

# Case study on use of hydrological model to study the impact of climate change on snowmelt and water availability

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International Centre for Integrated Mountain Development

Kathmandu, Nepal

# Content

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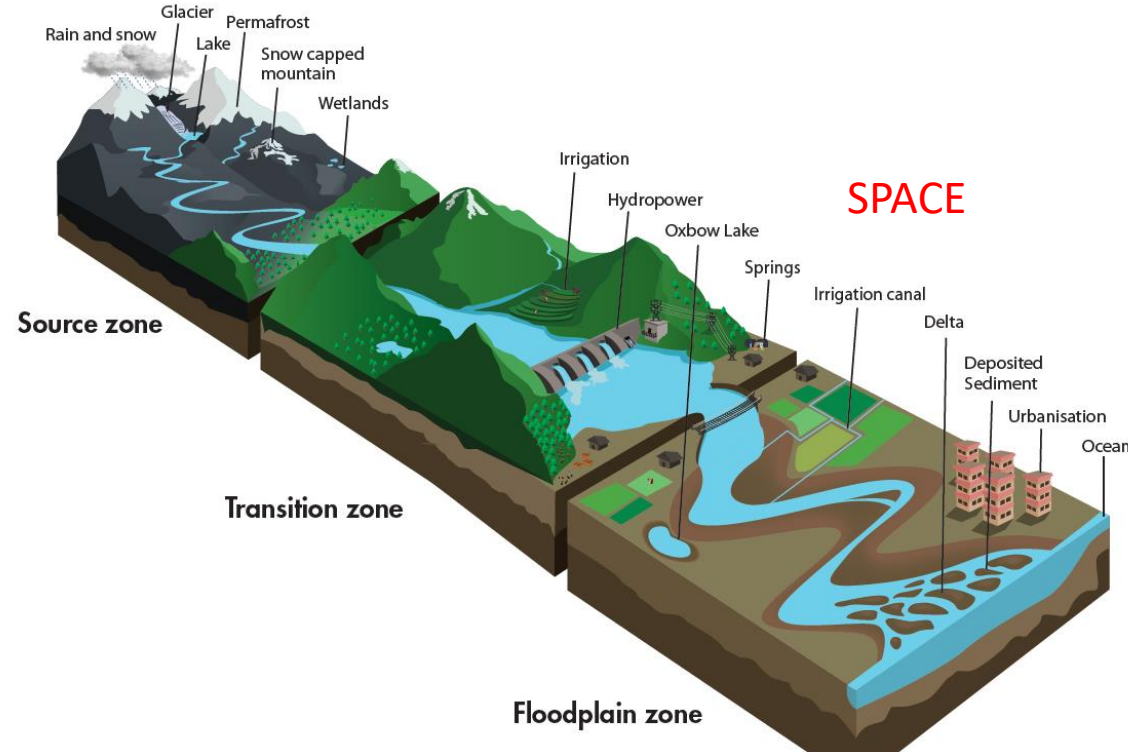
- Hydrological modelling system
- Model classifications
- Why hydrological models?
- Choosing the right models
- Impacts of climate change on snowmelt and water availability

# Hydrological modelling system

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- Simple representation of a part of hydrological cycle
- Definition:
  - “Mathematical representation of the flow of water and its constituents on some parts of the land surface or subsurface environment” (Maidment, 1993)
  - “Hydrologic models are simplified, conceptual representations of a part of the hydrological cycle” (Wikipedia)
  - **Models are imperfect representations, but are valuable tools** with which to study a variety of conditions and predict answers that would be impractical to obtain by measuring or observing the actual system (source:Comet)

