

# An Overview of North Slope Hydrology and Potential Response to Climate Change

Presented by:

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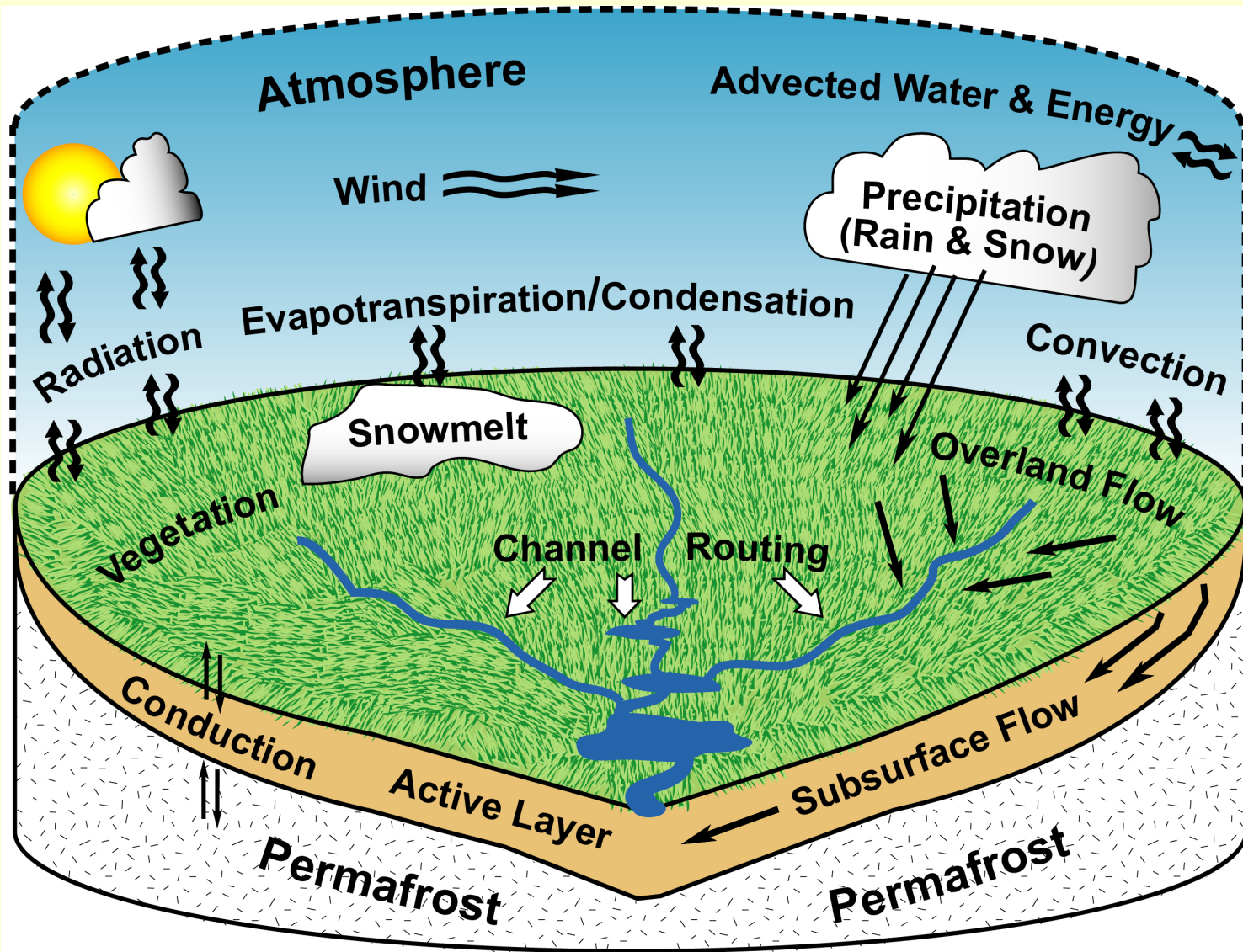
Wildlife Response to Environmental Arctic Change

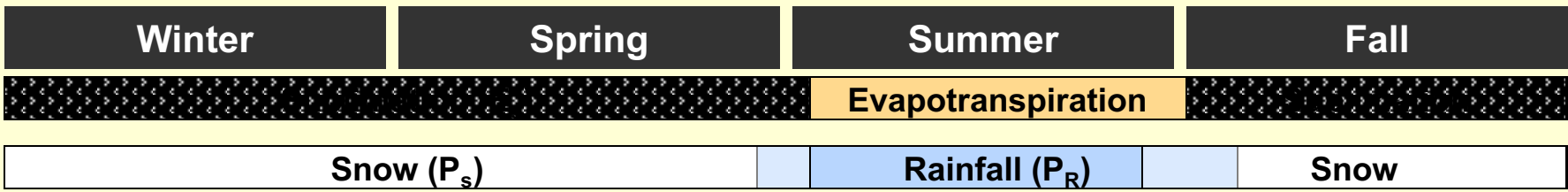
(WildREACH)

