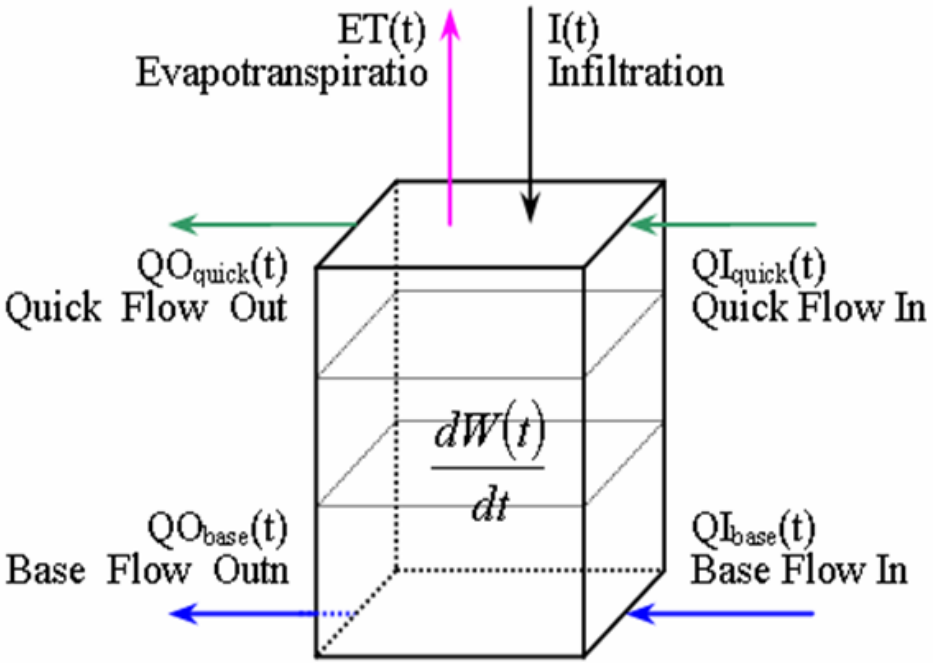
Coupled **R**outing and **E**xcess **ST**orage (CREST) Distributed Hydrological Model

Overview

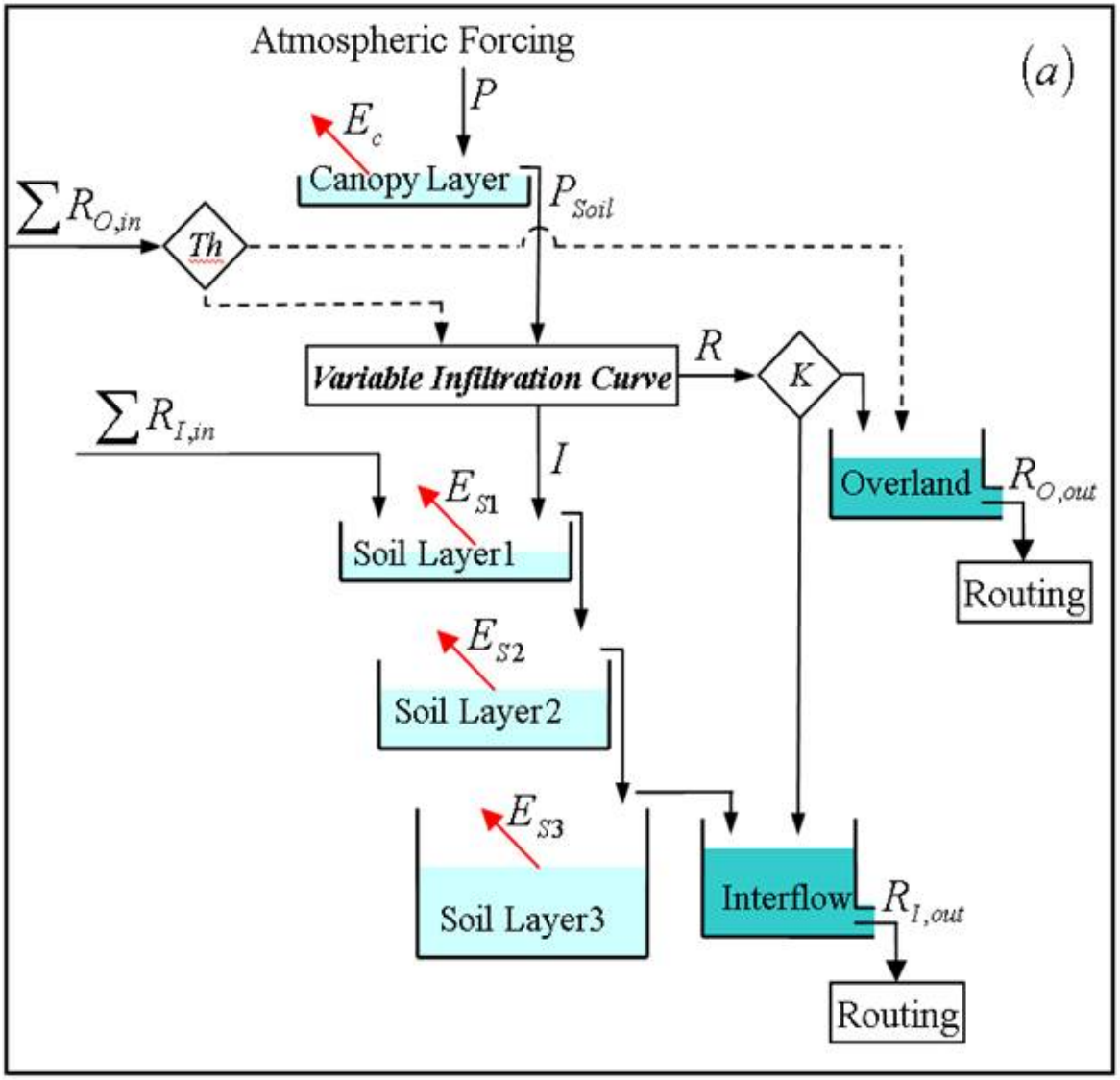
Water Balance

Grid-Based Water Balance
Rate of change of Soil Water

$$\frac{dW(t)}{dt} = I(t) - ET(t) + \sum QI_{quick}(t) - QO_{quick}(t) + \sum QI_{base}(t) - QO_{base}(t)$$