# Representation of real world system



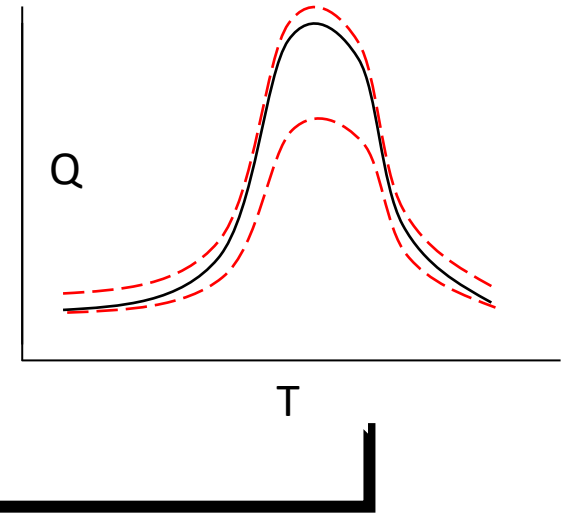
Reality

Modelling system

Input  
P, T, WS, RH, SH

**Representative Processes  
using models**

Parameters optimization



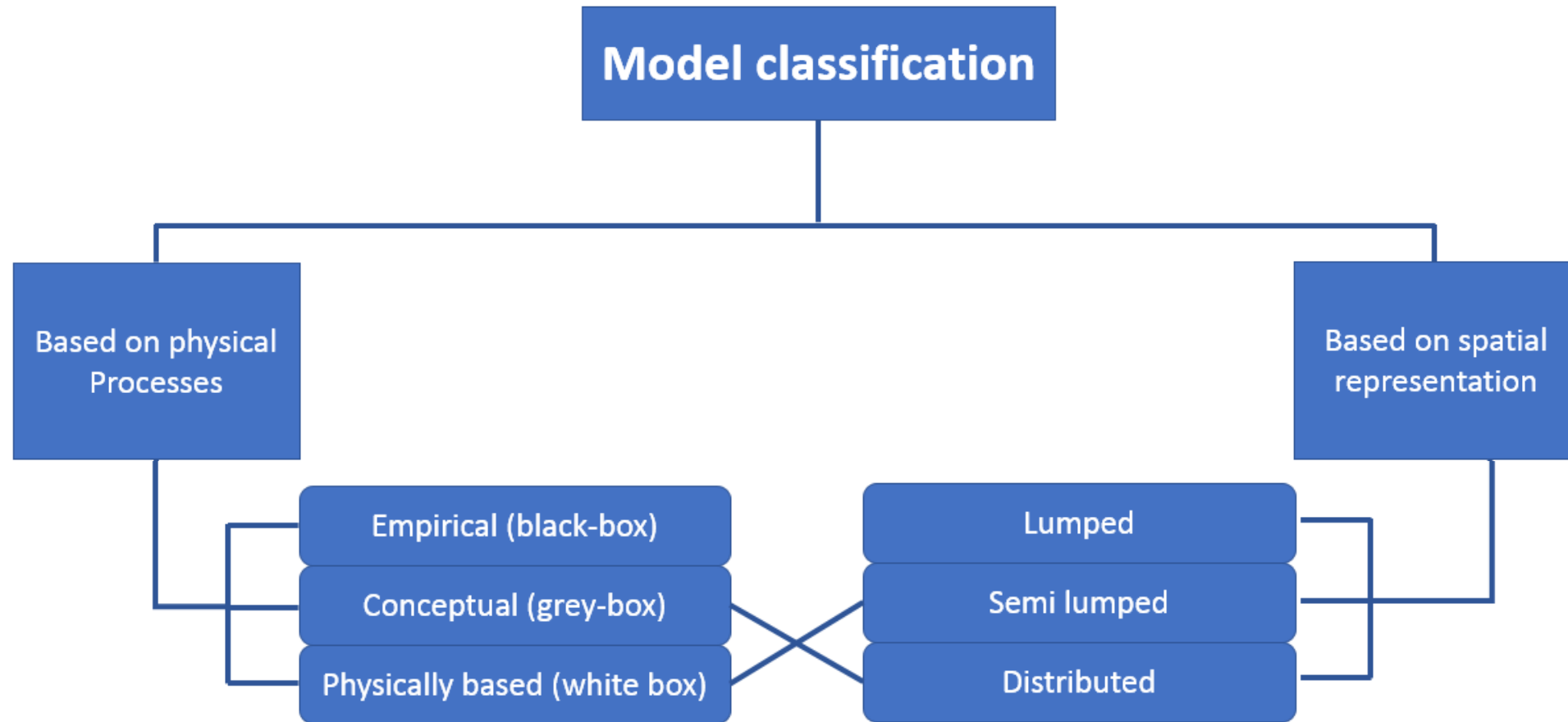
# Remember Uncertainty!!