17-18 November 2008

# Outline

- Introduction to the Arctic hydrologic cycle
- General water balance approach
- Discussion of seasonal hydrologic features in the Arctic
- Hydrologic response to climate change
  - Scenario I: Increasing air temperature
  - Scenario II: Increasing air temperature with increasing precipitation
- Panel discussion

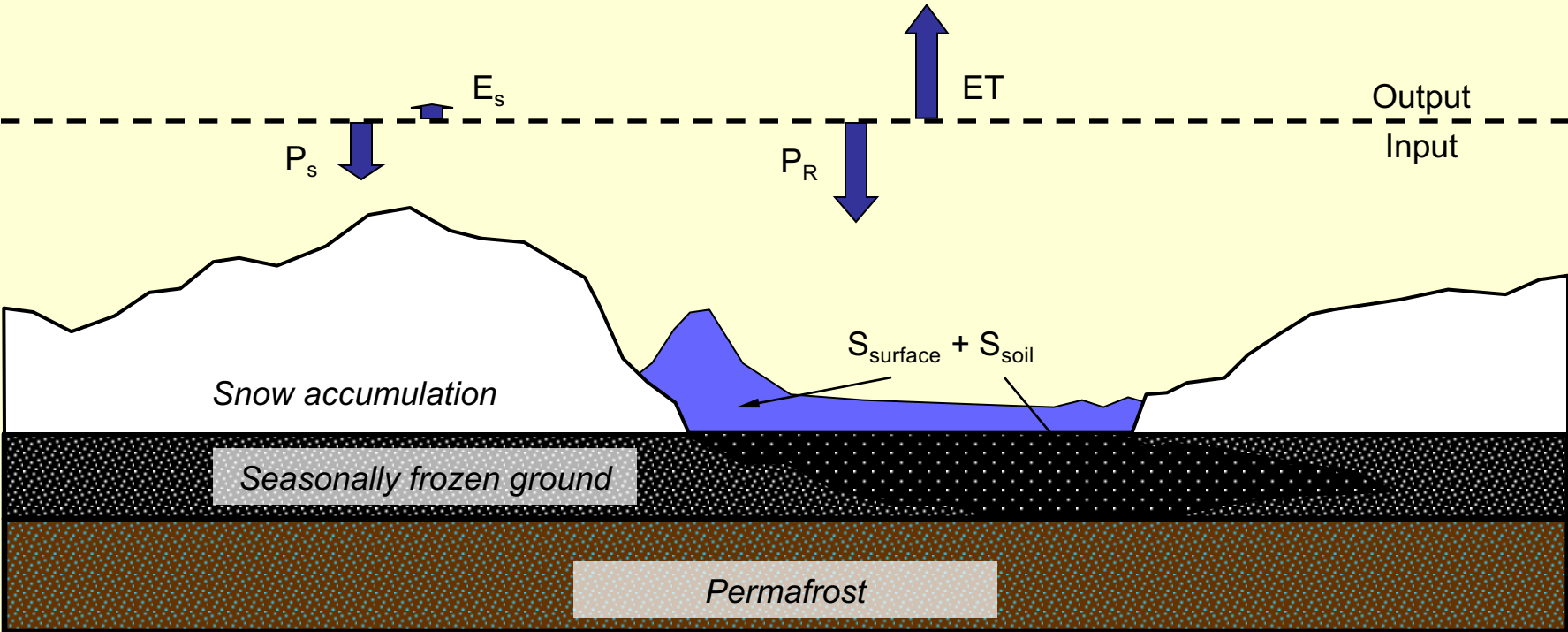