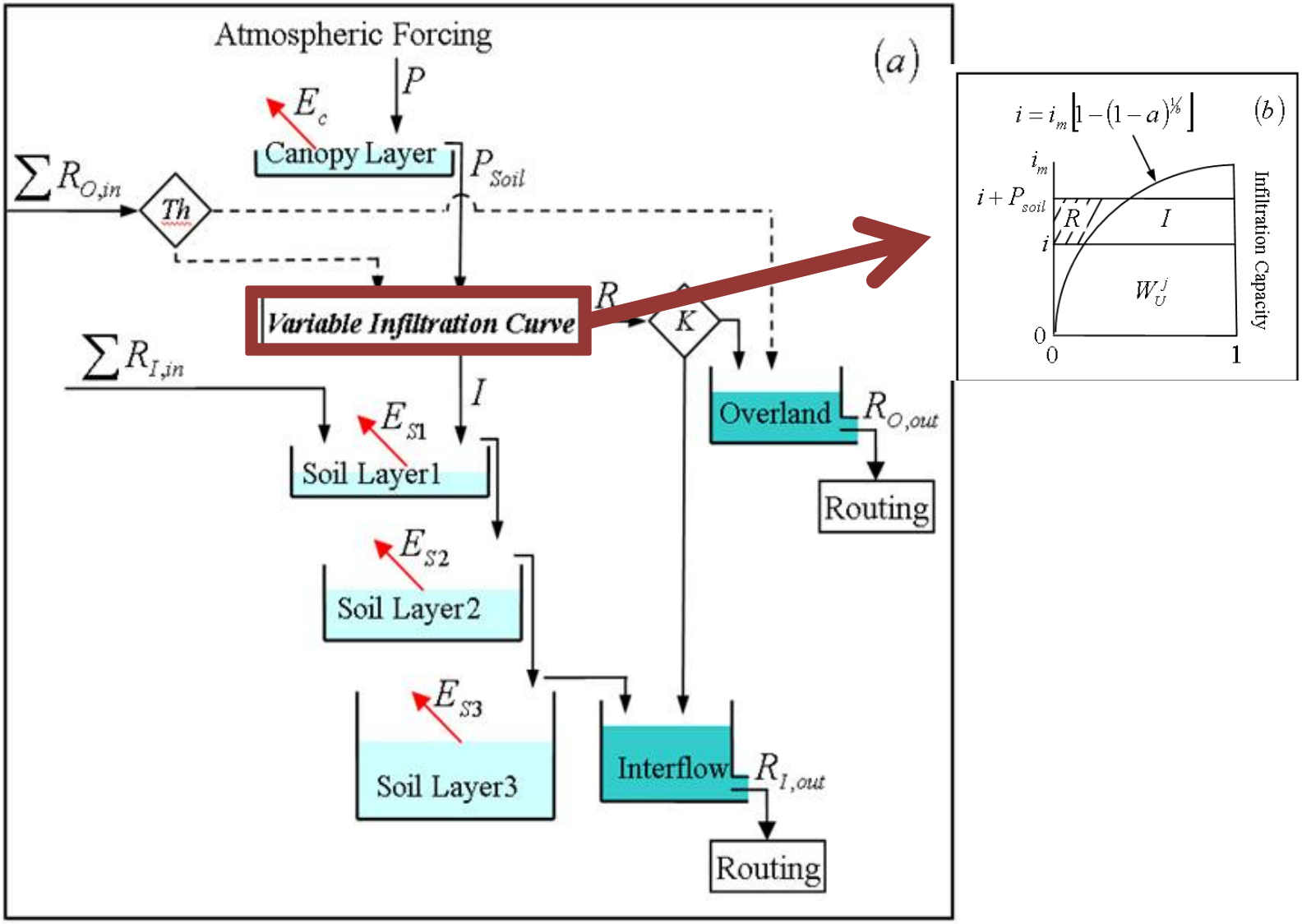


CREST Model



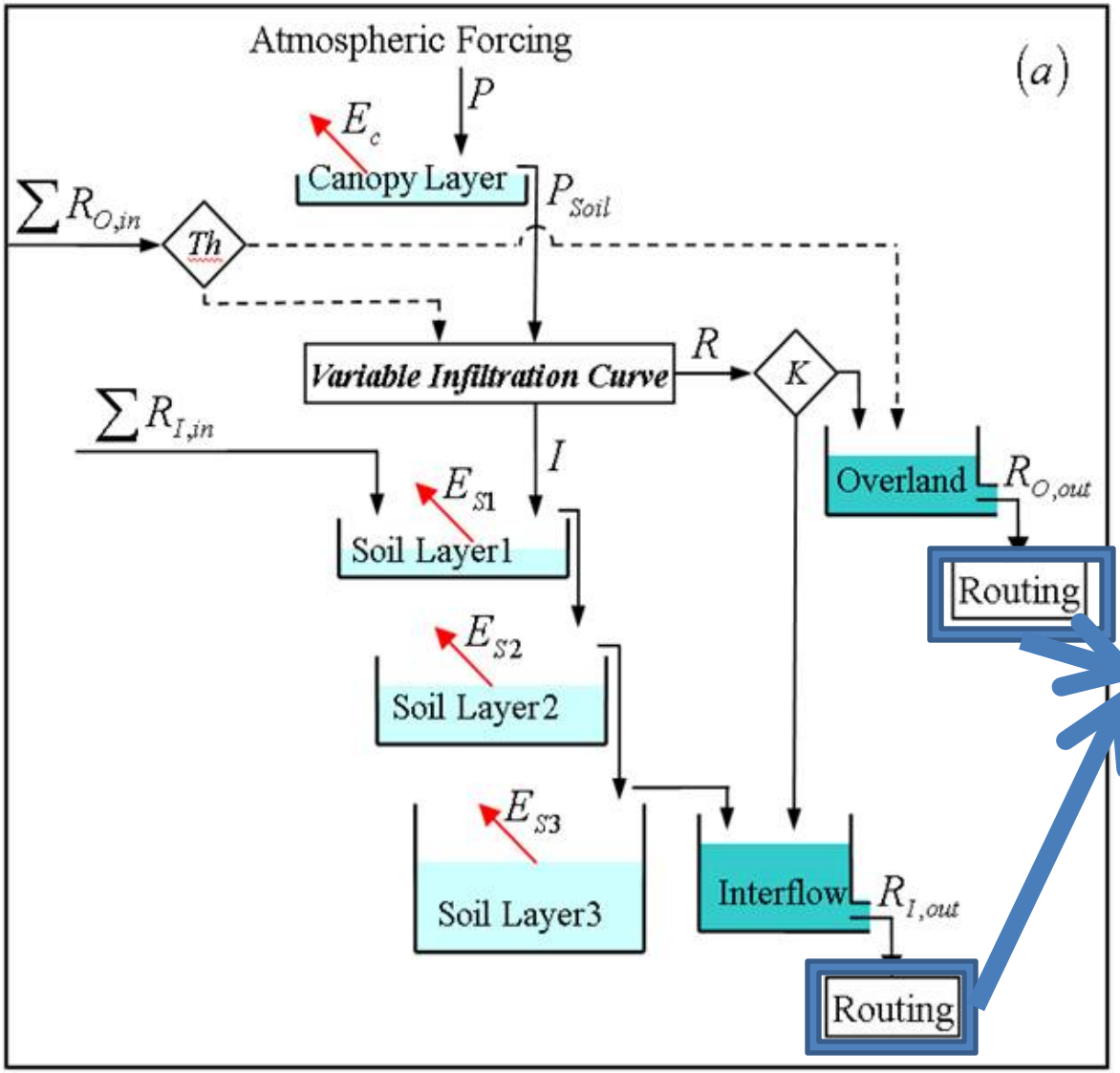
- 2 Forcings
- 17 Parameters
- 9 Outputs

