COHYST 2010

A Total Water Budget Approach to Integrated Water Management

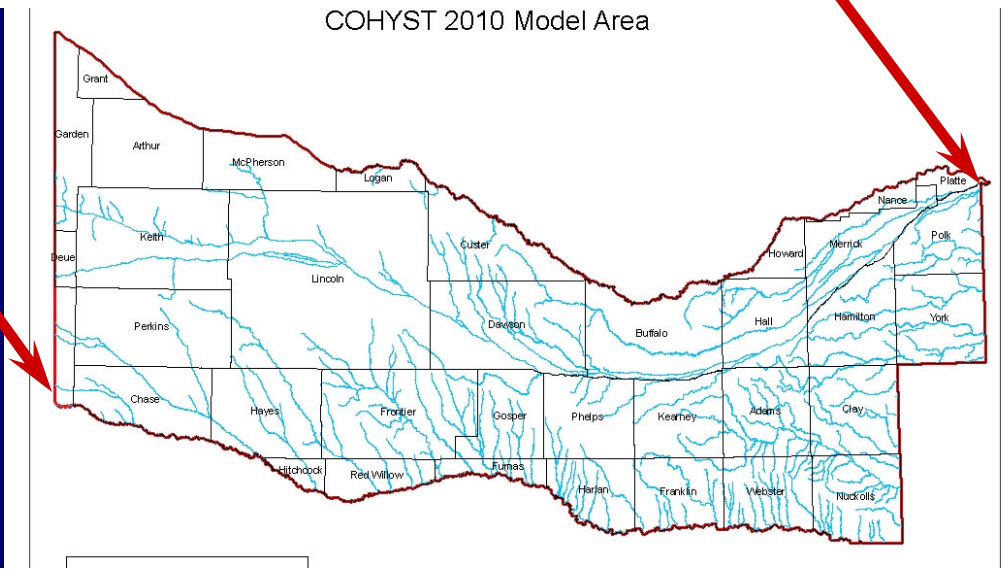
DNR Modeling Group Meeting
October 14, 2010
North Platte, NE
Doug Hallum, P.G.
Nebraska Department of Natural Resources

Sponsors

- Central Platte NRD
- Tri-Basin NRD
- Twin Platte NRD
- Central Nebraska Public Power & Irrigation District
- Nebraska Public Power District
- Nebraska Game & Parks Commision
- Nebraska Department of Natural Resources

COoperative HYdrology STudy

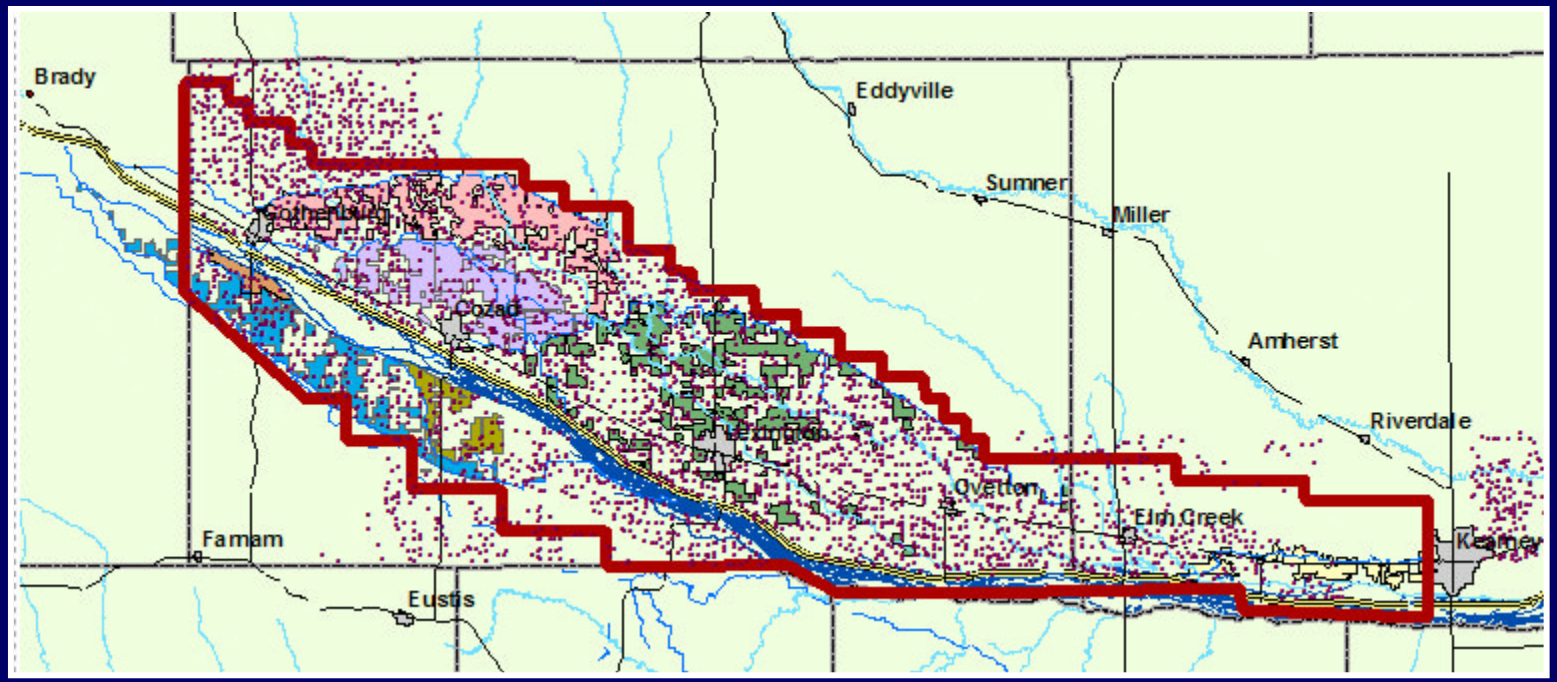
COHYST



The challenge…

- New management objectives, but
- Similar to an existing work

The CWM Project



The solution…

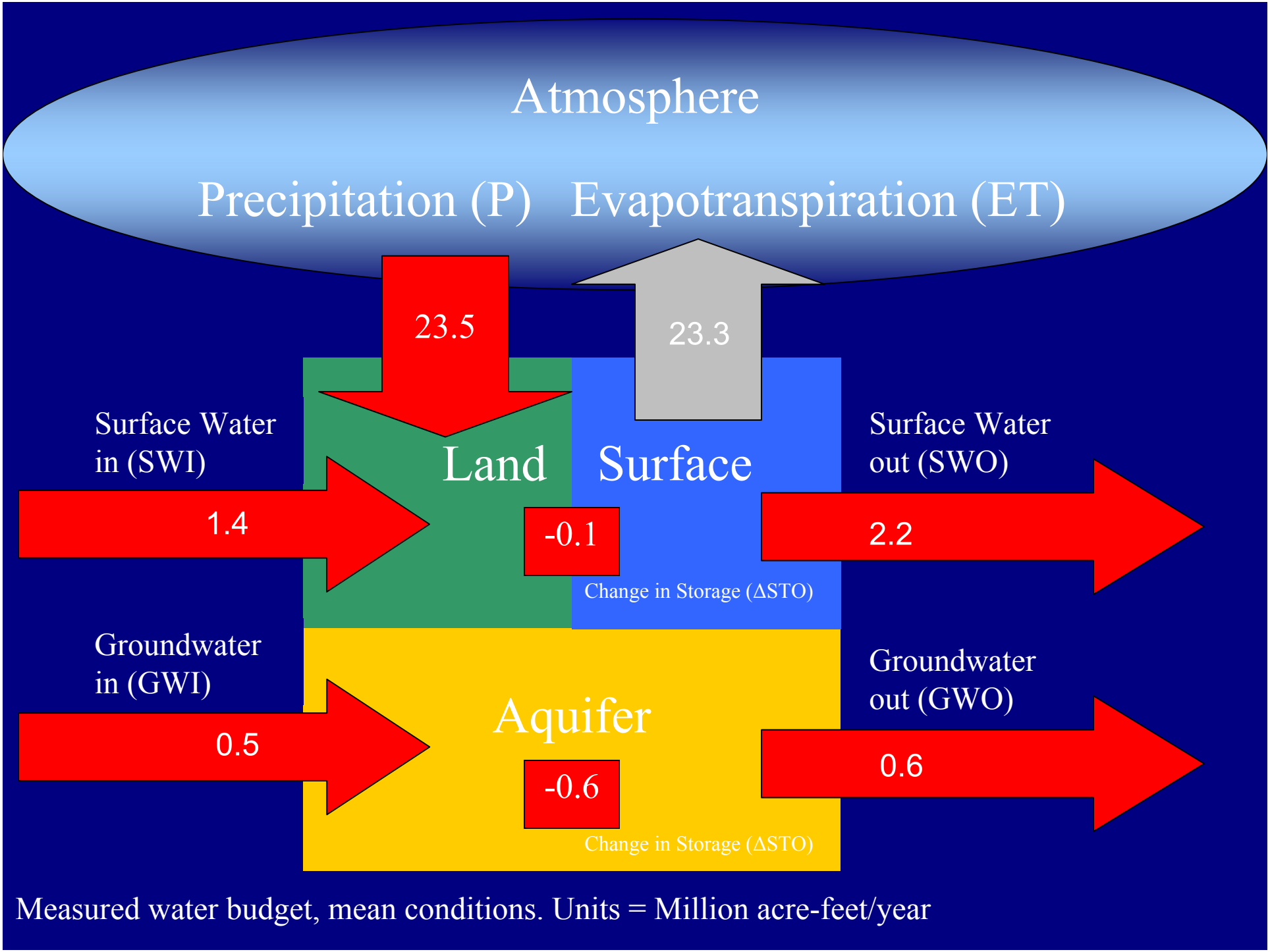
- Join forces and develop one project to do the work (COHYST 2010)