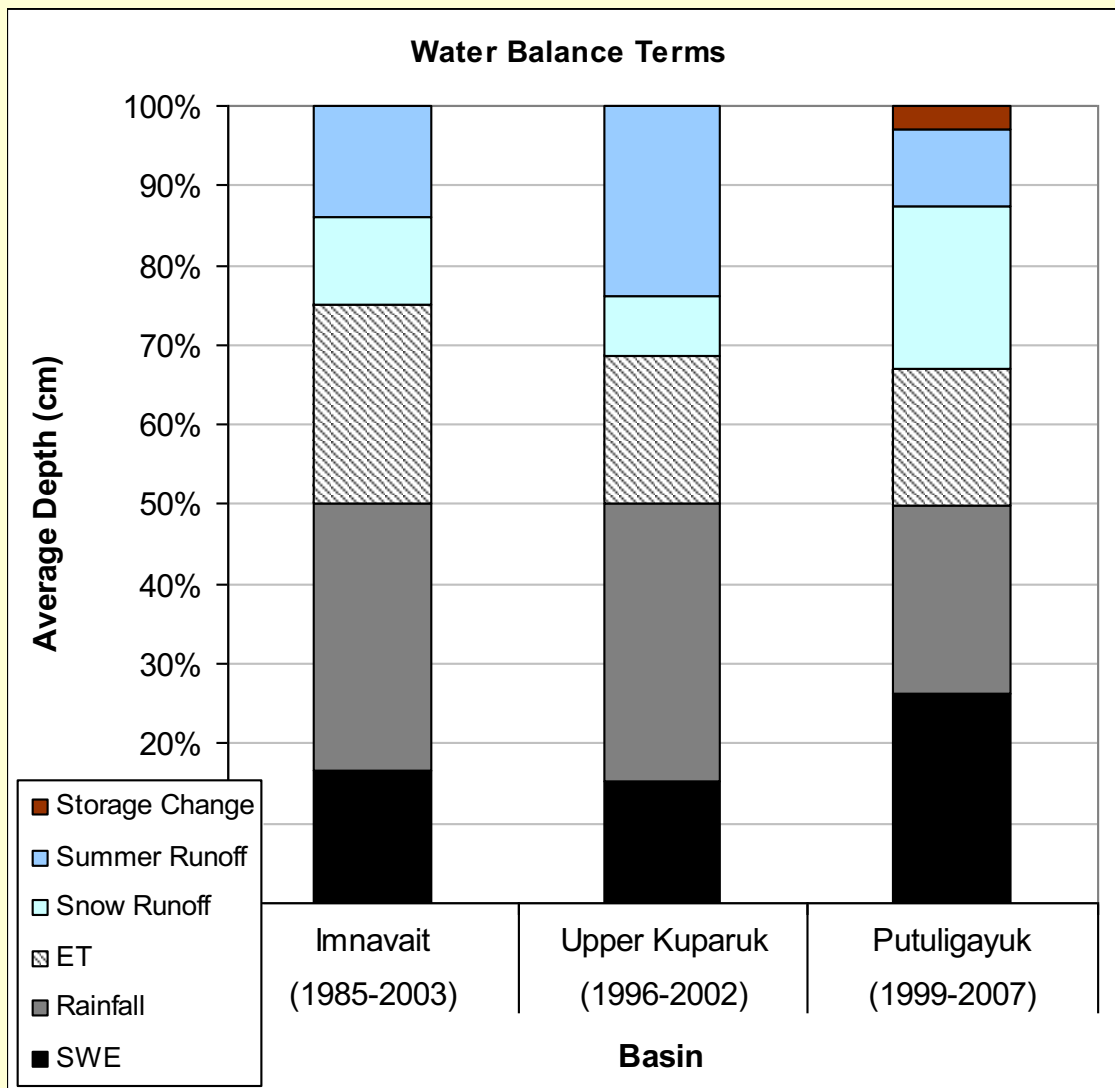
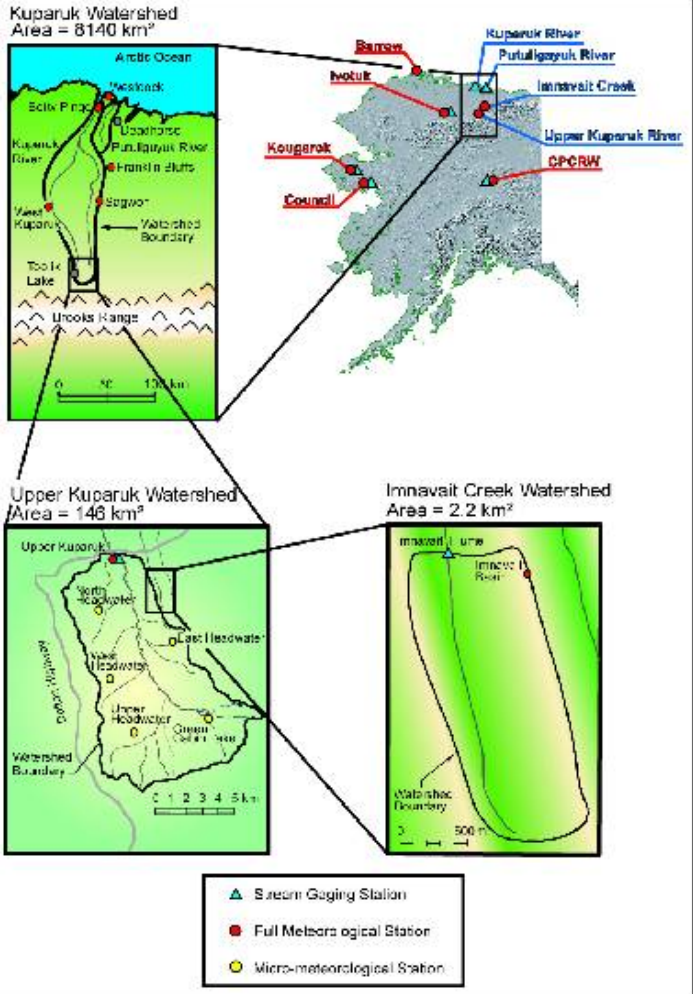
**Water Balance:**

$$(P_S + P_R) - (E_S + ET) - R = \Delta (S_{\text{surface}} + S_{\text{soil}})$$

P<sub>s</sub>=snow, P<sub>R</sub>=rain, E<sub>s</sub>=sublimation, ET=evapotranspiration, R=surface runoff,  
 S<sub>soil</sub>=soil moisture storage, and S<sub>surface</sub>=surface water storage

