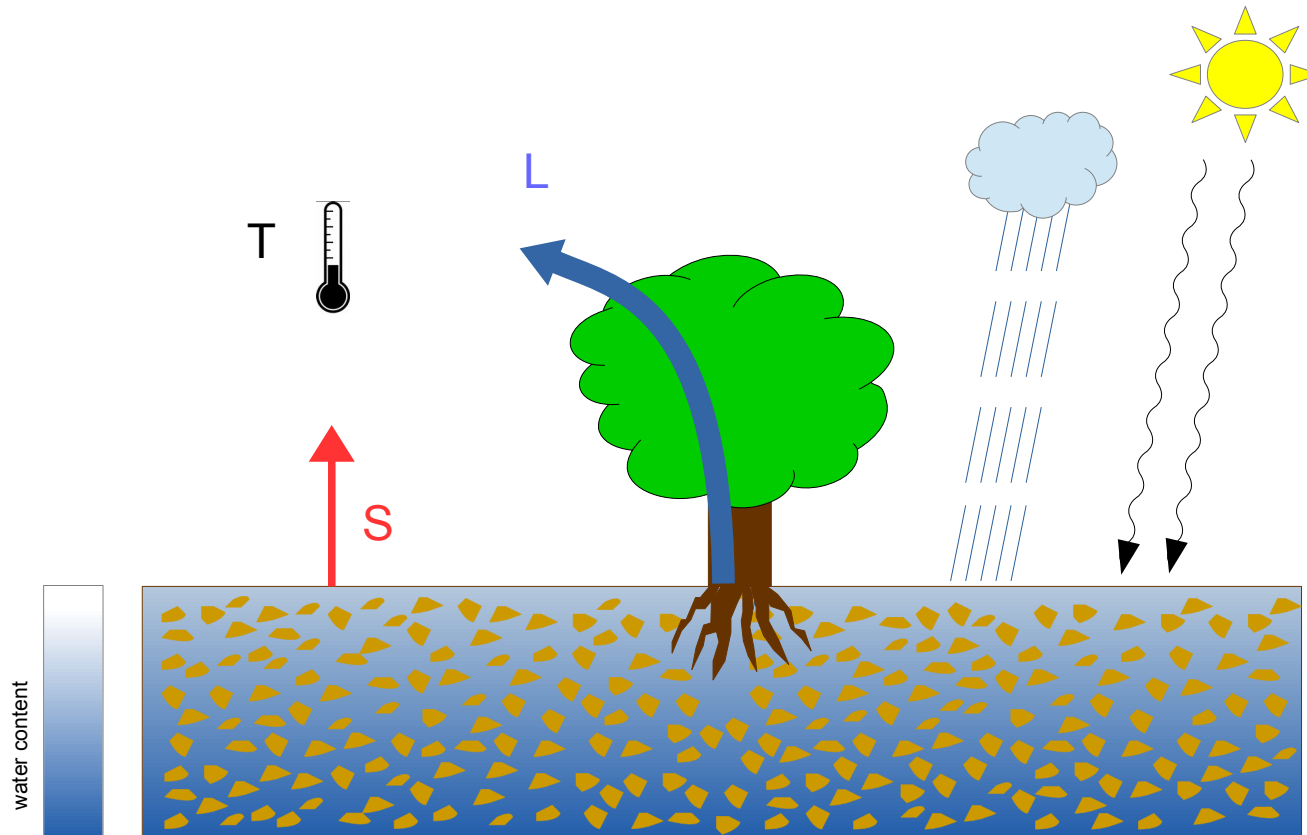Climate Limited-area
Modelling Community

The reduction of systematic biases in