Management Objectives

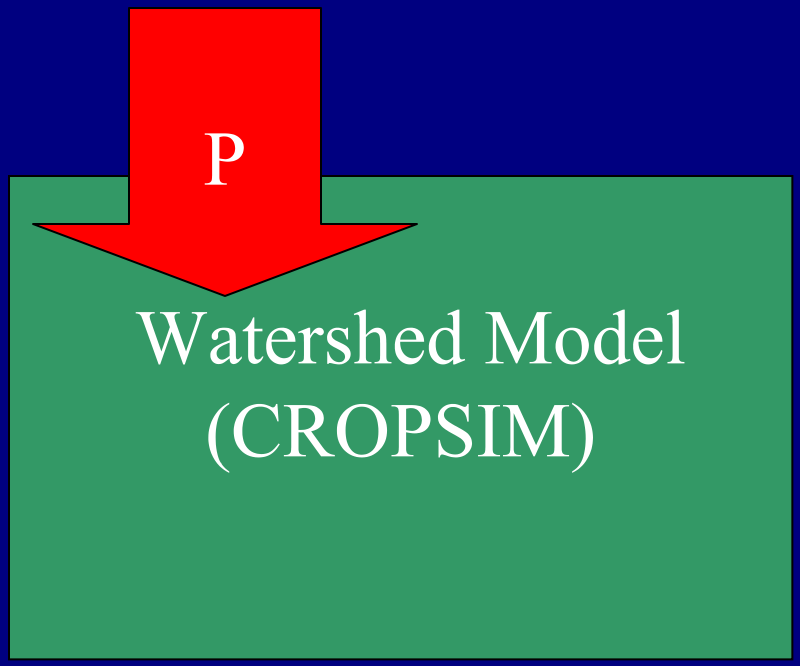
- Model must take into account:
  - Complete water budget
  - Temporal variability
  - Transient flow targets
  - Consumptive use
- Tracking and Accounting
- Incorporate surface water component
- Capable of management alternatives analysis