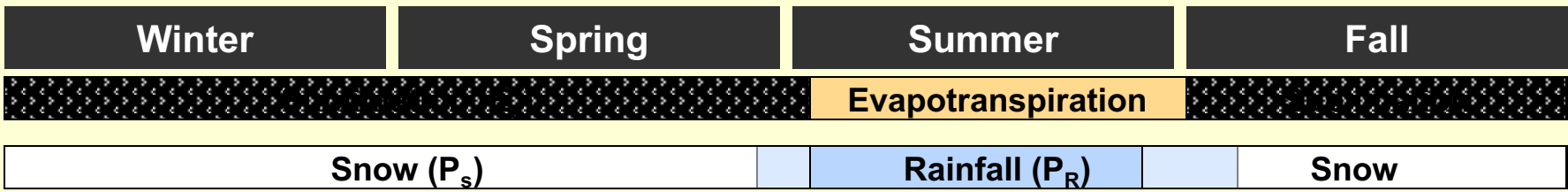


# Water Balance Terms for Selected Arctic Basins



Data sources: Kane et al., 2000; Kane et al., 2004; Kane et al., 2008.

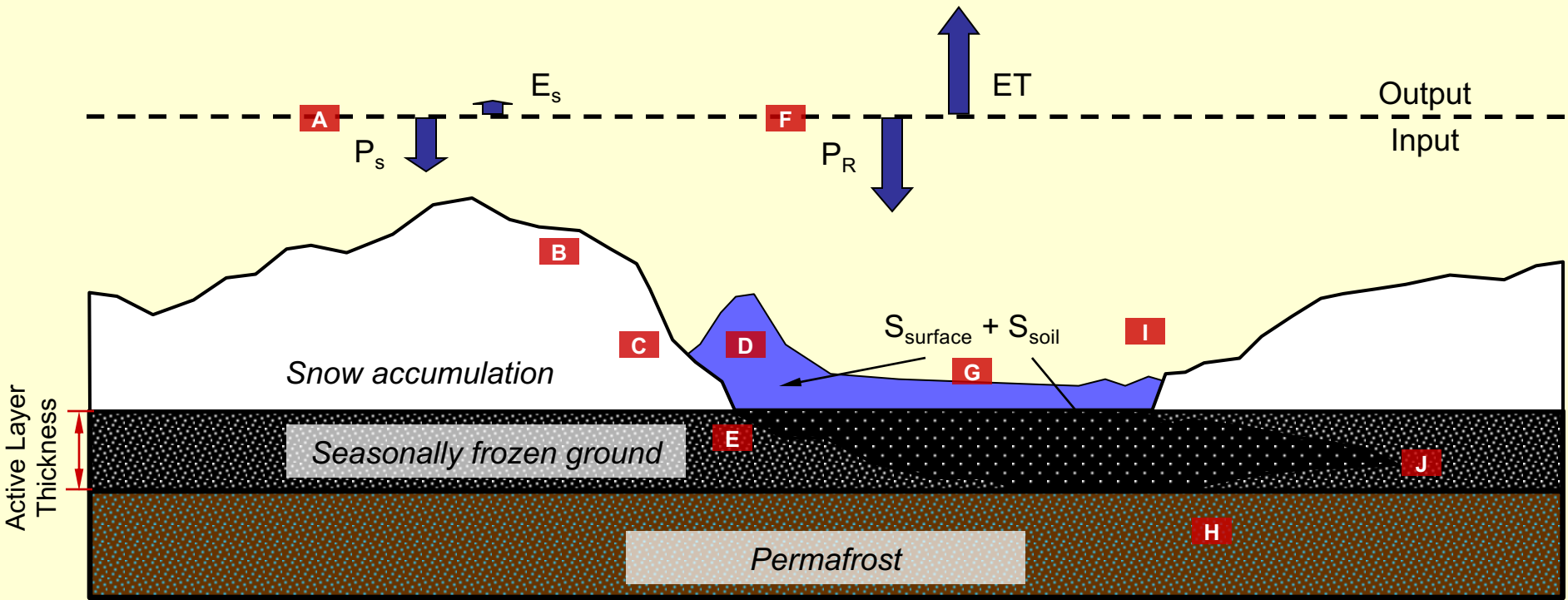
Map from WERC/UAF



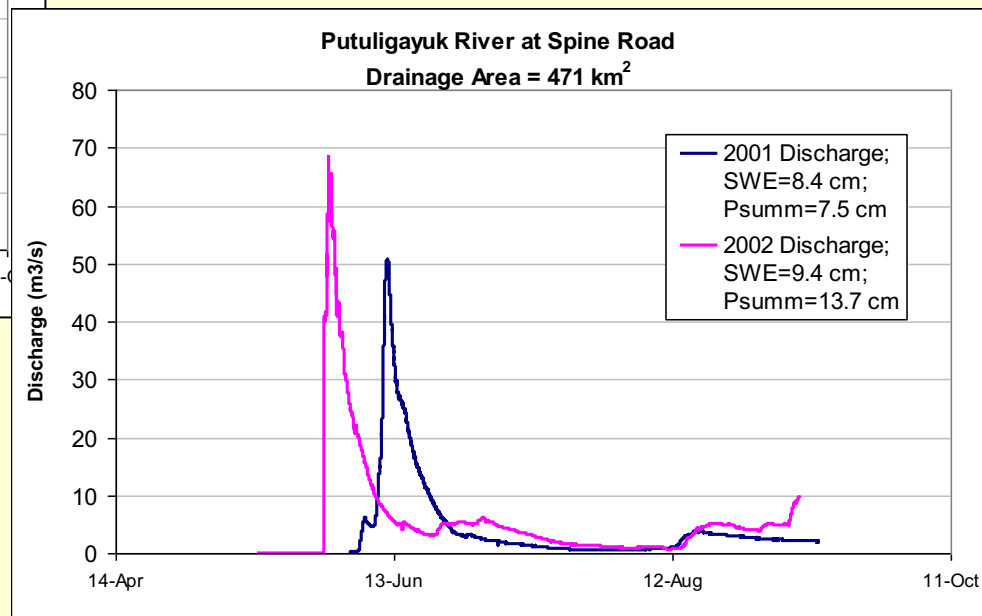
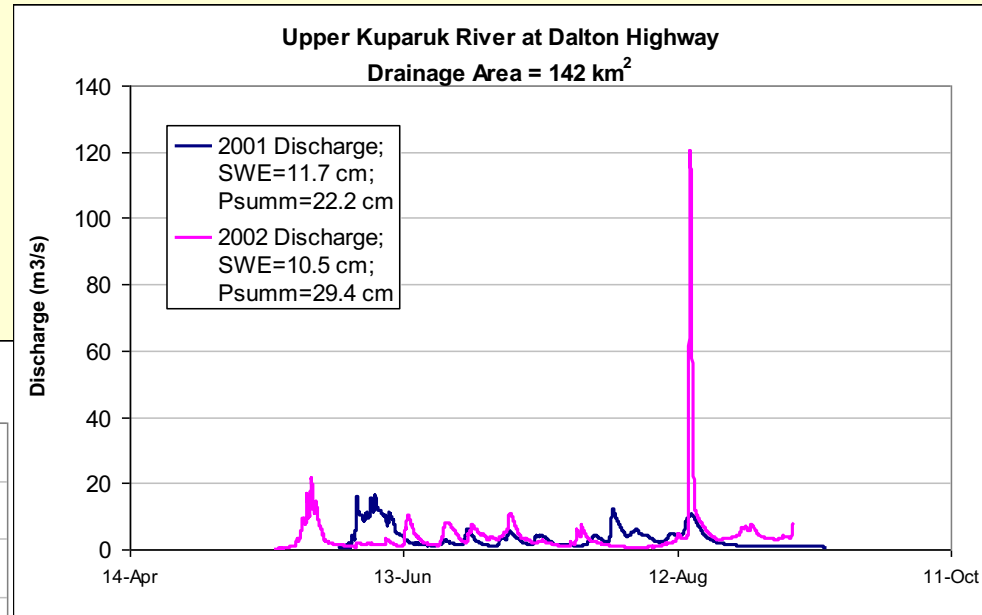
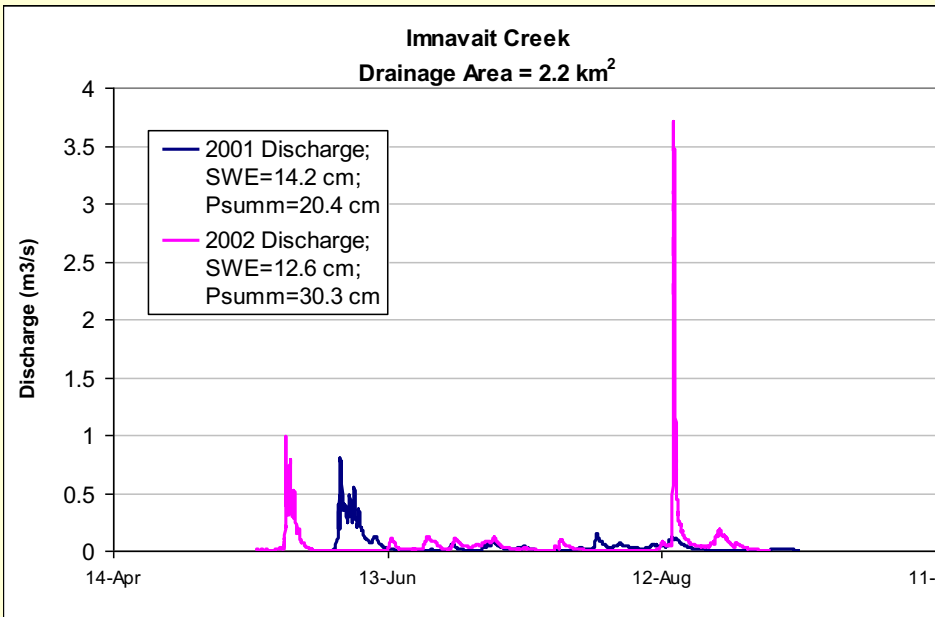
**Water Balance:**