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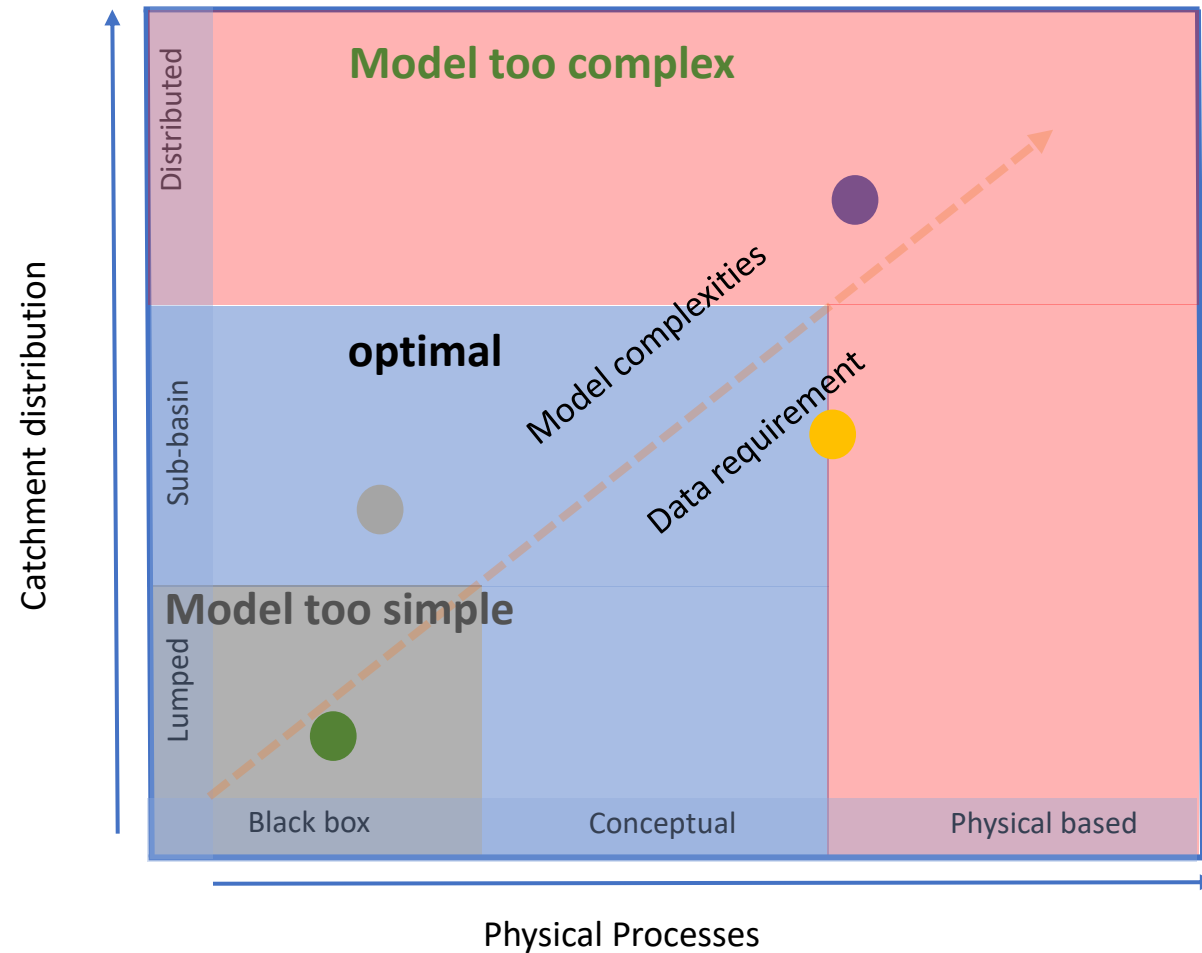
- Spatial representation of real world is limited!
- Input data are sparse !!
- Validation data is not perfect
- Model is 'just' a representation

UNCERTAINTY!!