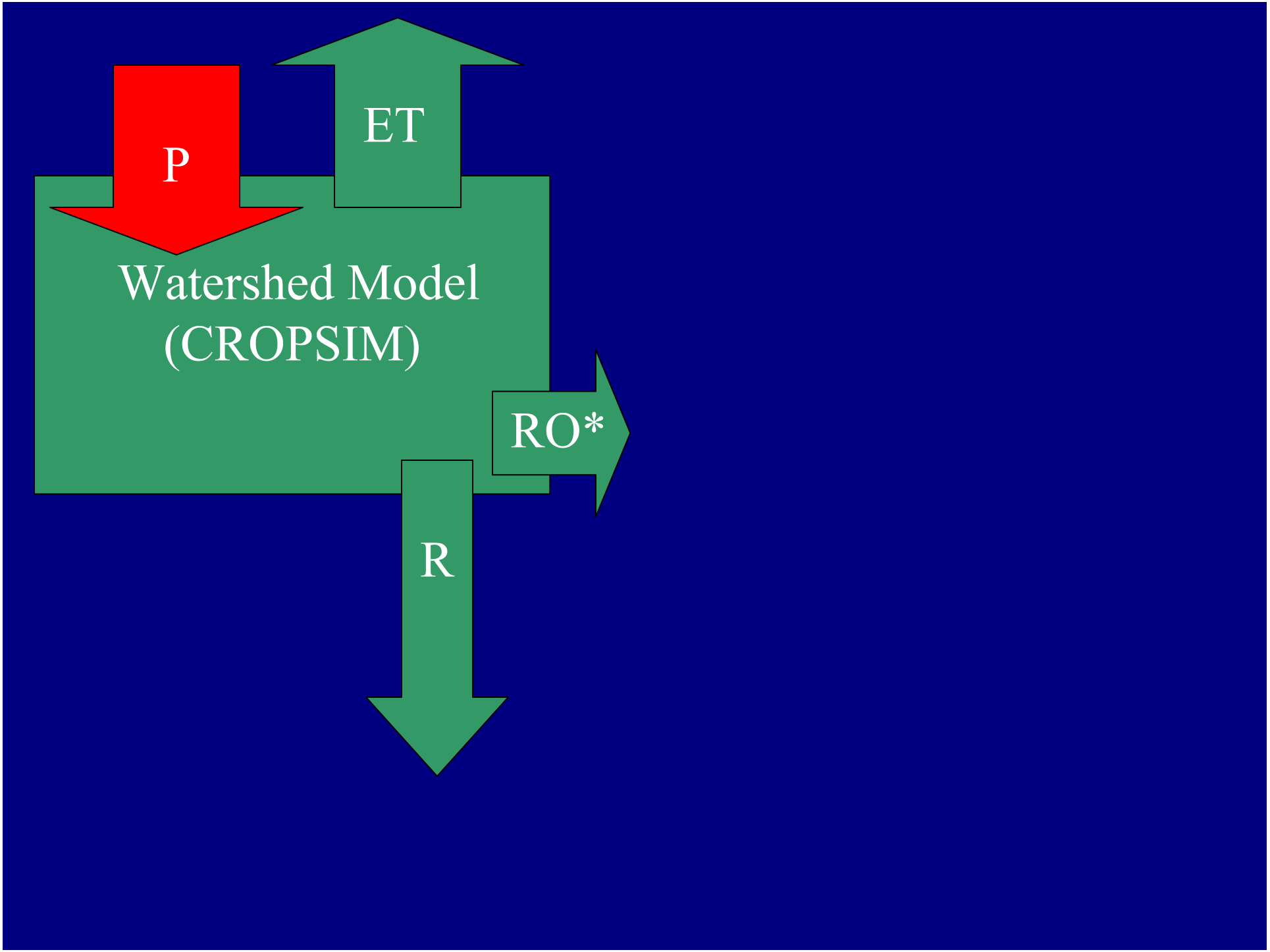
Phases

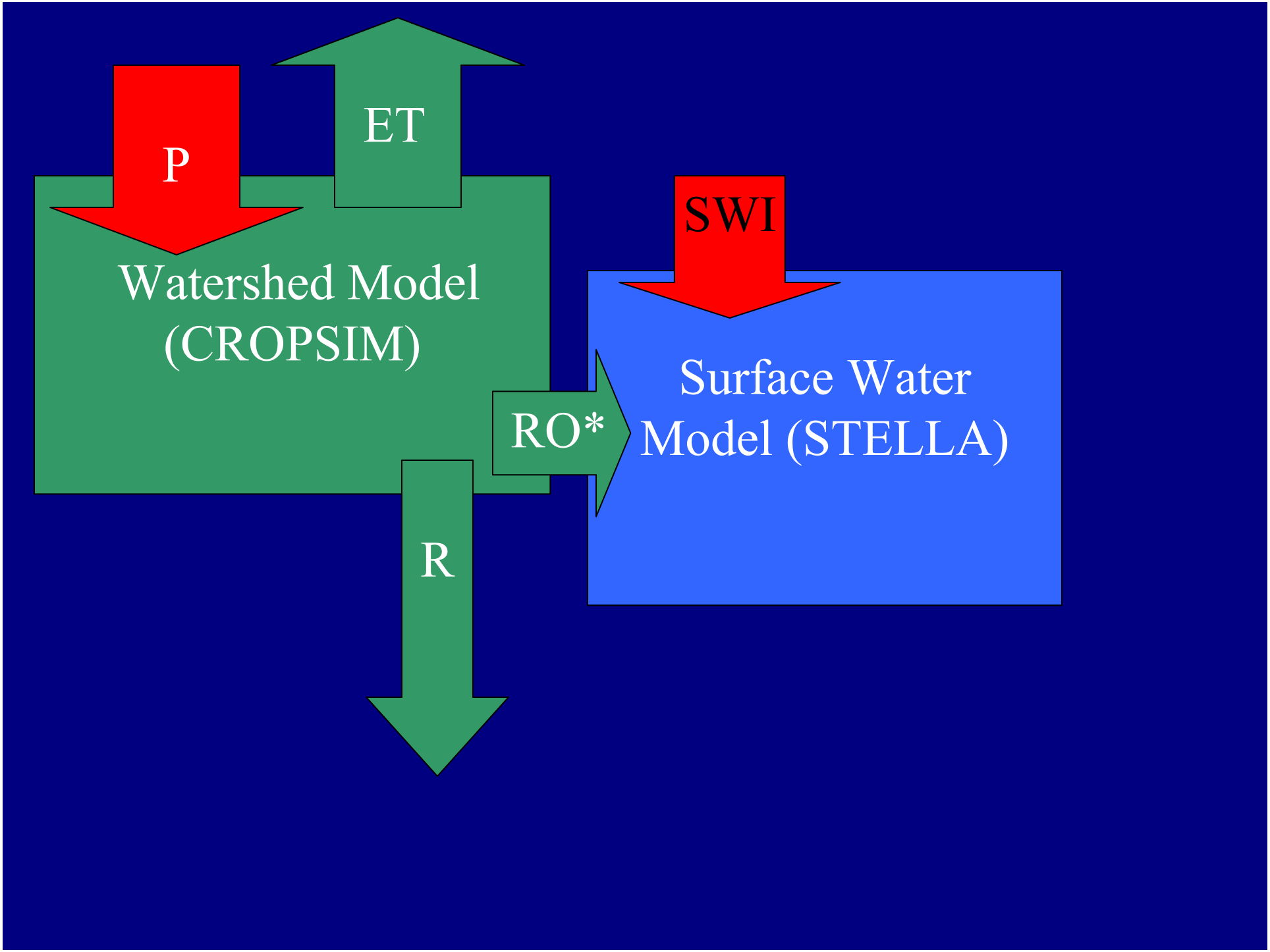
- Phase I: Water Budget
- Phase II: Develop a suite of modeling tools
- Phase III: Develop applied tools

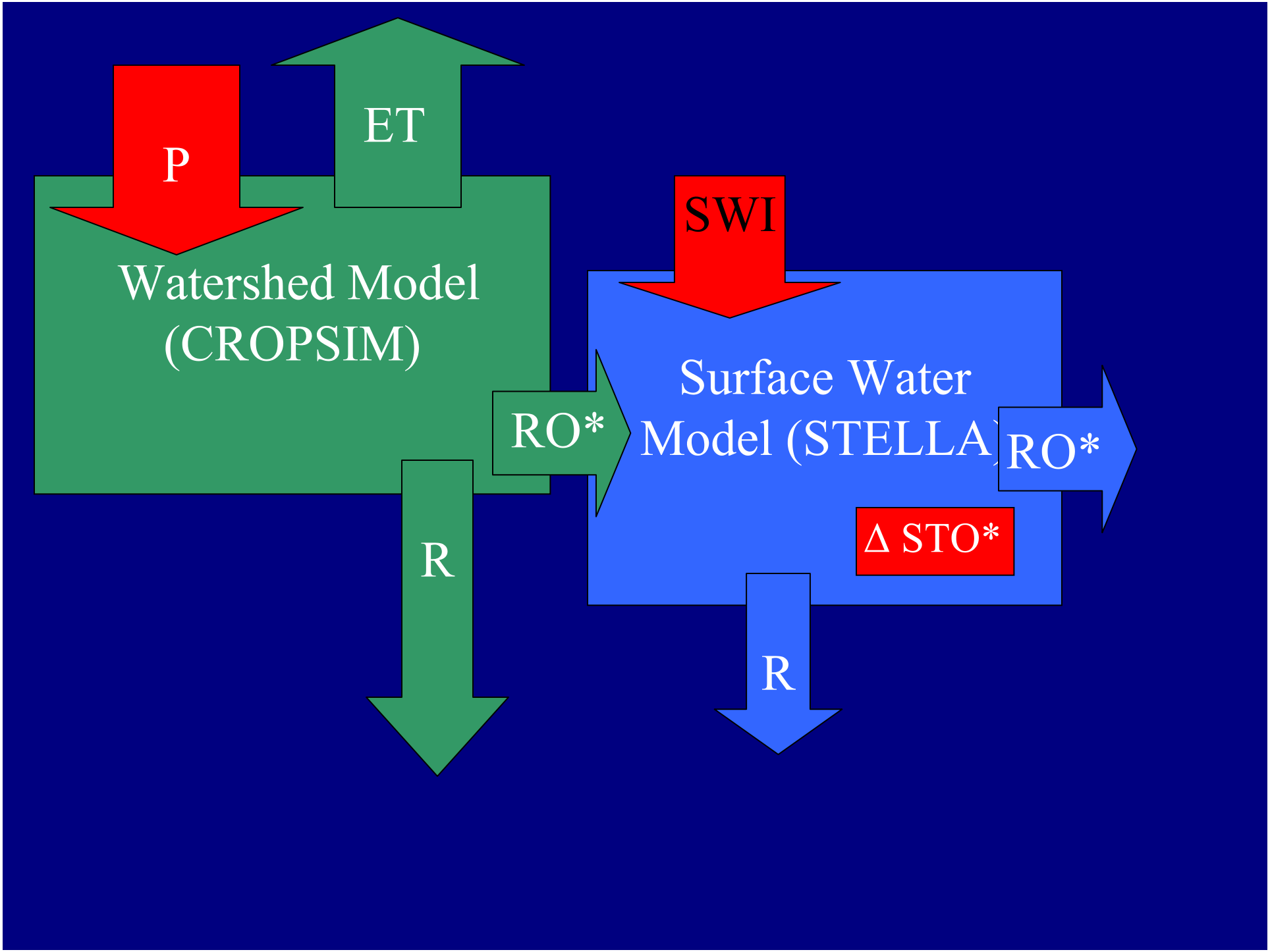


Measured water budget, mean conditions. Units = Million acre-feet/year


P
Watershed Model
(CROPSIM)