soil-moisture limited regions of Europe by stochastic root depth variation
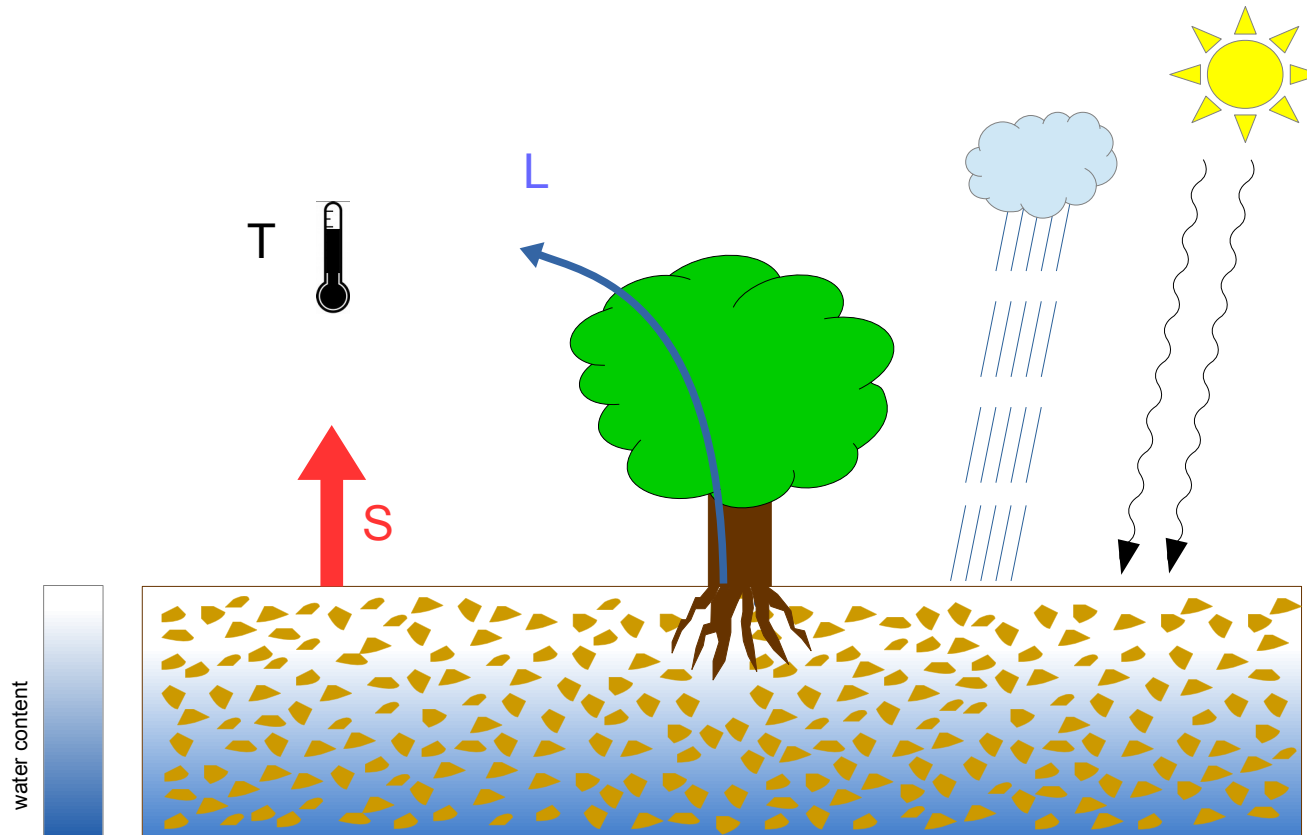
Marcus Breil