$$(P_s + P_R) - (E_s + ET) - R = \Delta (S_{\text{surface}} + S_{\text{soil}})$$

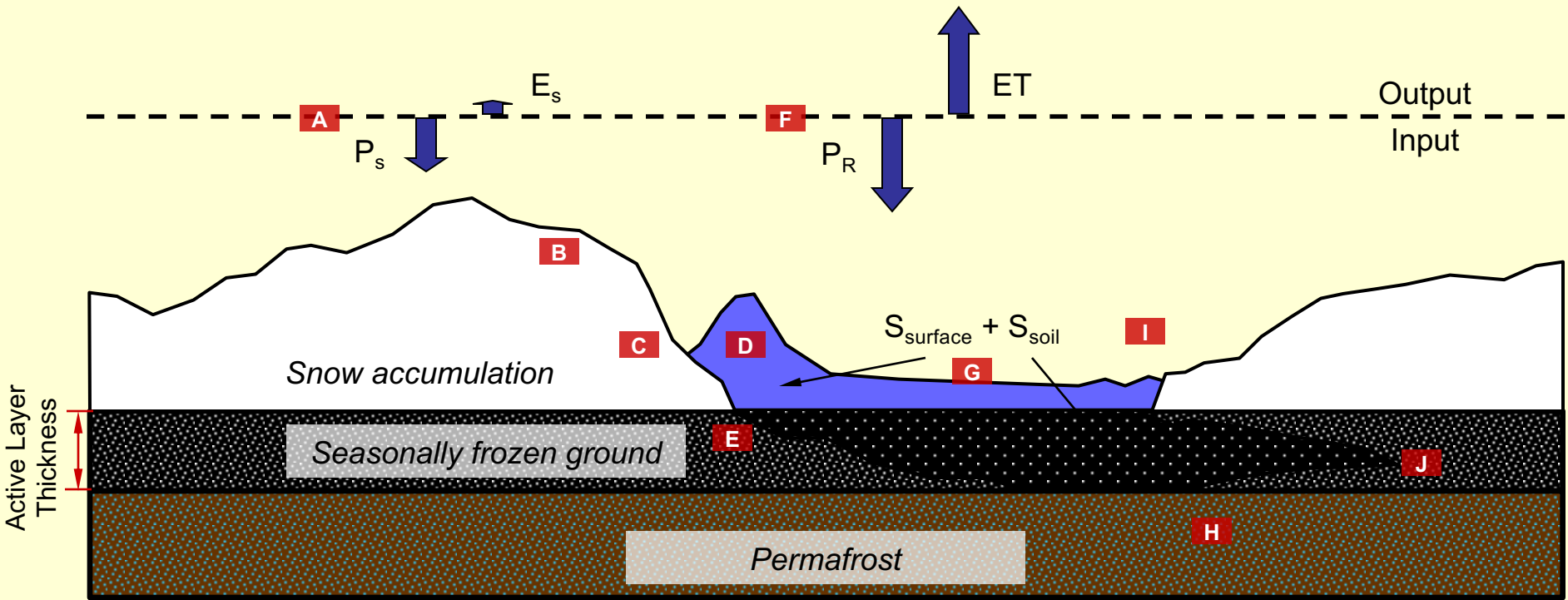
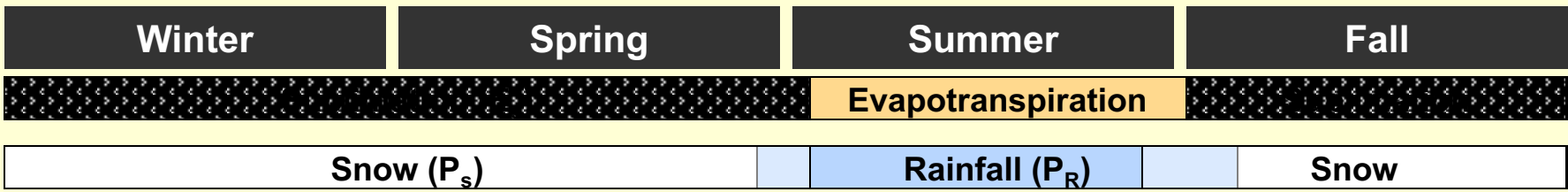
$P_s$ =snow,  $P_R$ =rain,  $E_s$ =sublimation,  $ET$ =evapotranspiration,  $R$ =surface runoff,  
 $S_{\text{soil}}$ =soil moisture storage, and  $S_{\text{surface}}$ =surface water storage