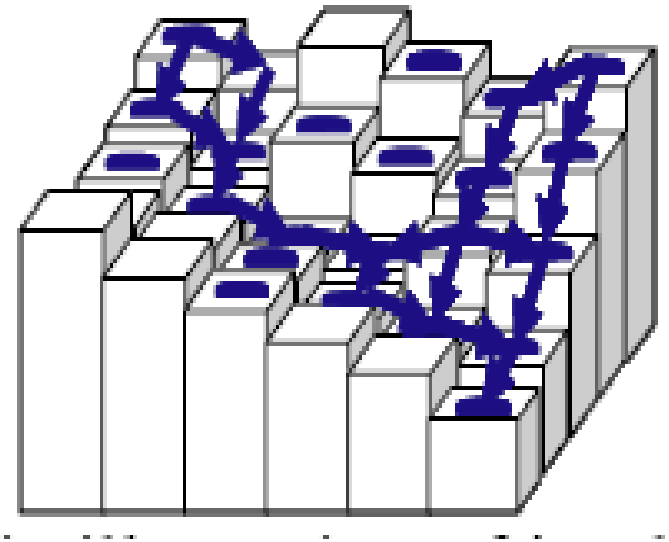
CREST Model


Atmospheric Forcing
(a)
E_c
P
Canopy Layer
P_{Soil}
$\sum R_{O,in}$
Th
Variable Infiltration Curve
R
K
$\sum R_{I,in}$
I
E_{S1}
Soil Layer1
Overland
$R_{O,out}$
Routing
E_{S2}
Soil Layer2
E_{S3}
Soil Layer3
Interflow
$R_{I,out}$
Routing

$i = i_m\left[1-(1-a)^{1/b}\right]$
(b)
i_m
$i + P_{soil}$
R
I
i
W_U^j
0
0
1
Infiltration Capacity