ET
P
Watershed Model
(CROPSIM)
RO*
R


ET
P
Watershed Model
(CROPSIM)
SWI
Surface Water
Model (STELLA)
RO*
R


ET
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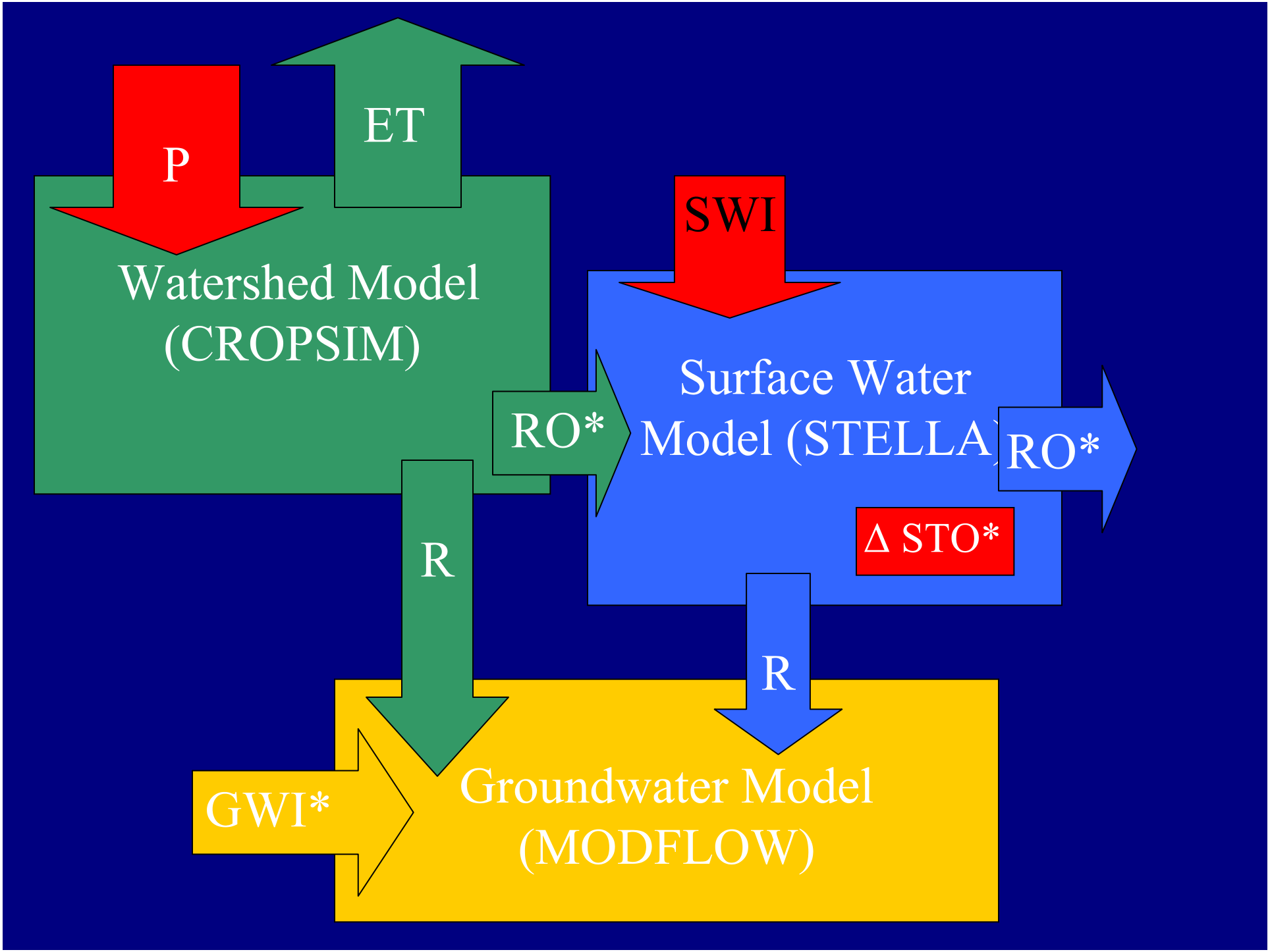
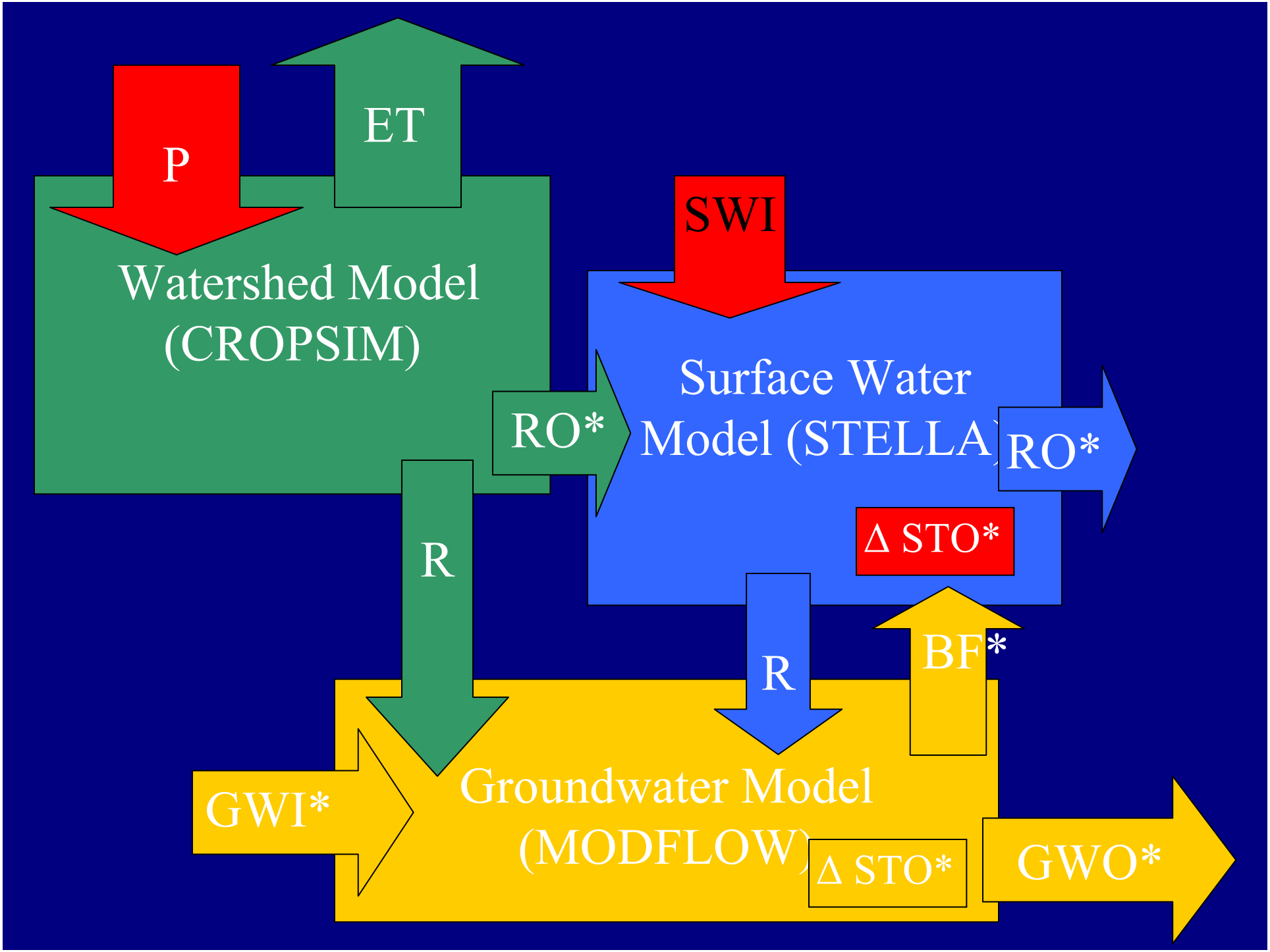
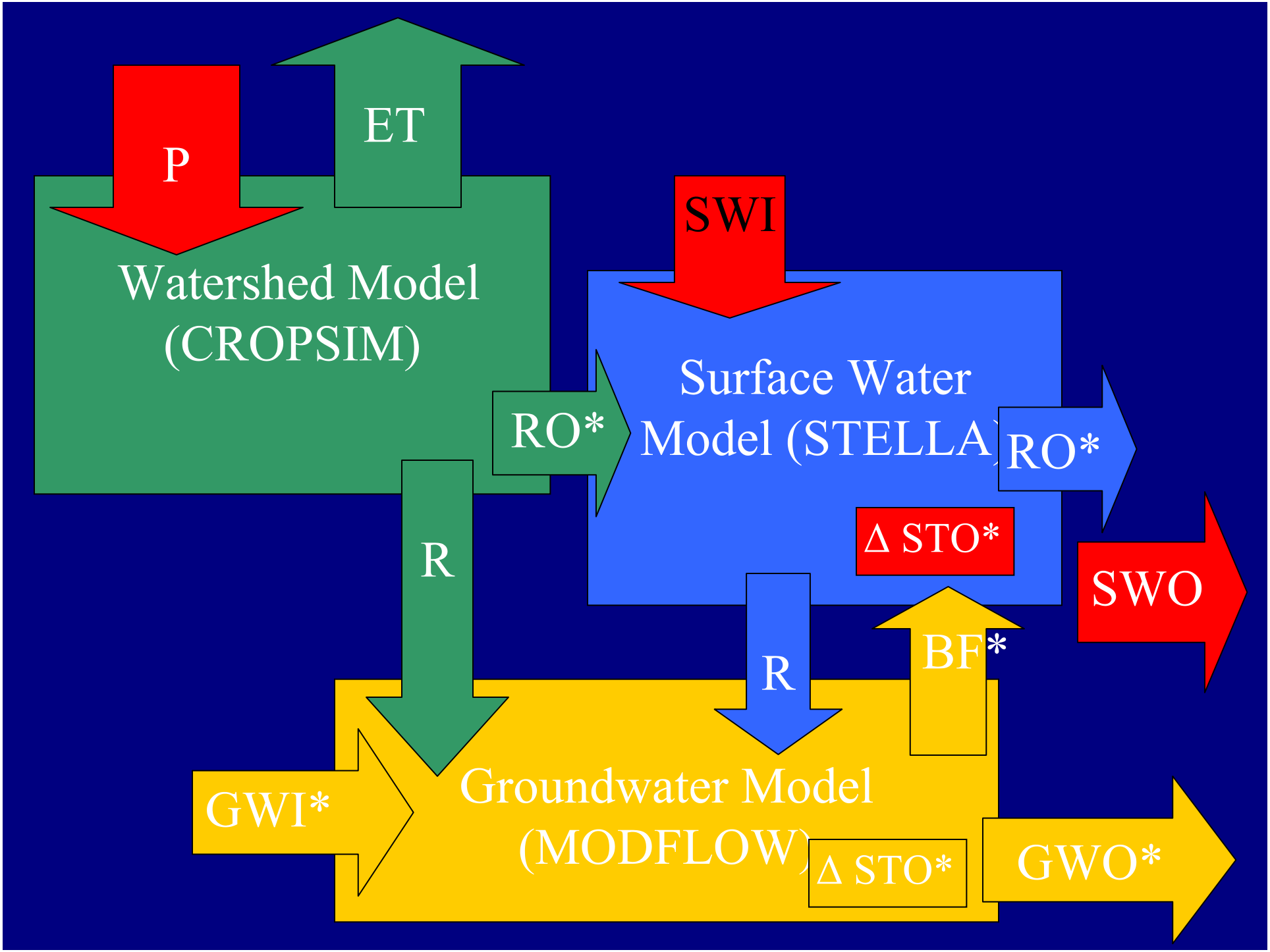
Watershed Model
(CROPSIM)
SWI
RO*
Surface Water
Model (STELLA)
RO*
Δ STO*
R
R