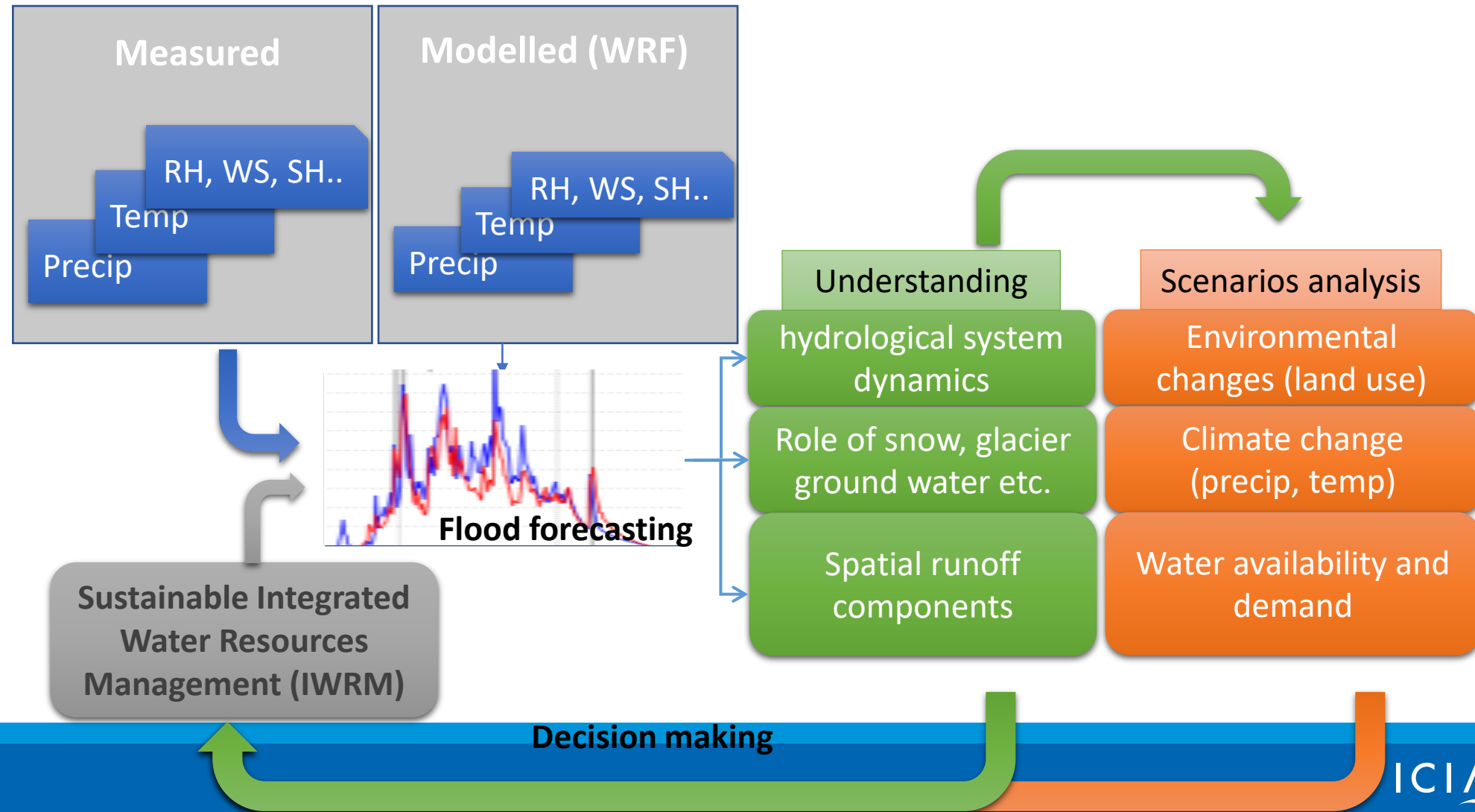
# Model classification



# How to choose the best model for you?



# Significance of Hydrological Modelling: Understanding system dynamics and planning







# Few hydrological models

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- J2000 hydrological model
- SWAT hydrological model
- GR4J hydrological model
- SPHY model

# Jena Adaptable Modelling System (JAMS)

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- Software framework for environmental model development and application
- Create *integrated models* from *single components*
- Features:
  - Hydrological and nutrient transport models (J2000, J2000S)
  - GUIs for model creation and deployment
  - Various computing environments (Desktop, Grid-based, Server-based, ...)
- JAVA-based, LGPL-licensed
- WWW: <http://jams.uni-jena.de>

