LECTURE #17

ADDITIONAL HSPF FEATURES

ATMOSPHERIC DEPOSITION OVERVIEW

Types of Deposition

Dry Deposition

- Input as areal flux rate – ADFX
- Specified as lb/ac or kg/ha per interval

Wet Deposition

- Input as concentration in rainfall – ADCN
- Specified as mg/l

Methods of Specifying Deposition

Monthly-varying

- Input values for first day of each month in MONTH-DATA table
- Daily values interpolated from these values

Time Series

- User supplies an input time series in WDM file

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HSPF MODULE SECTIONS AND CONSTITUENTS RECEIVING ATMOSPHERIC DEPOSITION

PERLND and IMPLND

Unit area fluxes added to surface or upper zone storages only

Dry Flux = **ADFX**

Wet Flux = **PRECIP** x **ADCN**

PQUAL	Overland flow-associated constituents
PEST	All pesticides (crystalline, adsorbed, & solution forms)
NITR	NO3-N, NH3-N, and Organic N
PHOS	PO4-P and Organic P
TRACER	Tracer

IQUAL	Overland flow-associated constituents

RCHRES

Total fluxes added to dissolved storage

Dry Flux = **ADFX** x **Surface area**

Wet Flux = **PRECIP** x **ADCN** x **Surface area**

CONS	All conservative constituents
GQUAL	All general constituents
NUTRX	NO3-N, NH3-N, and PO4-P
PLANK	Refractory organic N, P, and C

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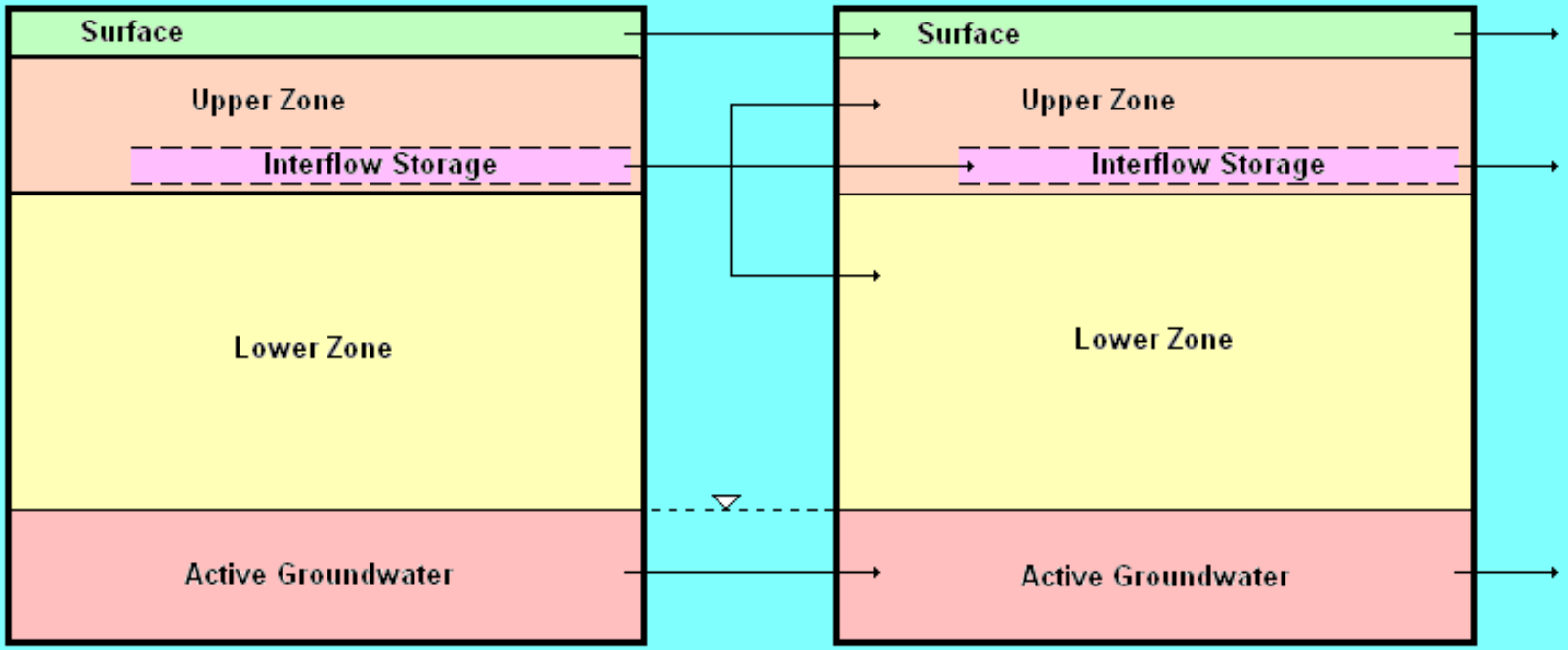
LATERAL INFLOW OVERVIEW

The existing outflow of any constituent for any PERLND or IMPLND may be routed as inflow to a downslope PERLND or IMPLND.