P
ET
Watershed Model
(CROPSIM)
SWI
RO*
Surface Water
Model (STELLA)
RO*
Δ STO*
R
R
GWI*
Groundwater Model
(MODFLOW)


P
ET
Watershed Model
(CROPSIM)
SWI
Surface Water
Model (STELLA)
RO*
RO*
R
Δ STO*
R
BF*
GWI*
Groundwater Model
(MODFLOW)
Δ STO*
GWO*


P
ET
Watershed Model
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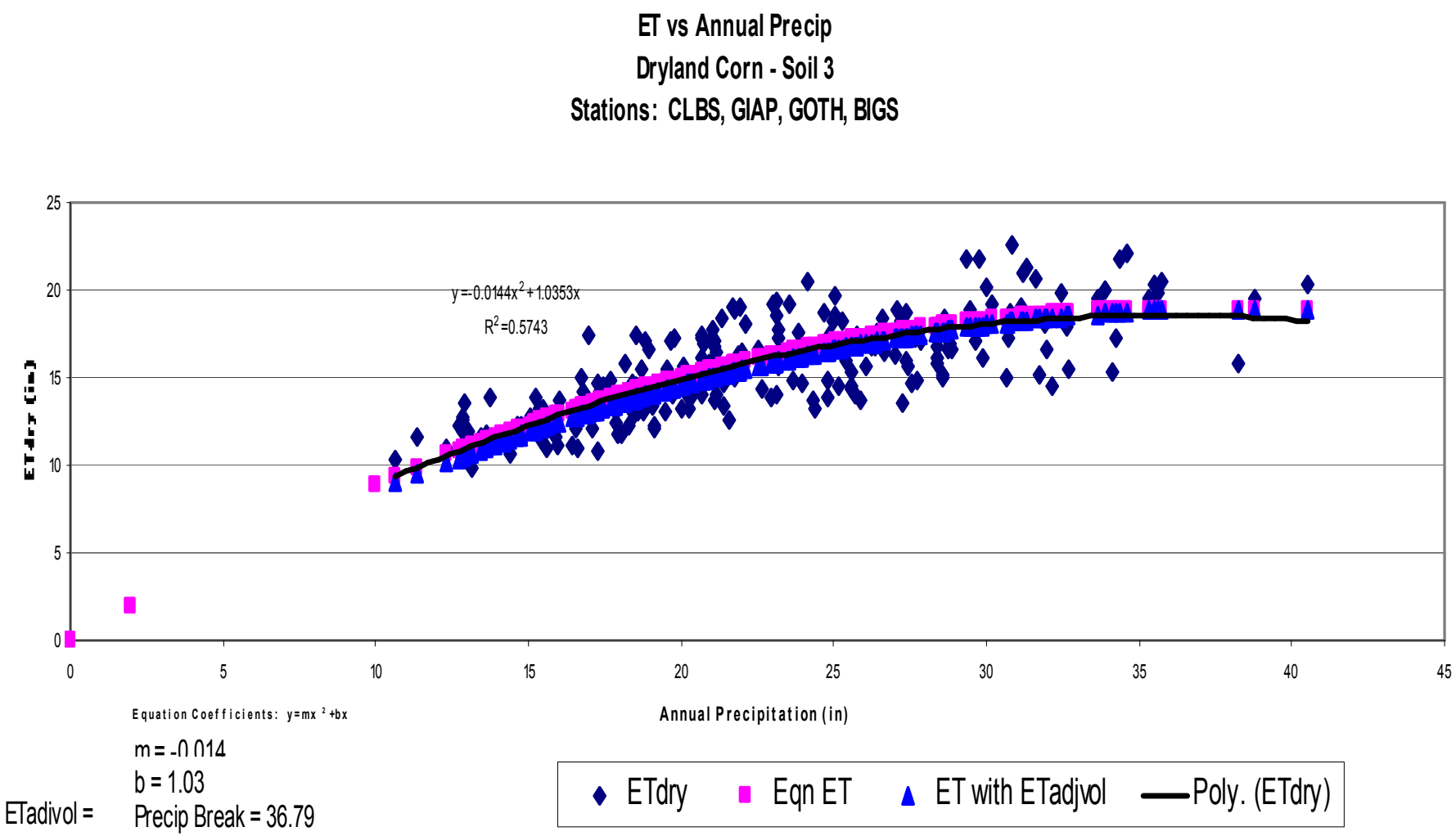
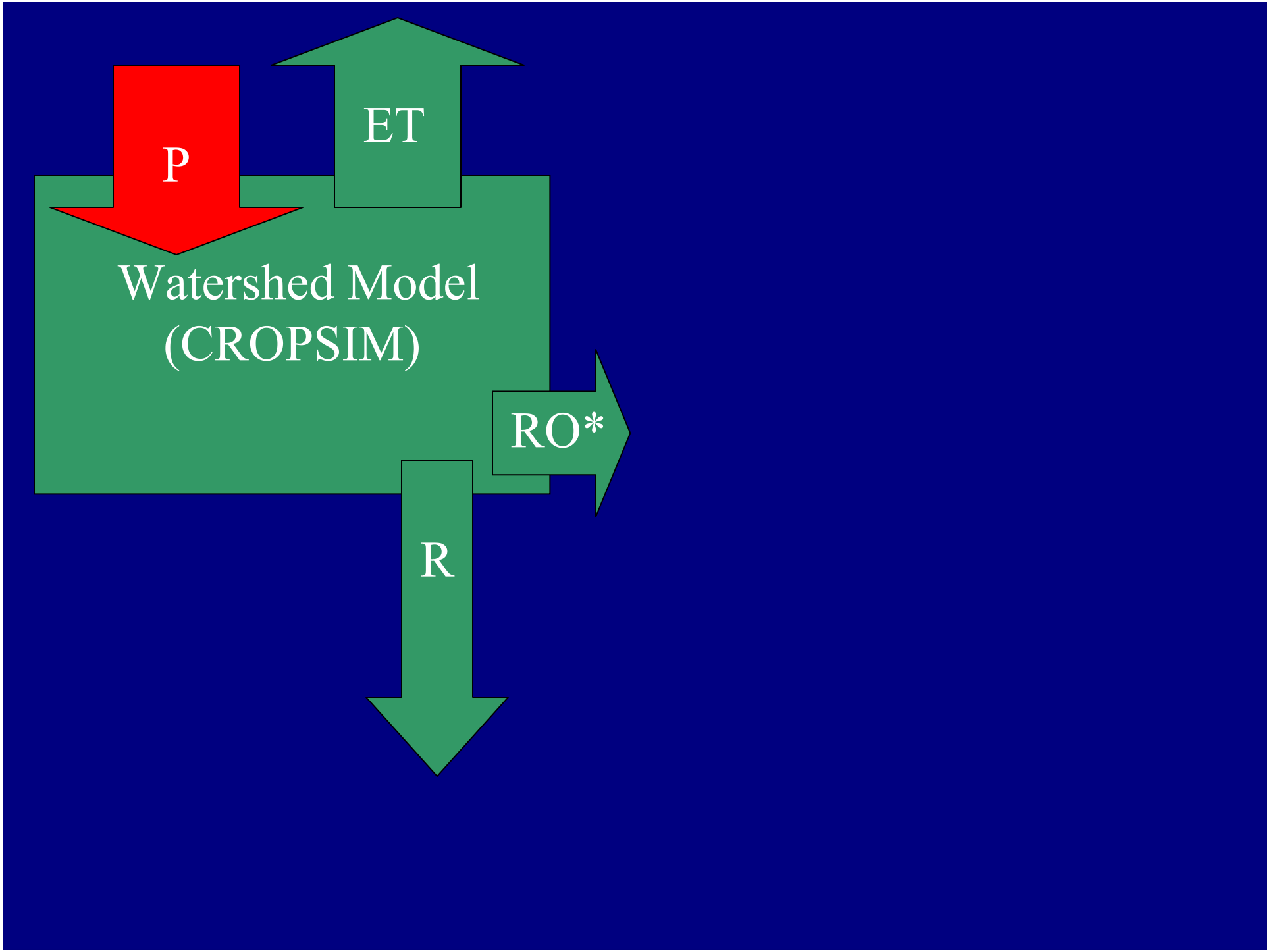
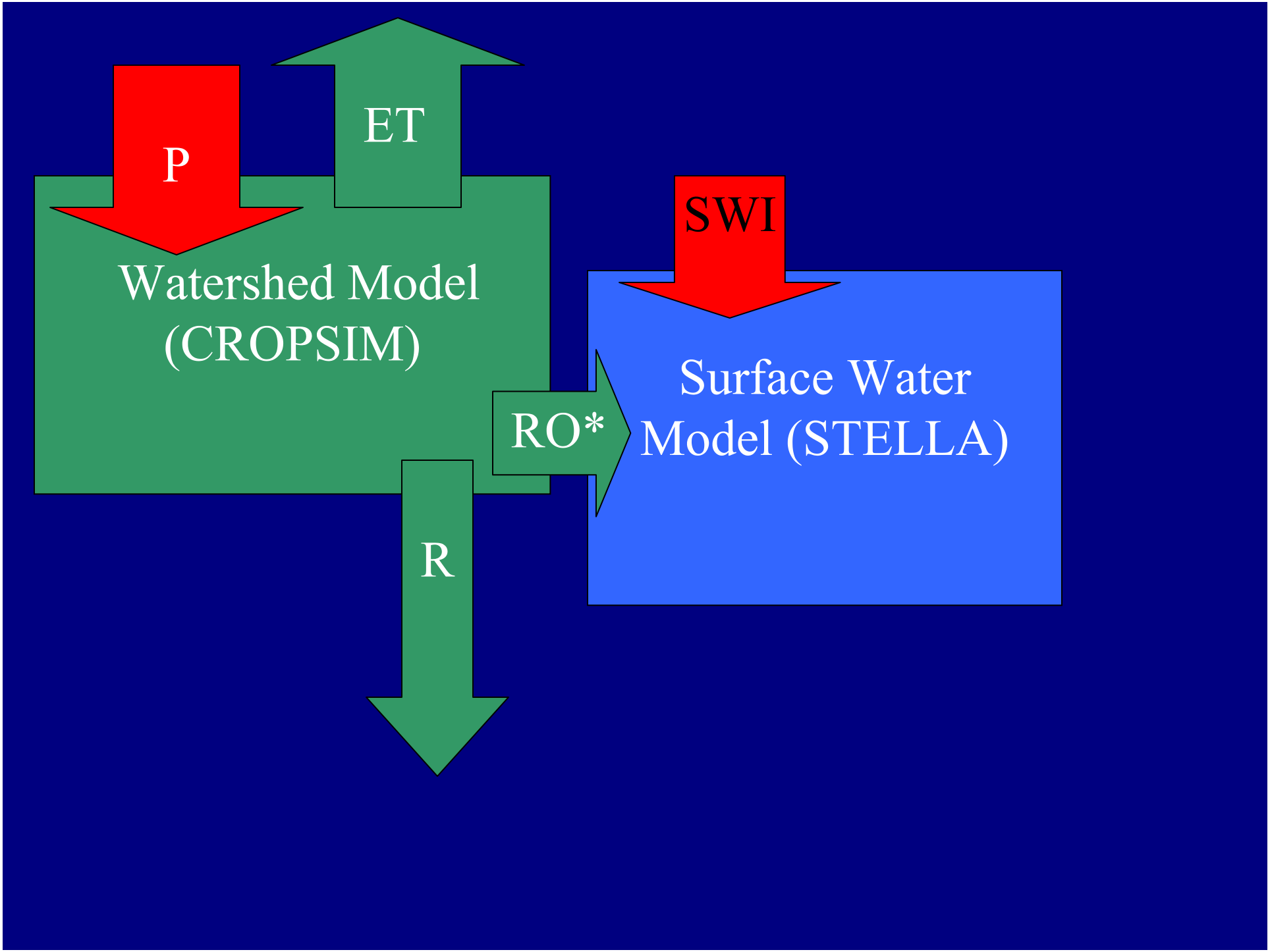
Surface Water
Model (STELLA)
RO*
RO*
R
Δ STO*
SWO
R
BF*
GWI*
Groundwater Model
(MODFLOW)
Δ STO*
GWO*