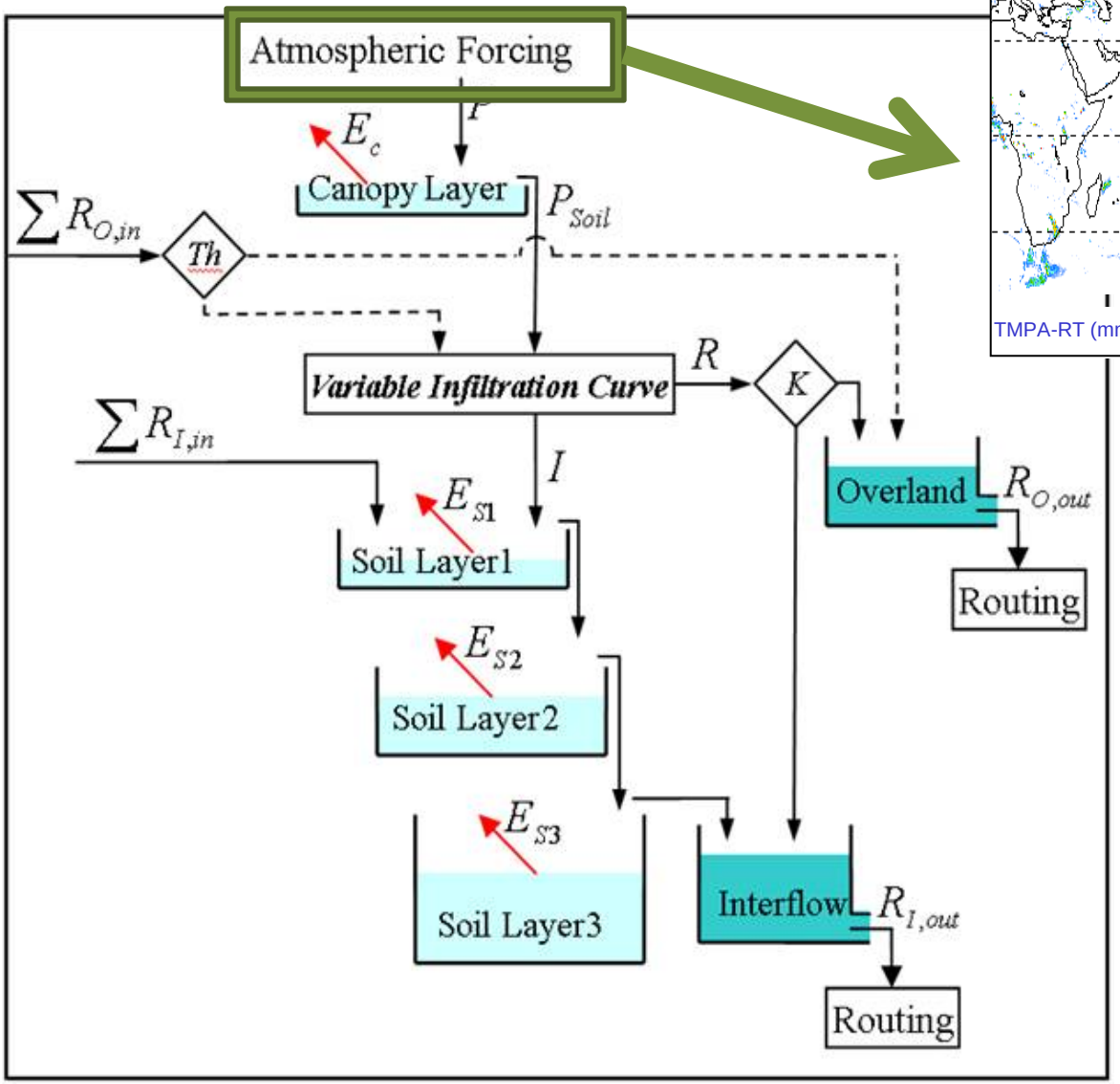
CREST Model

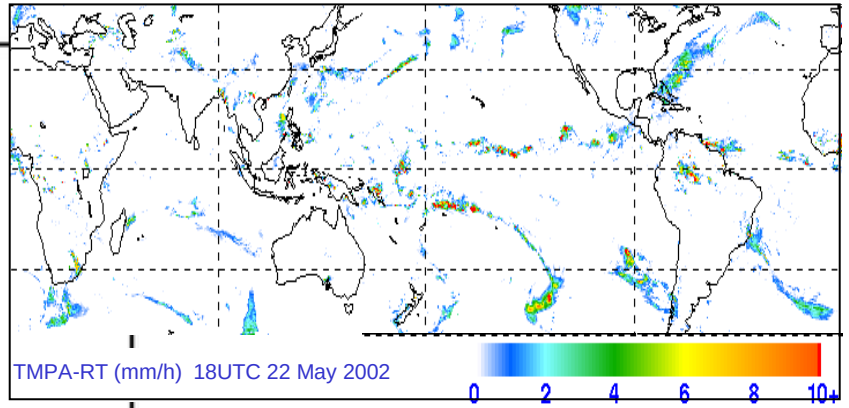




Cell-to-Cell Flow Routing

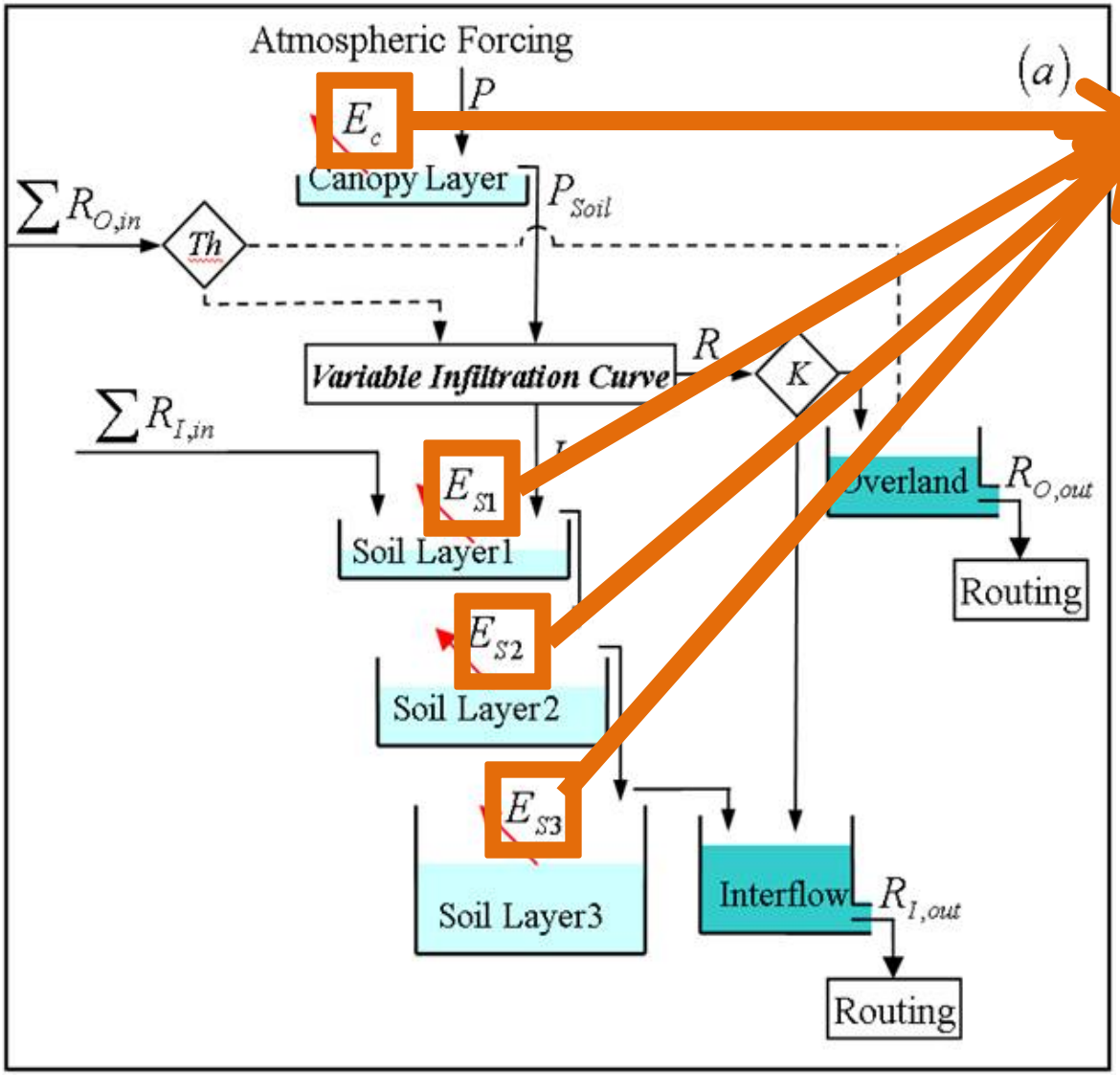
CREST Model





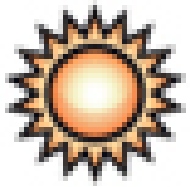
- TMPA 3B42RT
- NWP QPF
- Rain Gauges
- Ground Radar
- *Gridded*

CREST Model

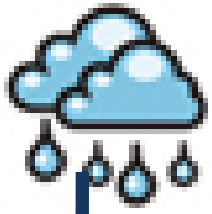


- Potential Evapotranspiration
- Typically "bibimo" global monthly mean PET that is provided

CREST Model



Evapotranspiration



Precip.