Institute of Meteorology and Climate Research,
Karlsruhe Institute of Technology (KIT)

Concept
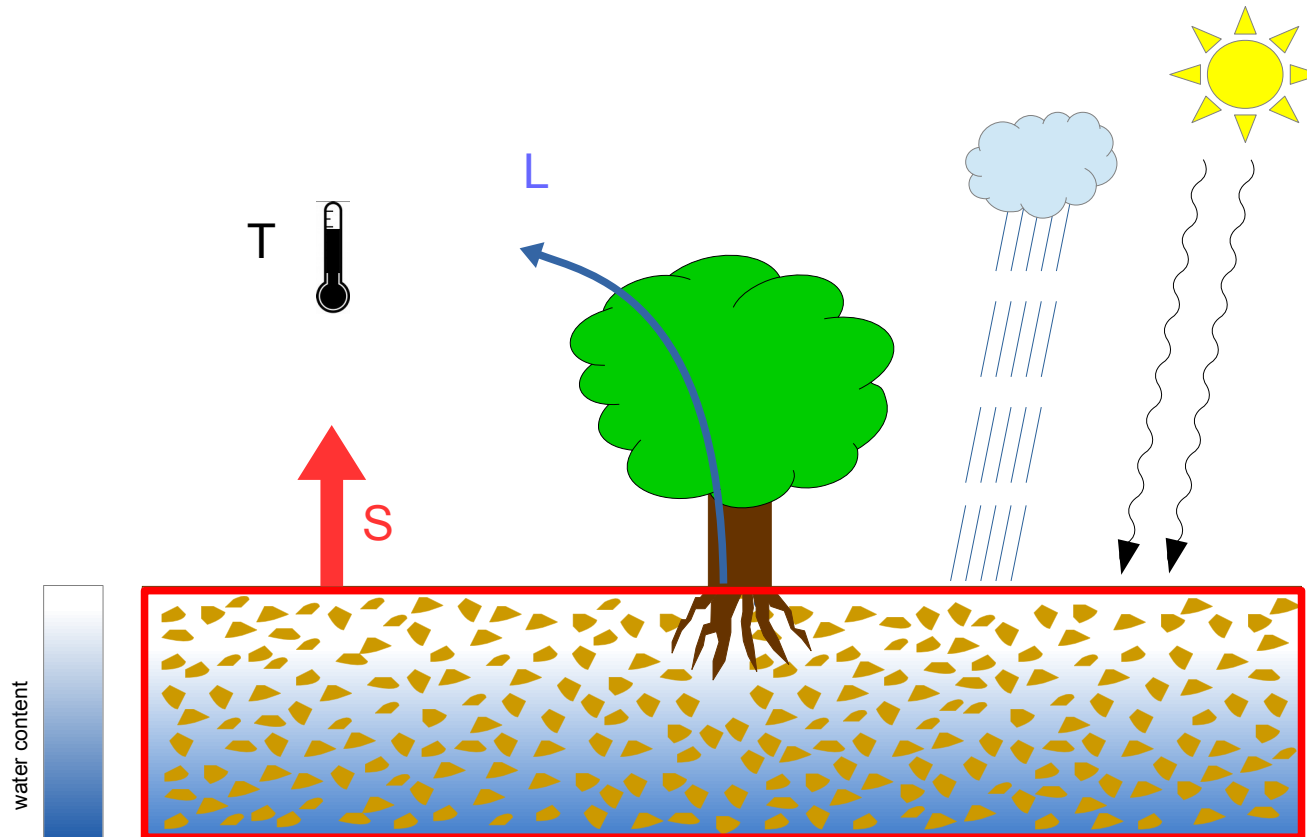