What happens when RO and BF do not equal total flow?


ET vs Annual Precip
Dryland Corn - Soil 3
Stations: CLBS, GIAP, GOTH, BIGS
y = -0.0144x2 + 1.0353x
R2 = 0.5743
ETdry (in)
Annual Precipitation (in)
0
5
10
15
20
25
30
35
40
45
Equation Coefficients: y=mx2+bx
m = -0.014
b = 1.03
ETadivol =
Precip Break = 36.79
ETdry
Eqn ET
ET with ETadjvol
Poly. (ETdry)


ET
P
Watershed Model
(CROPSIM)
RO*
R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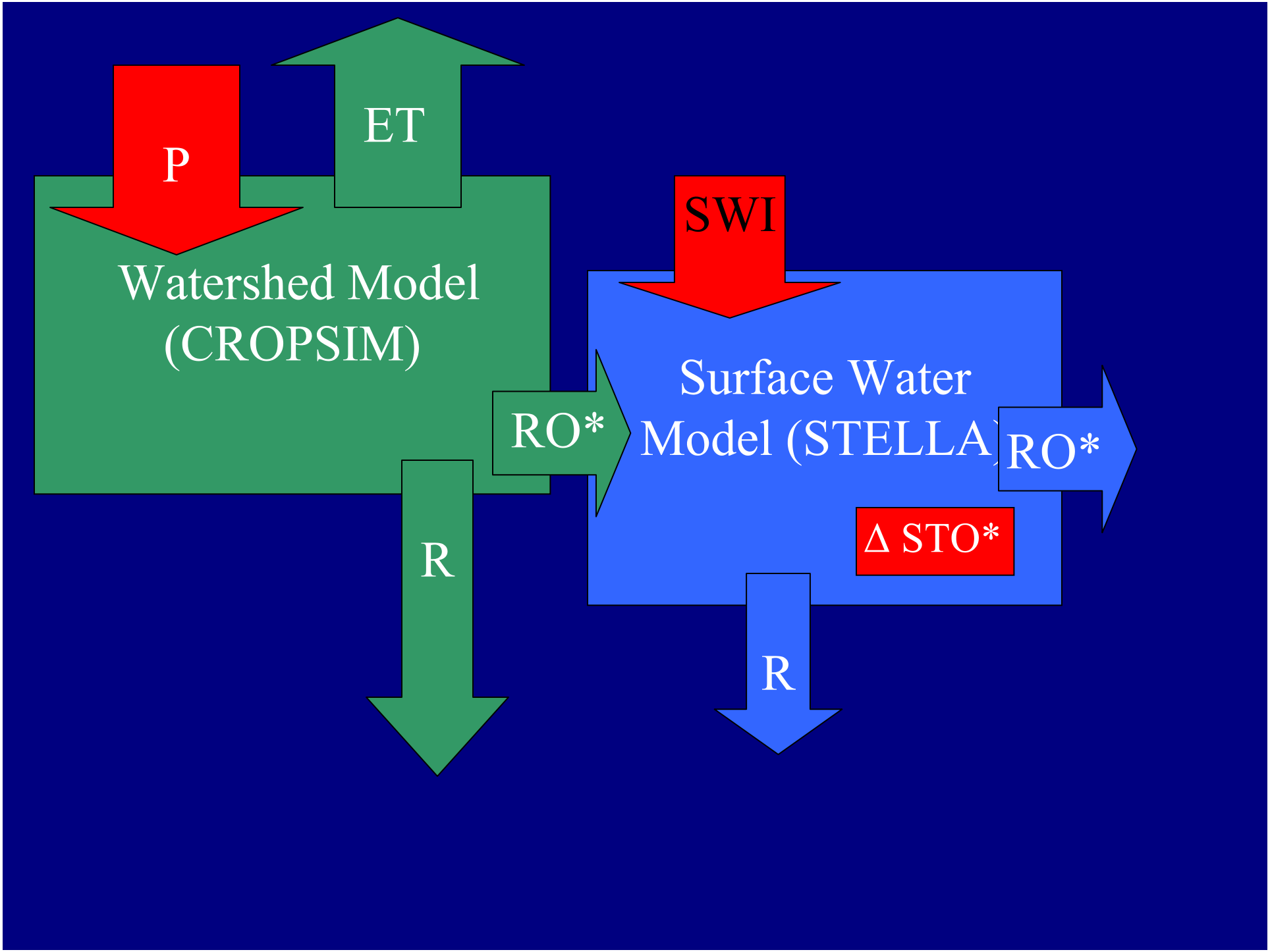
SWI
Surface Water
Model (STELLA)
RO*
R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Watershed Model
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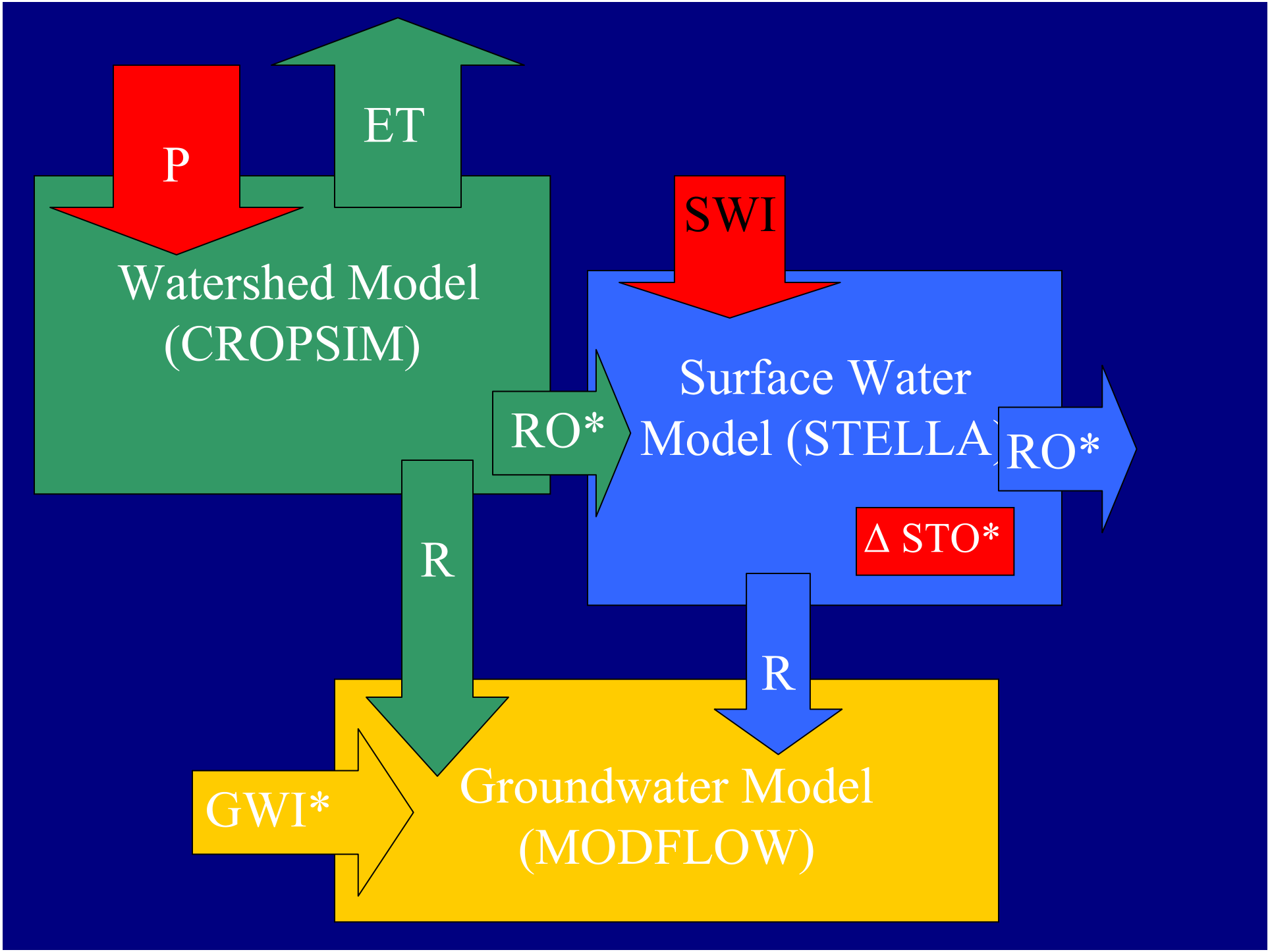
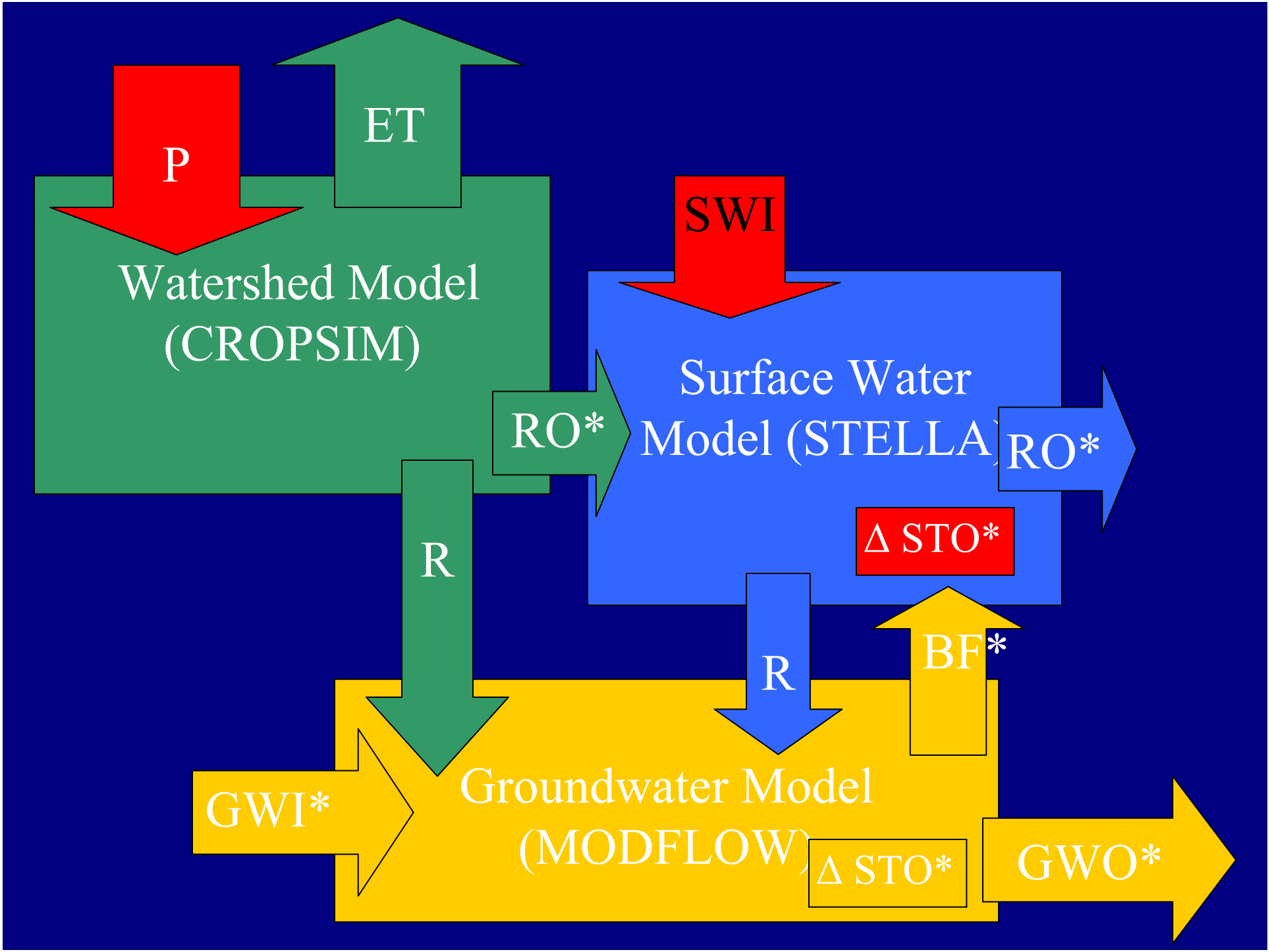
RO*
Surface Water
Model (STELLA)
RO*
Δ STO*
R
R