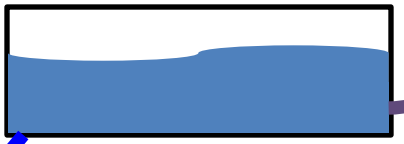
Impervious Area

Soil/Vegetation

Direct Surface Runoff

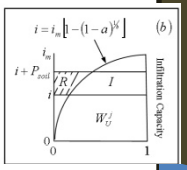
Overland Reservoir

Grid Cell Routing



Grid Cell Routing

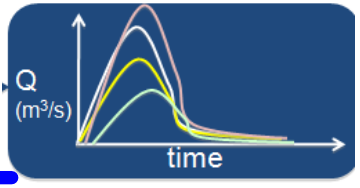
Infiltration



VIC Model

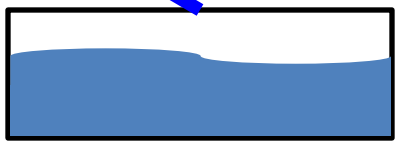
Grid Cell

Stream flow



Interflow

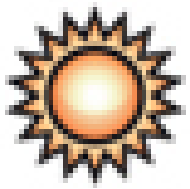
Grid Cell Routing



Interflow Reservoir

Grid Cell Routing

CREST Model Outputs

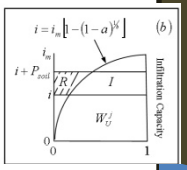


Evapotranspirati

Precip.