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LATERAL INFLOW METHODS

MASS BALANCE CONSTITUENTS

These constituents are modeled by tracking a storage and all input and output fluxes (e.g., flow, sediment, overland-flow-associated general constituent).

Lateral inflow is a direct transfer of mass to the storages in the downslope land segment. Permissible storages are surface, upper zone, interflow, lower zone, and active groundwater.

CONCENTRATION CONSTITUENTS

These constituents are modeled by assigning a concentration to the outflow of water or sediment (e.g., temperature, DO, sediment-associated general constituent)

Lateral inflow is handled by altering the outflow concentration as a function of the lateral inflow concentration. This can affect sediment-associated outflow, surface runoff, interflow, and baseflow. There is no effect on the upper zone or lower zone since these have no storages or direct outflows.

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LATERAL INFLOW PARAMETER INPUT

MASS BALANCE CONSTITUENTS - None

CONCENTRATION CONSTITUENTS

Weighting factors are used to specify the effect of lateral inflows on the effective outflow concentration. Separate factors are specified for each relevant soil layer (surface, baseflow, etc.) The PERLND table appears below.

LAT-FACTOR

< PLS>	Sediment	Surface	Interflow	Baseflow ***
#	#	SDLFAC	SLIFAC	ILIFAC	ALIFAC ***
1	5	0.3	0.5	0.5	0.4

END LAT-FACTOR

Effective outflow concentration is computed each timestep as the weighted average of the original computed concentration and the lateral inflow concentration.

Refer to Time Series Catalog for details of the lateral inflow time series.

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SPECIAL ACTIONS OVERVIEW

Special Actions are used to represent the effects of processes that are not addressed by the model algorithms - particularly *human intervention* in the natural system.

They are commonly used to:

1. Alter miscellaneous parameters for natural processes not explicitly modeled.
2. Modify soil storages of agricultural chemicals to represent fertilizer and pesticide applications.
3. Alter soil characteristics to represent effects of agricultural operations.
4. Perform reservoir operations that are too complex to represent with existing options.

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SPECIAL ACTIONS TYPES

TYPE	EXAMPLE OF USAGE
Basic	One-time alteration of a parameter or storage
Repeated	Annual fertilizer applications on same date
Conditional	Avoid applying chemicals during a rain event by using a logical condition
Deferred	Re-attempting a failed conditional action after a specified delay
Undated	Reservoir operation rule applied every interval of the run
Distributed	Spread out fertilizer application over several days/weeks to simulate variability in local farming practices
User-defined Variable Name	Create a single name for a compound fertilizer type such as manure, or represent gross operations such as moldboard plowing or harvesting
User-defined Variable Quantity	Gain access to the value of an internal variable for use in a logical condition (e.g., the rainfall in the current timestep) or as an action value

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SPECIAL ACTION DETAILS

Basic Action line

A Special Action modifies a single Target variable at a given point in time. It can be reset to, or incremented by, a given Action Quantity.

```
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  PERLND  1   3     1976/06/05 12         SPS     2  1    +=     0.625
```

Math functions

An Action may modify a variable in many different ways (e.g. subtract, multiply, log, exponentiation)

```
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  PERLND  1   3     1976/06/05 12         SPS     2  1    *=       0.9
```

Repeated

An Action may be repeated, e.g. annually for ten years.

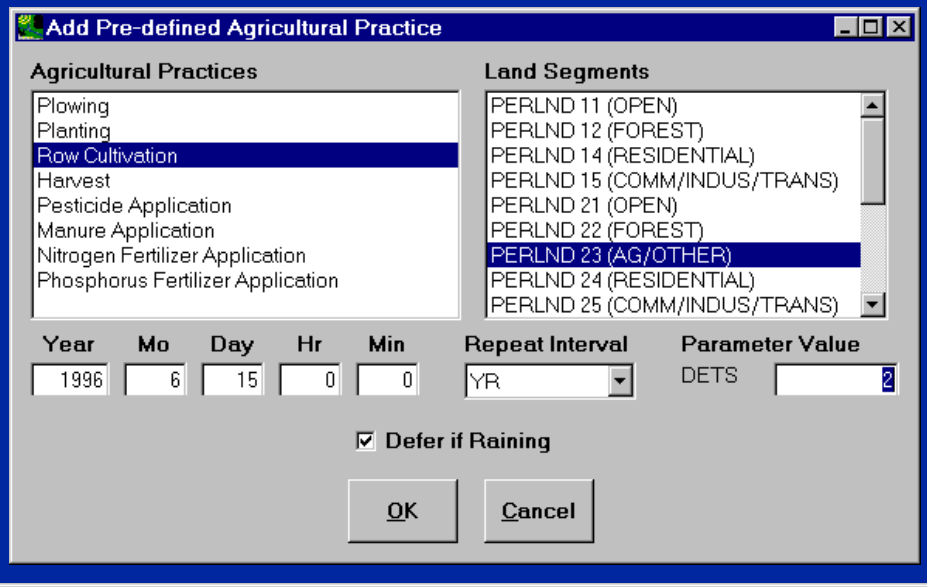
```
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  PERLND  1         1976/06/05 12         SPS     2  1    +=     0.625 YR   1 10
```

