HSPF for Water Balance Inputs to MODFLOW Updates for NFSEG 1.1

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NFSEG

• HSPF
  – Recharge
  – Maximum saturated ET for Evaporation Package
MODFLOW Inputs

- Recharge is the sum of Active Groundwater Inflow (AGWI) and Inactive Groundwater Inflow (IGWI)

\[ \text{Recharge} = \text{AGWI} + \text{IGWI} \]

But...

- PET is input as demand
- Maximum Saturated ET is PET minus all unsaturated ET values

\[ \text{MSATET} = \text{PET} - \text{CEPE} - \text{UZET} - \text{LZET} \]
AGWO
Active GroundWater Outflow

Evaporation

Precipitation

Precipitation Yield, SUPY

Interception Storage (CEPS)

Interception Evaporation, CEPE

Evaporation

Transpiration

Surface Detention Storage (SURS)

Interflow Inflow, IFWI

Infiltration, INFIL

Interflow Storage (IFWS)

Upper Zone Storage (UZS)

Lower Zone Storage (LZS)

Upper Zone ET, UZET

Lower Zone ET, LZET

Active Groundwater ET, AGWET

Baseflow ET, BASET

Vadose Zone

Saturated Zone

Interflow Inflow, IFWI

Infiltration, INFIL

Interflow Storage (IFWS)

Upper Zone Storage (UZS)

Lower Zone Storage (LZS)

Active Groundwater ET, AGWET

Baseflow ET, BASET

Inactive Groundwater Inflow, IGWI

Inactive Groundwater (Does not contribute to baseflow)
Mass Balance

• Mass balance with control volume (dashed blue box)

\[ \text{In} = \text{Out} + (\text{Change in storage}) \]

Take that (Change in storage) = 0

\[ \text{In} = \text{Out} \]

Precipitation - CEPE = SURO + IFWO + LZET + UZET + AGWI + IGWI + SURET
MODFLOW Recharge Equation

Recharge = precipitation - interception\_et - direct\_runoff - unsaturated\_et

where:

interception\_et = CEPE
direct\_runoff = SURO + IFWO
unsaturated\_et = LZET + UZET

Combine

precipitation - CEPE = SURO + IFWO + LZET + UZET + AGWI + IGWI + SURET

precipitation - CEPE - SURO - IFWO - LZET - UZET = AGWI + IGWI + SURET

Recharge = precipitation - CEPE - SURO - IFWO - LZET - UZET

Recharge = AGWI + IGWI + SURET
Surface ET (SURET)

• Zero except for water and wetlands
• For water and wetlands can be close to potential
Springs Plus Diffuse Groundwater Discharge to a Reach (Aggregate Discharge)

• Inactive Groundwater Storage Approach
  – Expanded to include
    o Wakulla Springs
    o St. Marks Rise
    o Wacissa Springs
    o Rainbow Springs
    o Silver Springs
Plan View of Reaches

Calibration-1

Calibration-4

Cross-sectional View of Sub-Watersheds

Closed Basin

AGWS-C

AGWS-1

AGWS-2

AGWS-3

AGWS-4

Watershed A

Watershed B

Sink

IGWI-C

IGWI-1

IGWI-2

IGWI-3

IGWI-4

IGWS
2010 Potentiometric Surface and Springsheds
Contributing Springsheds and Surface Subwatersheds

Georgia
Florida

Gulf of Mexico
St. Marks Rise

![Graph showing monthly average flow (cfs) over time from 1994 to 2014. The graph includes two lines: one for 02326900 and another for RCHRES 5.](image-url)
Wacissa River

[Variable] vs. Time

- Monthly Average Flow (cfs)
- Time (1994 to 2014)

Legend:
- 02326526
- RCHRES 9
Rainbow Springs
Additional Calibration Points

• USGS 02319500 SUWANNEE RIVER AT ELLAVILLE, FLA
• USGS 02320500 SUWANNEE RIVER AT BRANFORD, FLA.
02319500 Monthly
02319500 Monthly FDC
02320500 Monthly

Monthly Average Flow (cfs)

Time

St. Johns River
Water Management District
02320500 Monthly FDC