Soil/Vegetation

Infiltration



VIC Model

Grid Cell

Interflo

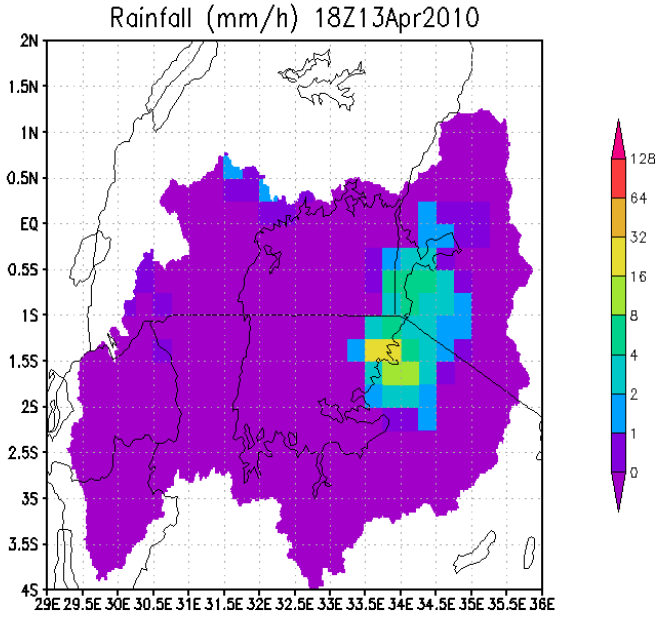
Grid Routing

Interflow Reservoir

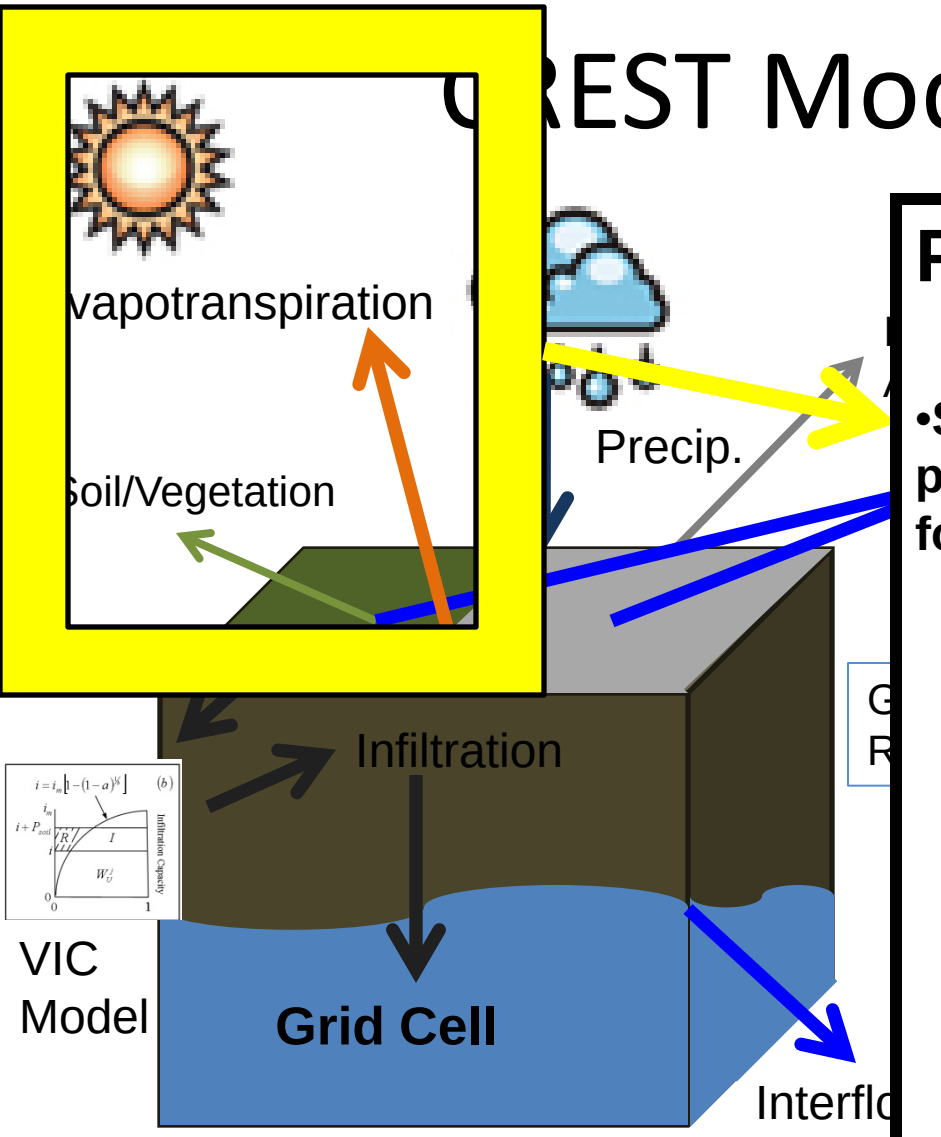
Routing

Rain Output

- **Spatially interpolated output of precip. Input forcing**



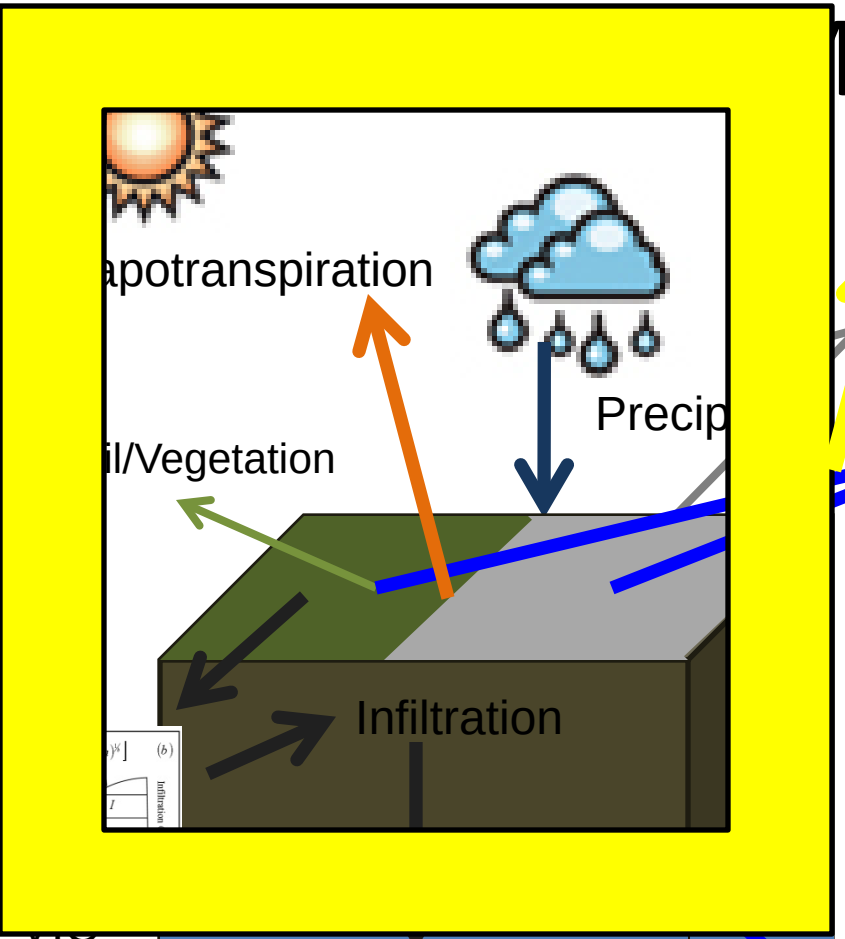
REST Model Outputs



PET Output

- **Spatially interpolated output of potential evapotranspiration input forcing**

lodel Outputs



Actual ET Output

- **Amount of liquid that actually evapotranspirated from the precipitation and soil**

