-ft)
  - NSM 4.6.2
  - ENP MOD1
  - NSRSM

Graphs show the discharge flows in different sections.
“Ever Views”
Aligned with Landscape Directionality
General lack of confidence in simulated water levels and flows close to the edge of the SFWMM domain.

Flow and Transport in a Linked Overland/Aquifer Density Dependent System (FTLOADDS) code – connected surface- and ground-water systems with variable-density flow.

FTLOADDS code has been used in several domain applications.
Considerable uncertainty remains in predicted water volumes that pass through the system (+/- 20%)
  - This uncertainty is driven by the inability to effectively estimate evapotranspiration, and uncertainty associated with elevation measurements

Both the general precision of predictions around the periphery of the SFWMM version 5.7 modeling domain, as well as the behavior of the model during both flooding and extreme drought events have been identified as issues in SFWMM peer review documents (Bras et al. 2005)

Current strategy is focused on interfacing SFWMM/RSM with smaller scale ground/surfacewater-estuarine models (like TIME or FTLOADDS based models).
Appropriate use of models

- Bales et al. 2007:
  - “The panel strongly urges careful consideration of the use of model output, and it should not be used to set targets or any other such prescriptions for restoration. Rather, it should be used to help estimate how the hydrology has changed and help design restoration experiments.”
  - “Rather, output from the NSRSM should be used in conjunction with other models, studies and information to suggest how flows across Tamiami Trail or hydrologic patterns in marl marshes might have changed.”
  - “…rather than use the model to predict flows into the upper end of Shark Slough, a prudent next step should be a set of activities that would design an experiment or set up a pilot study on how to get more water into this flow section. (Pg 18 of Bales et al. 2007)”

my.sfwmd.gov/pls/portal/docs/PAGE/PG_GRP_SFWMD_HESM/PORTLET_RSM_PEERREVIEW/TA B2564291/NSRSMFINALV3.PDF