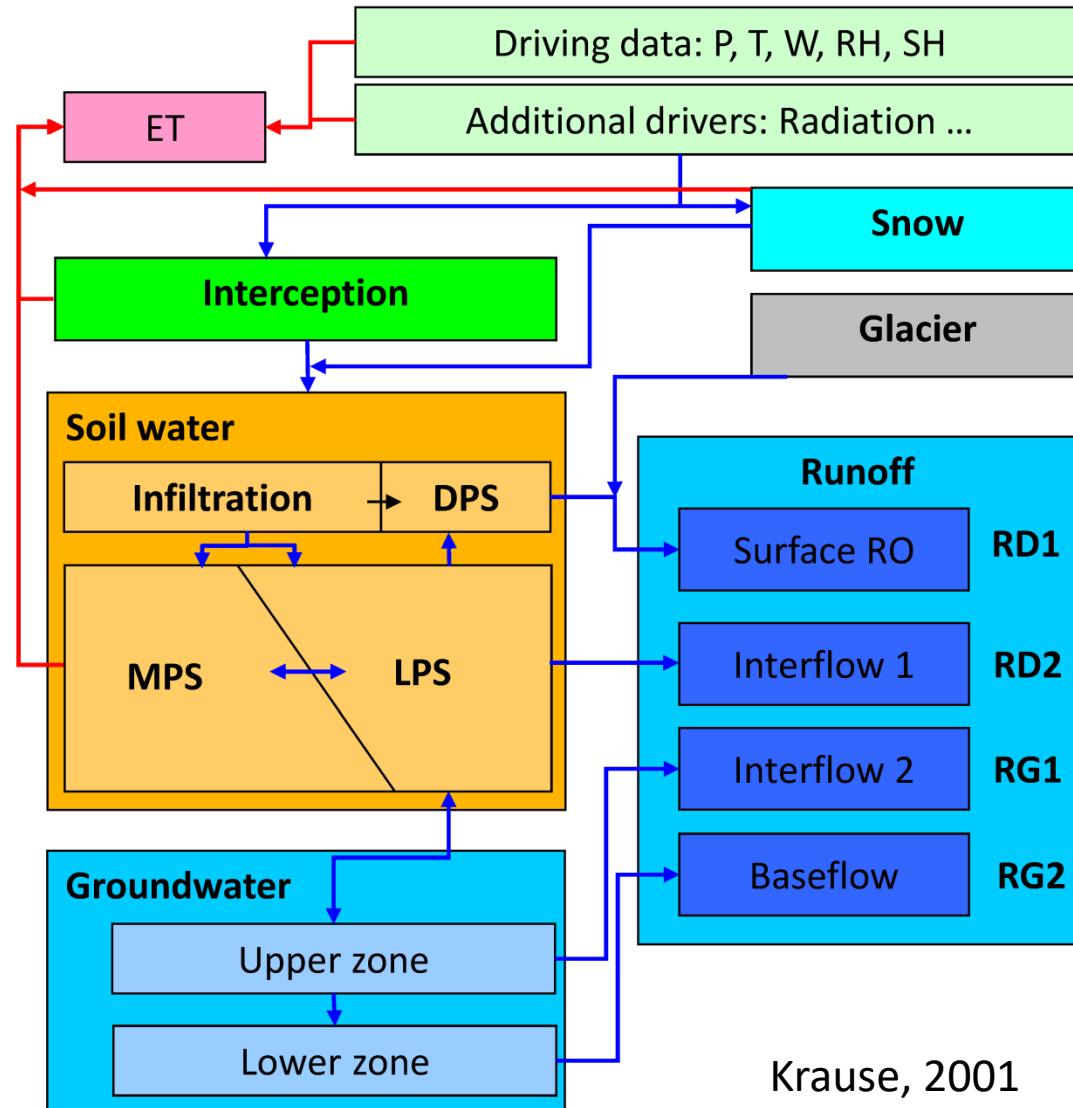


# JAMS-J2000

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- Process-oriented distributed hydrological model
- Implemented in the Jena Adaptable Modelling System (JAMS) framework
  - a software framework for **component-based** development and application of environmental models.
    - J2000g (simple water balance model),
    - Nutrient model (J2000-S)
- JAMS Data Explorer (JADE)
  - Sensitivity and uncertainty analysis
  - Web based calibration tools called 'OPTAS'

# Process oriented distributed hydrological model



- Glacier melt approach
  - Enhanced degree day factor
- Distributed output for each HRU

Krause, 2001

# Impacts of climate change on snowmelt and water availability

*Demonstration*





Photo Credit: Santosh Nepal

Thank you

ICIMOD