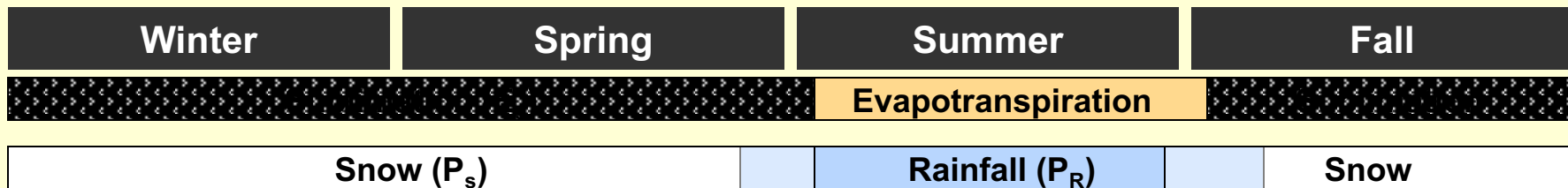
# Hydrographs for Selected Basins and Years



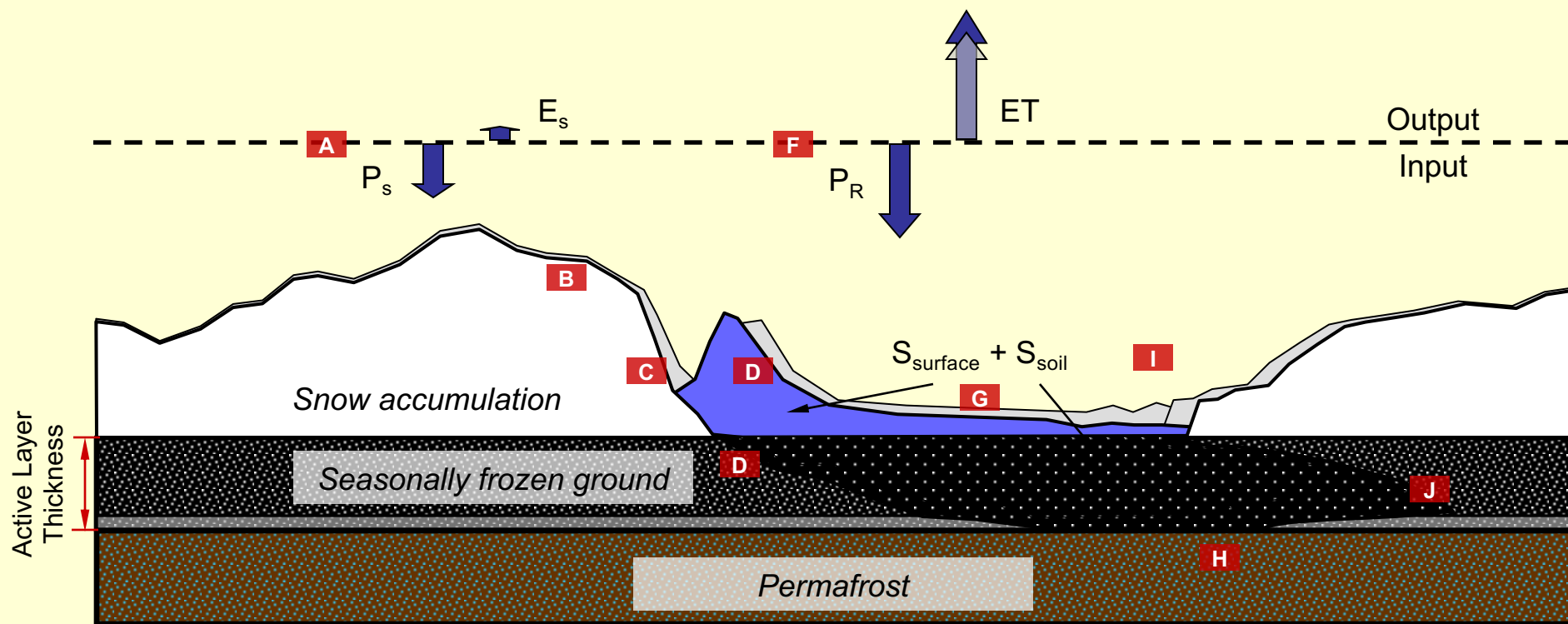
**Kane, D.L. and Hinzman, L.D., 2008.** Climate data from the North Slope Hydrology Research project. University of Alaska Fairbanks, Water and Environmental Research Center. URL: <http://www.uaf.edu/water/projects/NorthSlope/>. Fairbanks, Alaska, variously paged. November, 2008.