Concept

Concept

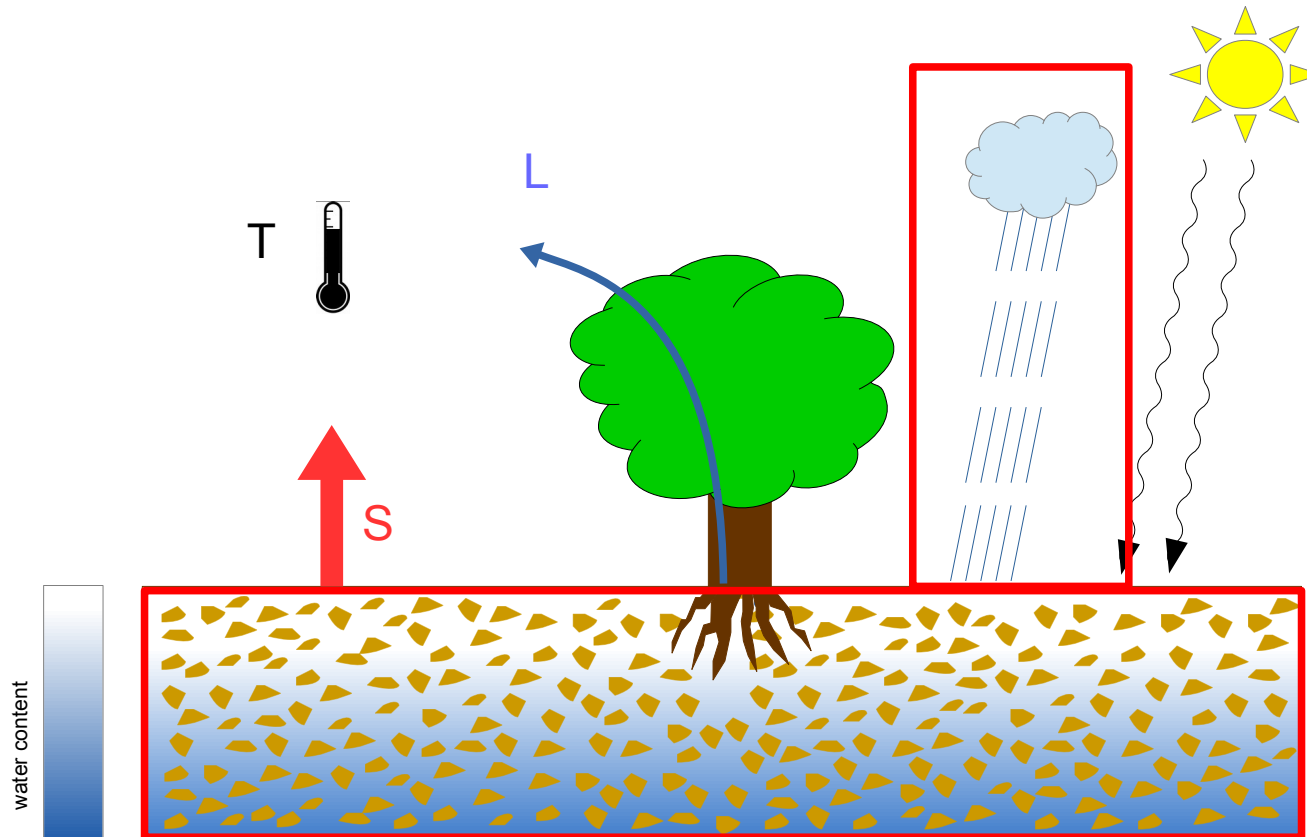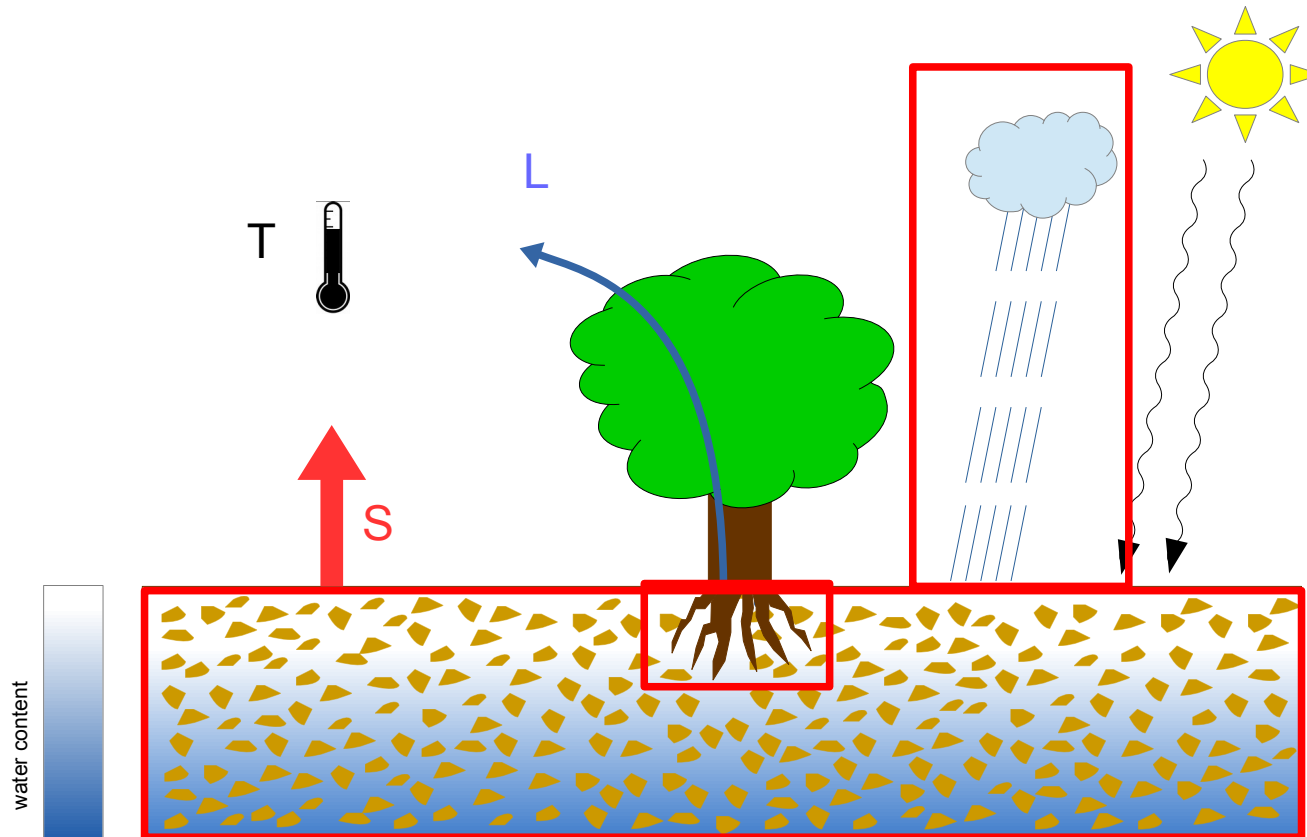