P
ET
Watershed Model
(CROPSIM)
SWI
RO*
Surface Water
Model (STELLA)
RO*
Δ STO*
R
R
GWI*
Groundwater Model
(MODFLOW)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SWI
Surface Water
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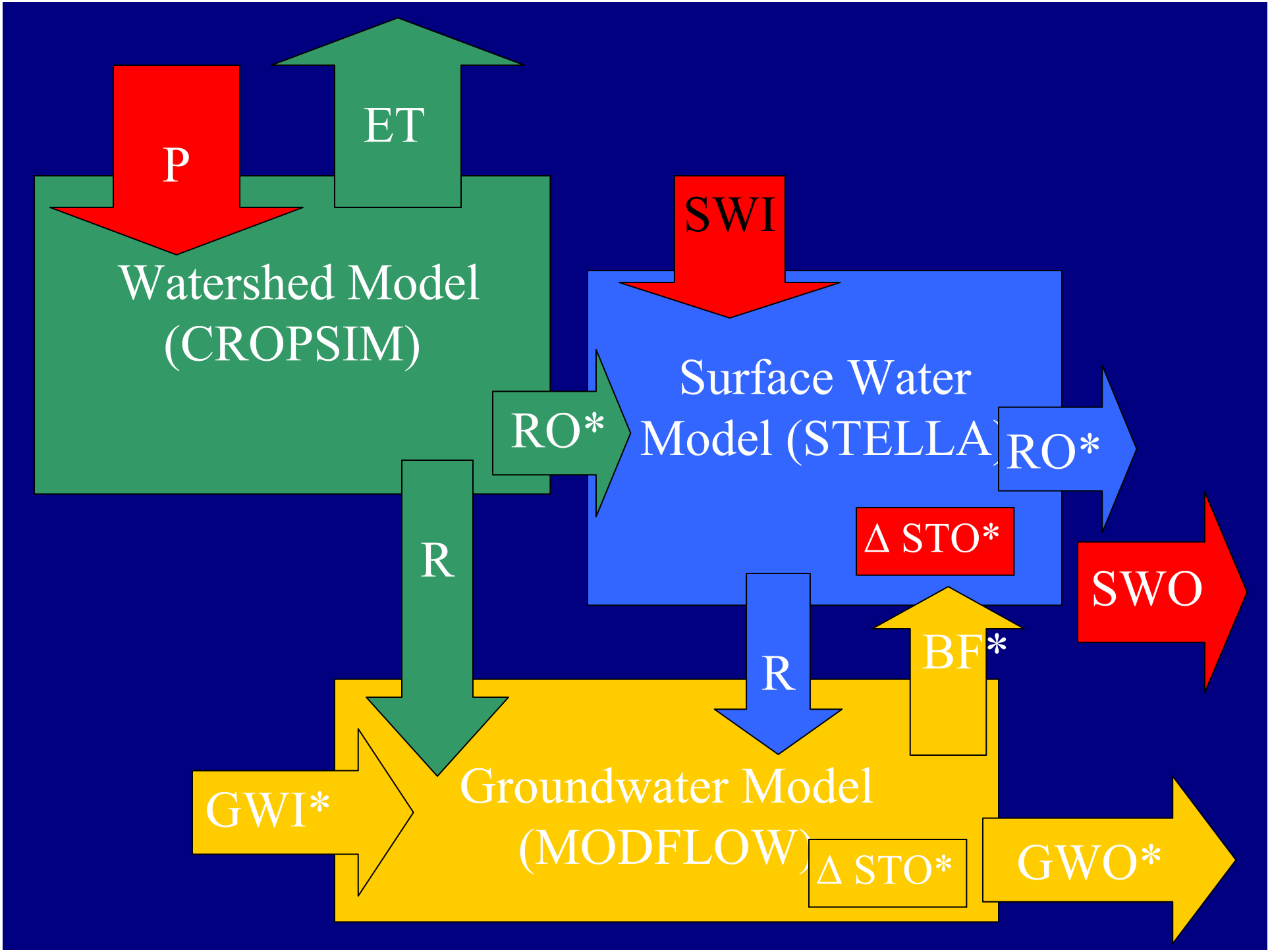
RO*
RO*
R
Δ STO*
R
BF*
GWI*
Groundwater Model
(MODFLOW)
Δ STO*
GWO*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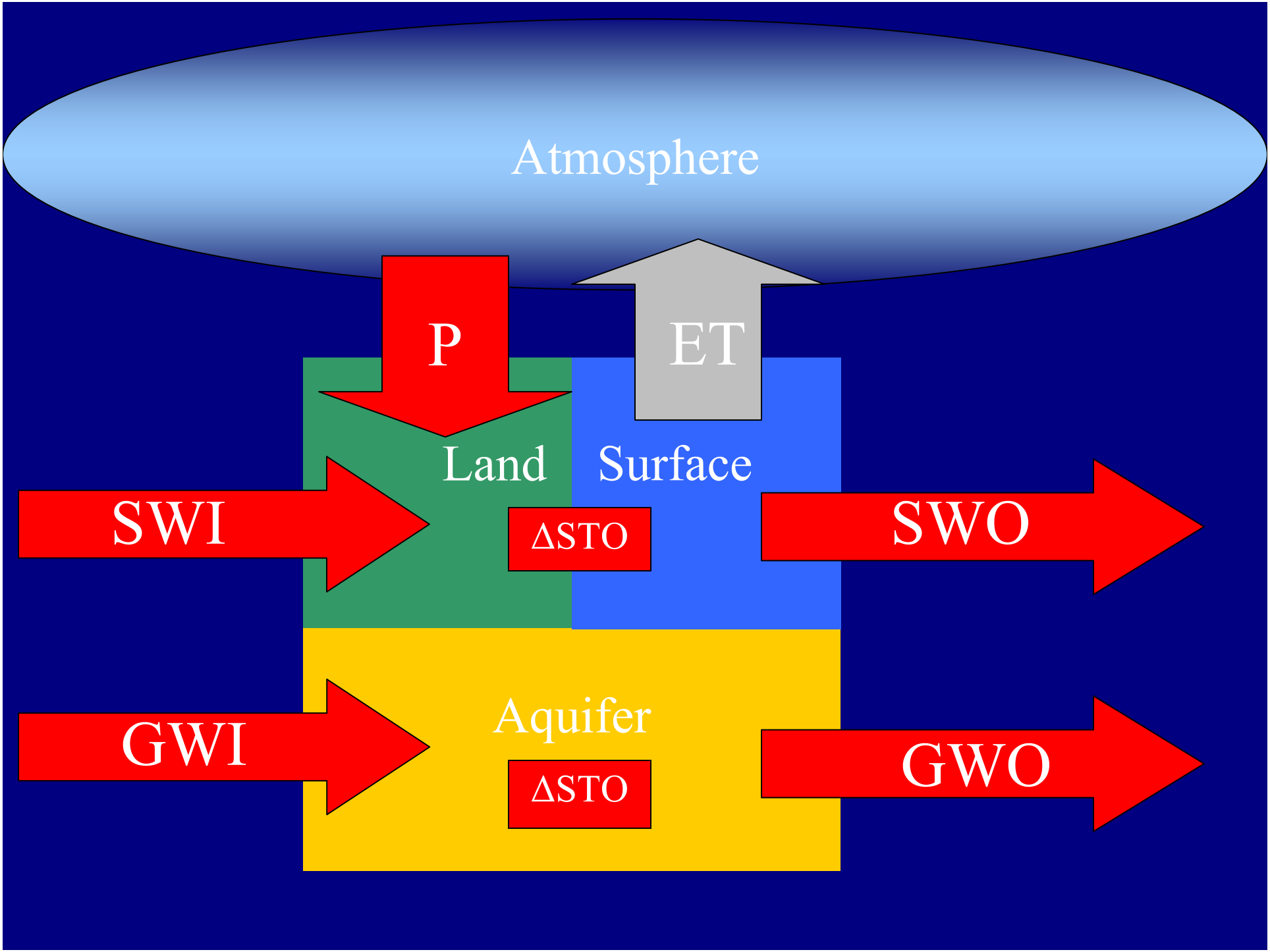
Surface Water
Model (STELLA)
RO*
RO*
R
Δ STO*
SWO
R
BF*
GWI*
Groundwater Model
(MODFLOW)
Δ STO*
GWO*


Atmosphere
P
ET
Land Surface
SWI
ΔSTO
SWO
Aquifer
GWI
ΔSTO
GWO

Acknowledgements

- The “Pioneers” of COHYST and CWM, who did the work and laid the foundation for this effort
- COHYST and CWM Sponsors
- NET
- Others

Questions?

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