Model

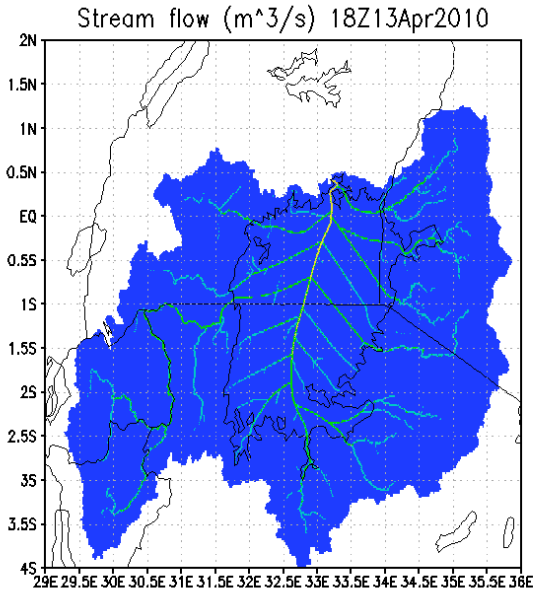
Grid Cell

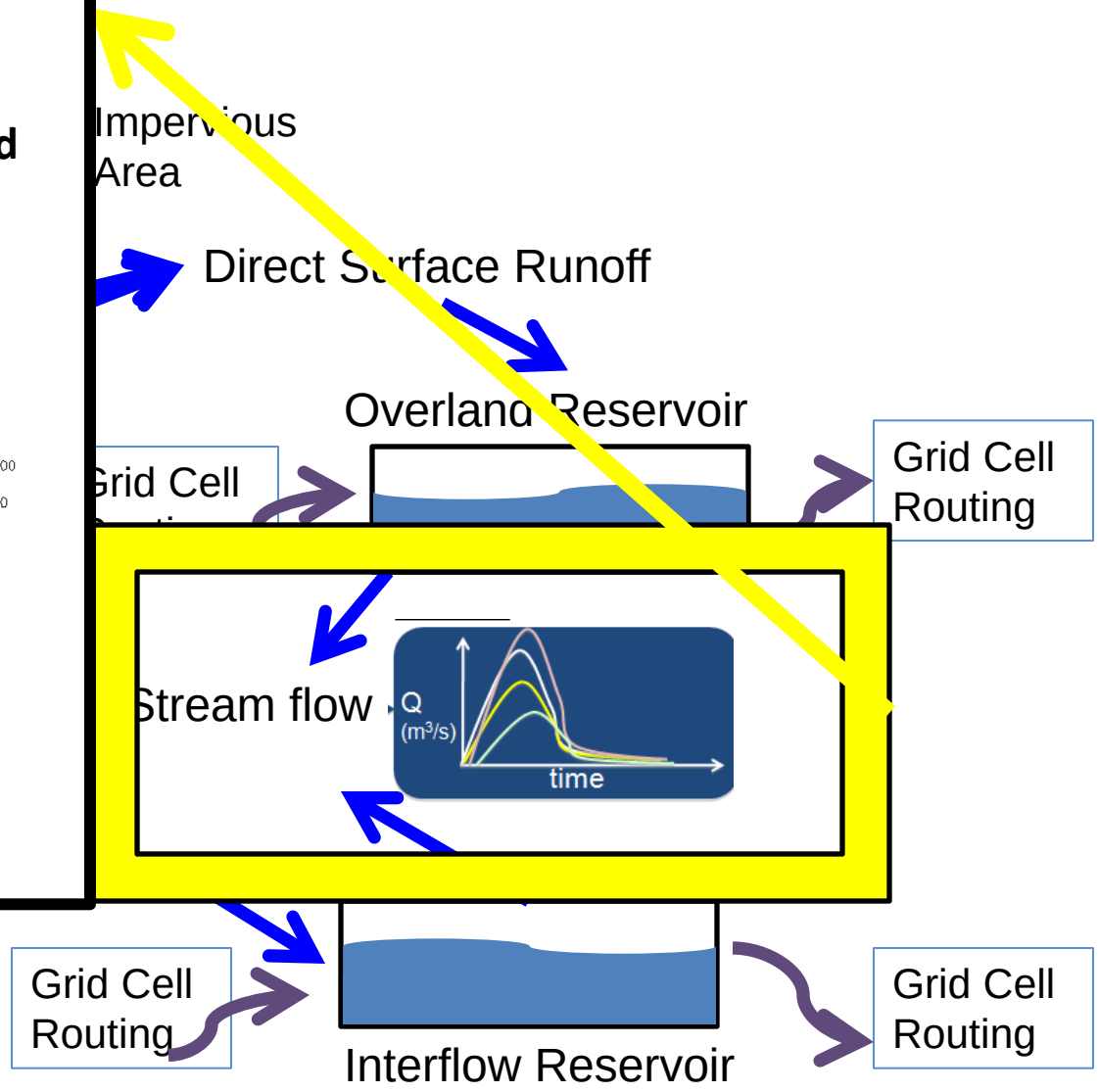
Interflo

CREST Model Outputs

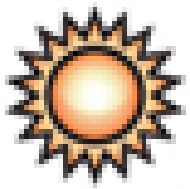
Runoff

- **Volume of water flowing over the grid cell per unit time**

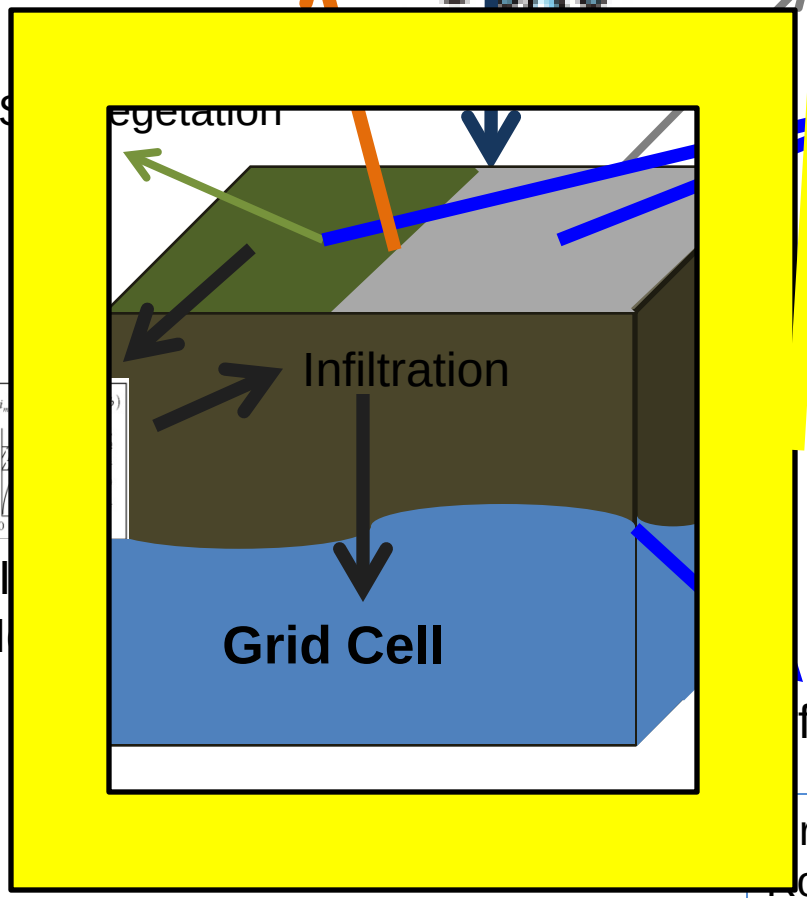




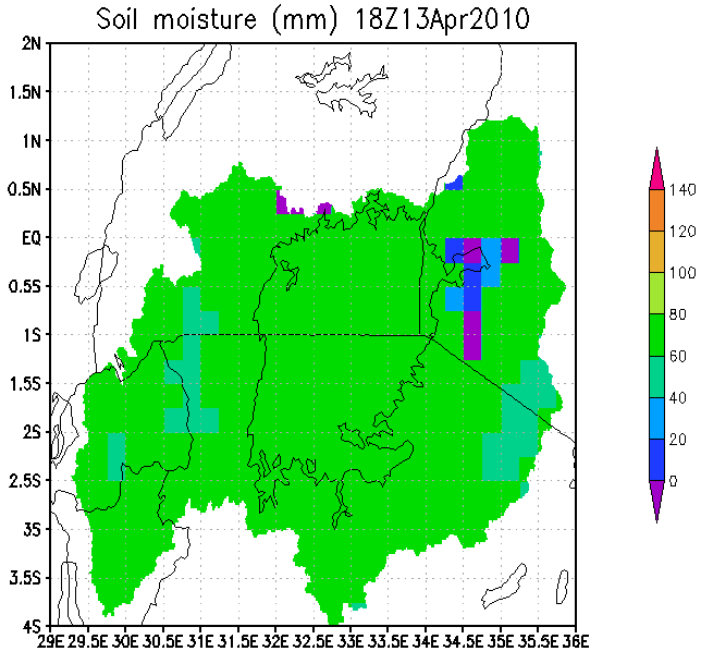
CREST Model Outputs

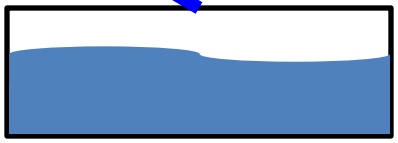


Evapotranspiration



Soil Moisture



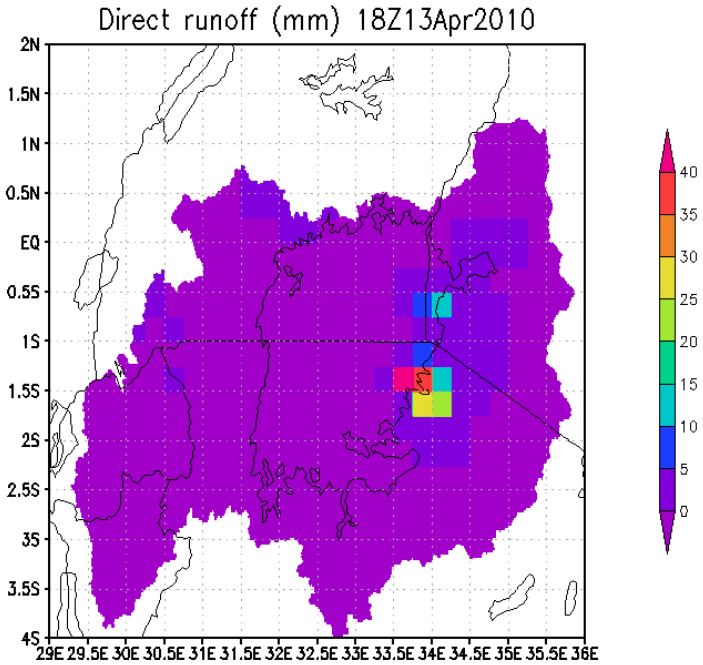


Interflow Reservoir

Grid Cell Routing

CREST Model Outputs

Direct Surface Runoff



Direct Surface Runoff

Grid Cell Routing

ream flow

Q (m^3/s)

time

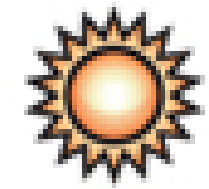
Interflow

Grid Cell Routing