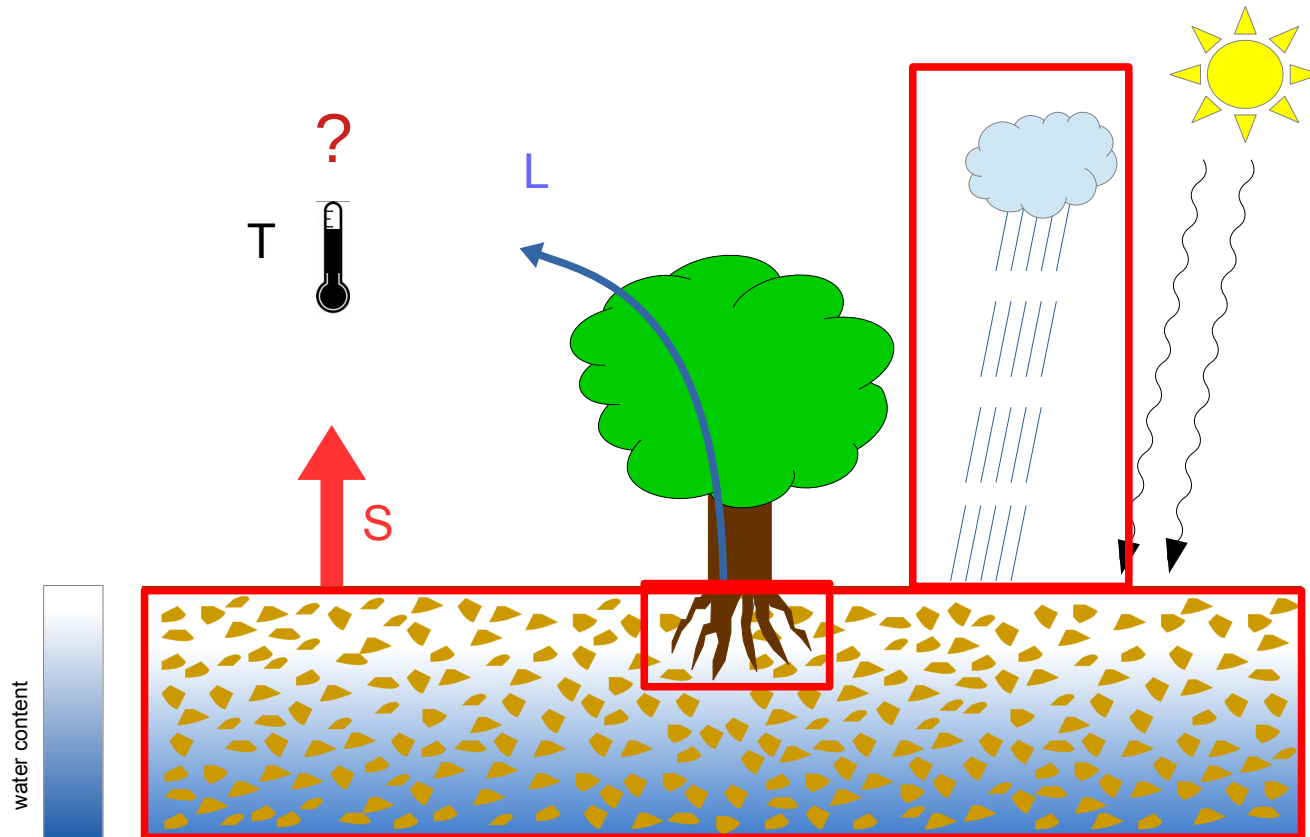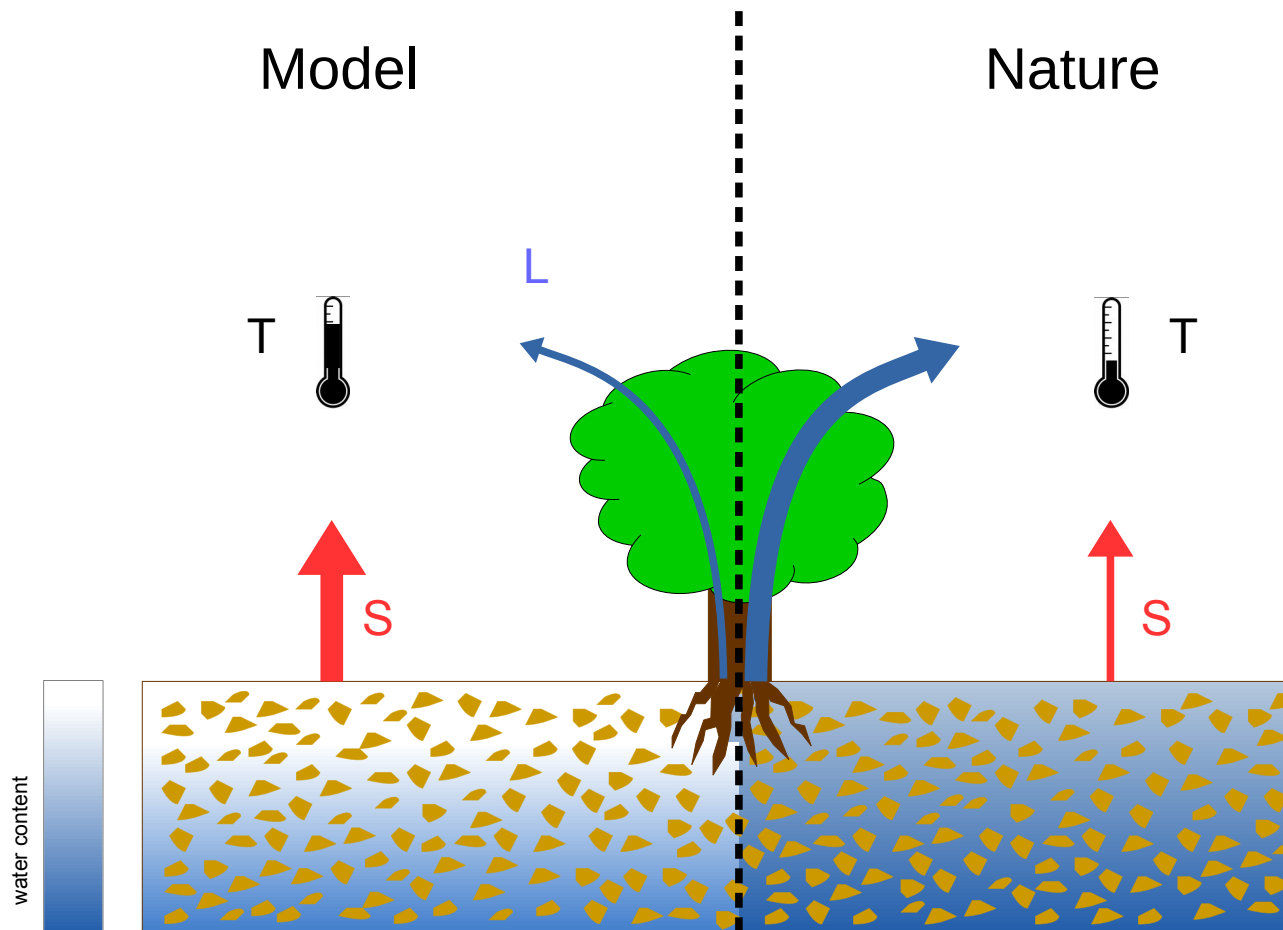Institute of Meteorology and Climate Research – Troposphere Research