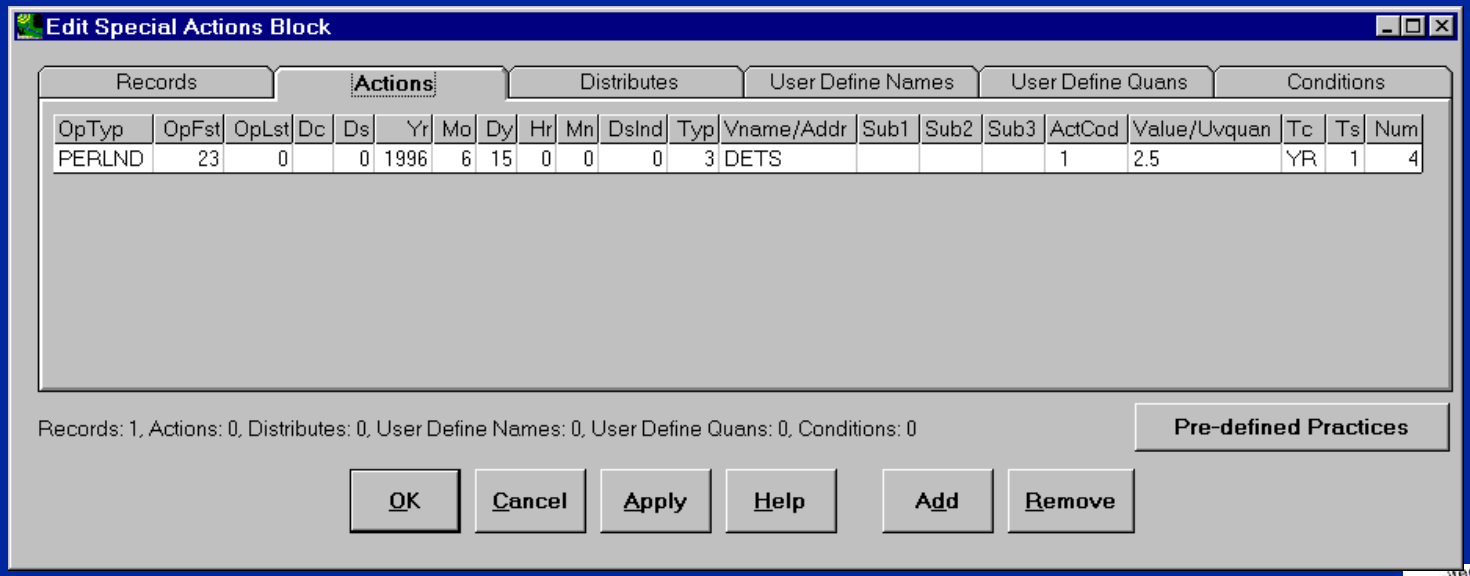
Conditional (IF / ELSE IF / ELSE / END IF)

An Action may depend on simulated conditions in the basin by referring to the current value of any variable in any operation.

```
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
IF (precip < 0.01) THEN
  PERLND  1         1976/06/05 12         SPS     2  1    +=     0.625 YR   1 10
END IF
```

SPECIAL ACTION EDITING IN WINHSPF





IRRIGATION OVERVIEW

IRRIGATION DEMAND - Choose one of three methods:

- Input timeseries
- Scheduled applications and rates
- Root zone soil moisture algorithm (AFSIRS)

WATER SOURCES - Choose up to 3 prioritized sources:

- External to basin, such as canals, pipes, and deep groundwater
- A RCHRES
- Local shallow groundwater (AGWS) in a PERLND

APPLICATION TARGETS - Divide among 5 possible storages:

- Interception (sprinkler systems)
- Surface (drip lines)
- Upper zone (shallow buried systems)
- Lower zone (deep buried systems)
- Active groundwater zone (seepage irrigation ditches in field)

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ROOT ZONE MOISTURE ALGORITHM

Inputs

- Depth (**CRDEP**), field capacity (**FLDCAP**), and wilting point (**WILTP**) for each soil layer.
- Growing season, root depth (**CRDEP**), and maximum allowable water depletion (**AWD**) for each crop (up to 3 crops per year). **CRDEP** and **AWD** may be constant or monthly varying, or may be defined by 4 stages of crop growth.
- Irrigation efficiency (**IREFF**)
- Fraction of land segment receiving irrigation (**ARZI**)

Method

- The root depth and soil layer parameters are used to compute the available water capacity (AWC) and field capacity of the crop root zone
- **AWD** is the fraction of AWC that may be depleted before irrigation is needed.
- When AWD is reached, net irrigation demand (NIR) is the amount of water needed to raise the root zone water storage up to field capacity.
- Gross irrigation demand (IRRDEM) = NIR adjusted by **IREFF**.

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