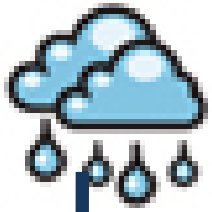
Interflow Reservoir

Grid Cell Routing

CREST Mo



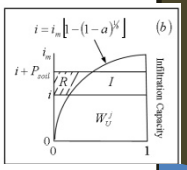
Evapotranspiration



Precip.

Soil/Vegetation

Infiltration



VIC Model

Grid Cell

Interflow

Interflow Reservoir

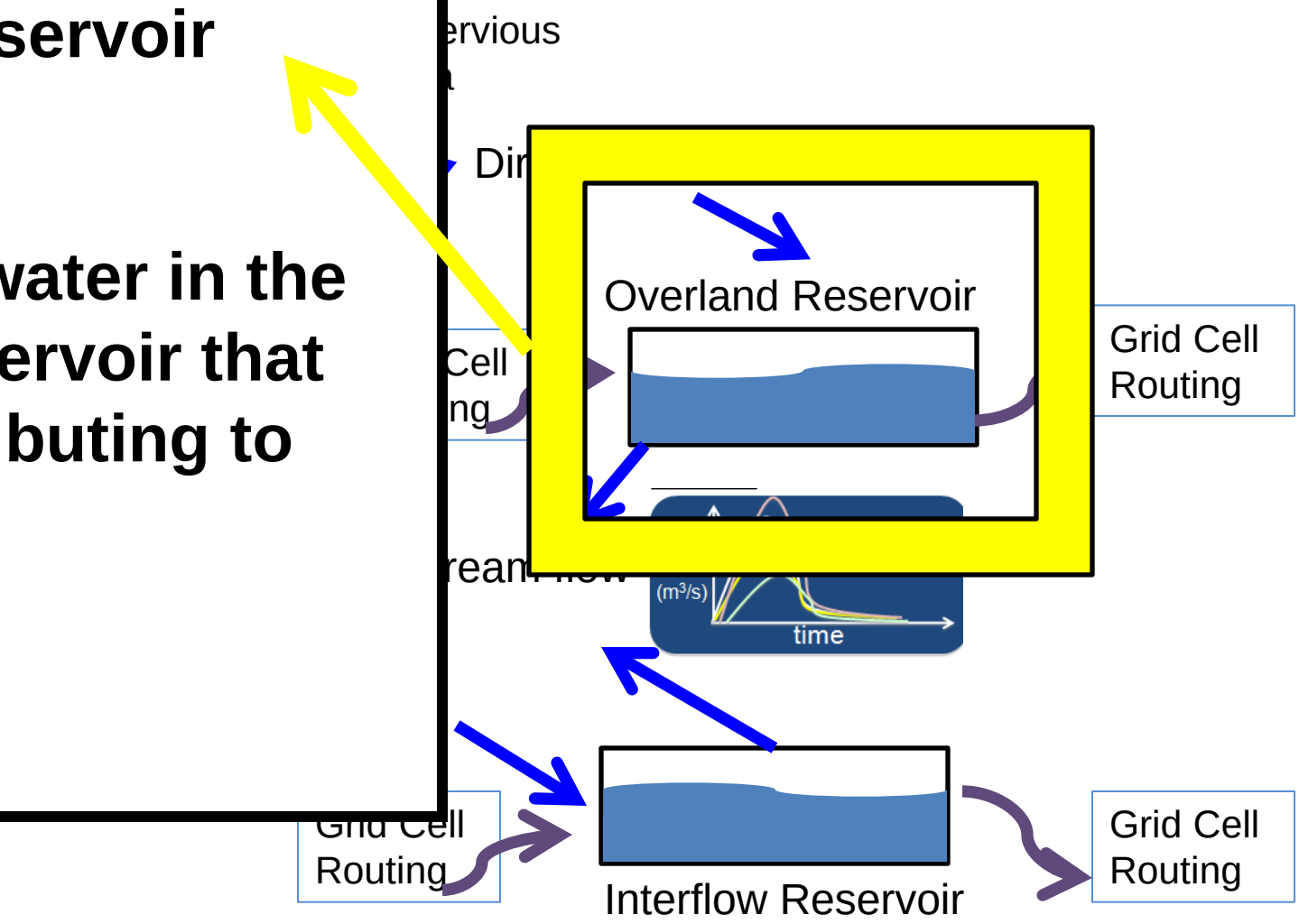
Infiltrated excess

- **Precipitation that infiltrated and is contributing to increasing the interflow reservoir**

CREST Model Outputs

Overland Reservoir Depth

- **Amount of water in the overland reservoir that will be contributing to Runoff**



CREST Model Outputs

Interflow Reservoir Depth

- **Amount of water in the interflow reservoir that will be routed and contribute to base flow Runoff**