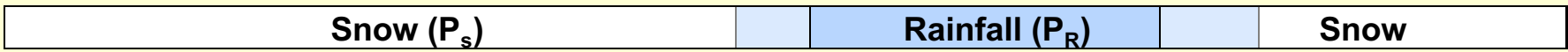
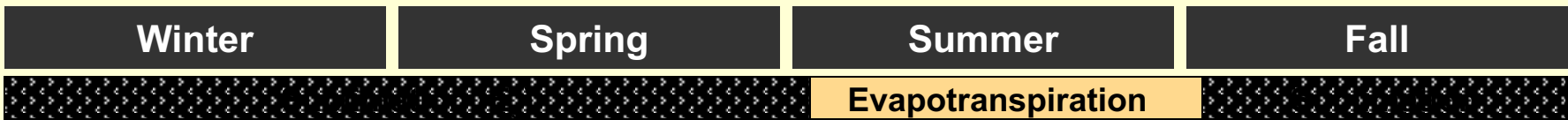






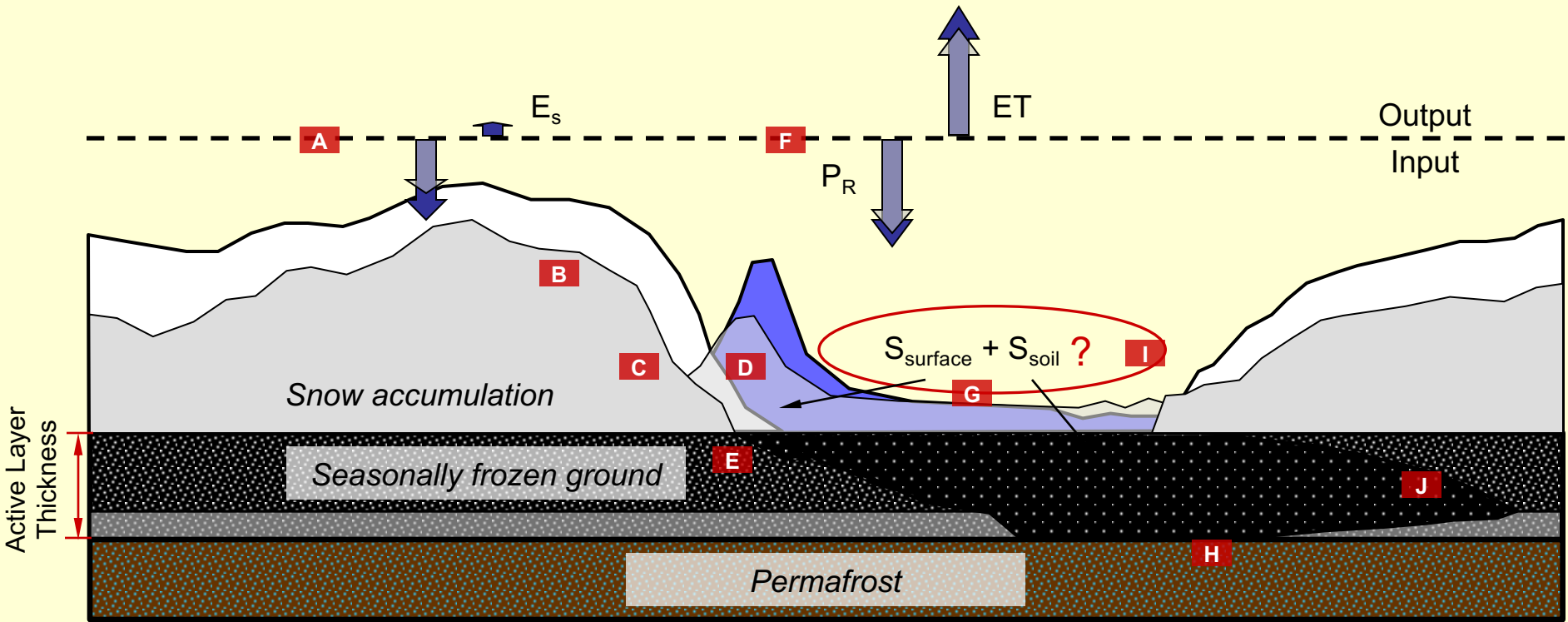
↑ Temperature only	
↓ Winter energy flux from ground to atmosphere	↑ Summer energy flux from atmosphere to ground
Enhanced active layer development	↑ Potential for mid-winter melt and ice in snow
↑ Soil storage capacity (settlement?)	↑ Evapotranspiration
Geomorphic and vegetation changes	↓ Soil moisture (no ↑ precipitation)





↑ Temperature, ↑ Precipitation

↓ Winter energy flux from ground to atmosphere Enhanced active layer development ↑ Soil storage capacity (settlement?) Geomorphic and vegetation changes	↑ Summer energy flux from atmosphere to ground ↑ Potential for mid-winter melt and ice in snow ↑ Evapotranspiration <b><u>Soil moisture change unknown</u></b>
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# References

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# Hydrology Panel

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