Concept

Concept

Concept
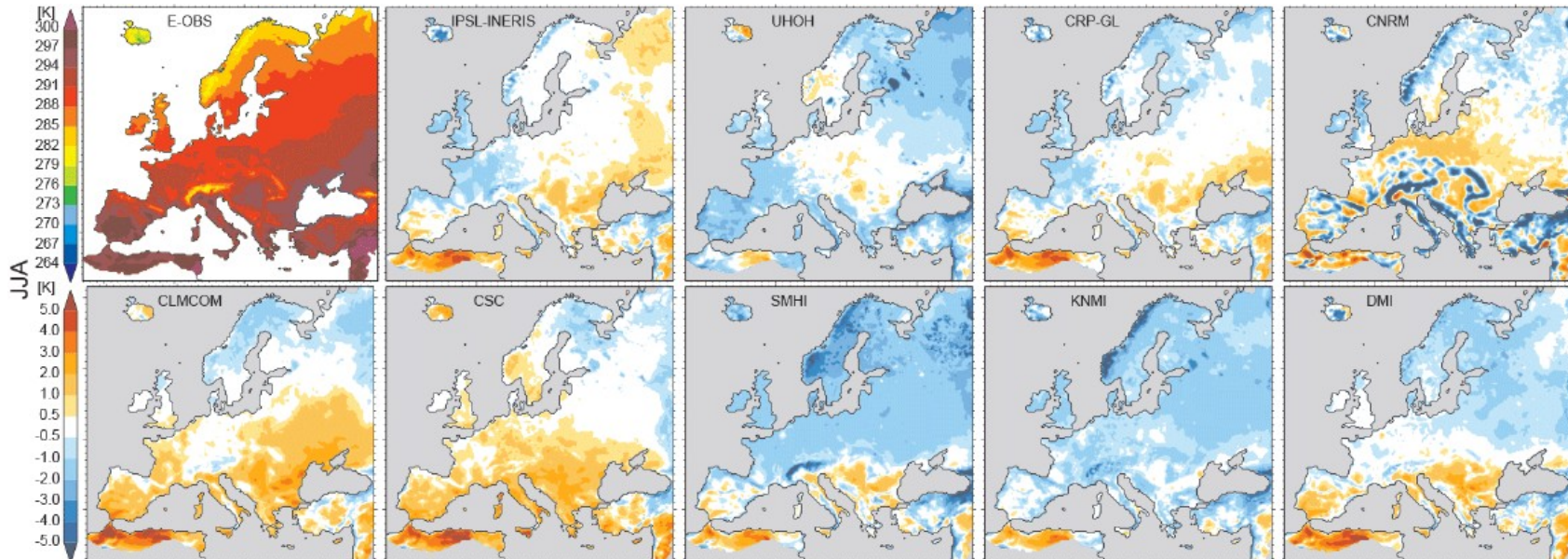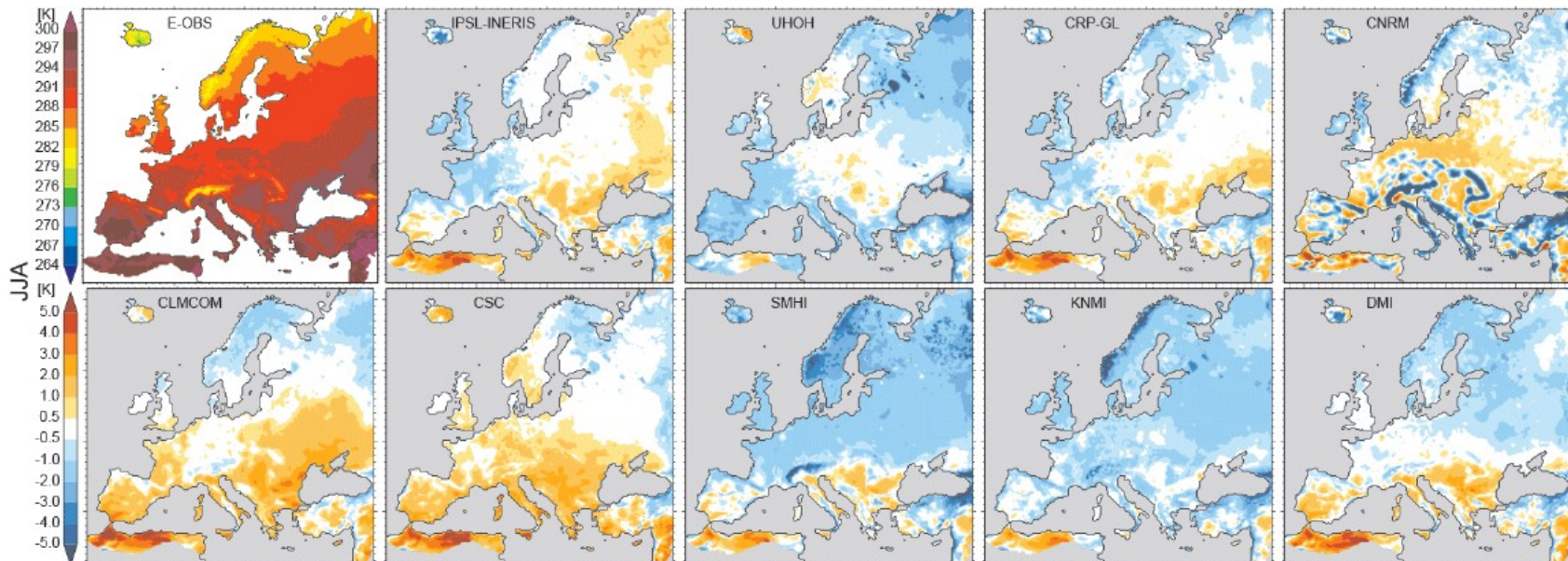
Concept

Systematic bias in model-intercomparisons

Kotlarski et al., (2014)

Systematic bias in model-intercomparisons

Kotlarski et al., (2014)

→ method that reduces only soil moisture induced biases
→ no significant negativ effects on other model processes
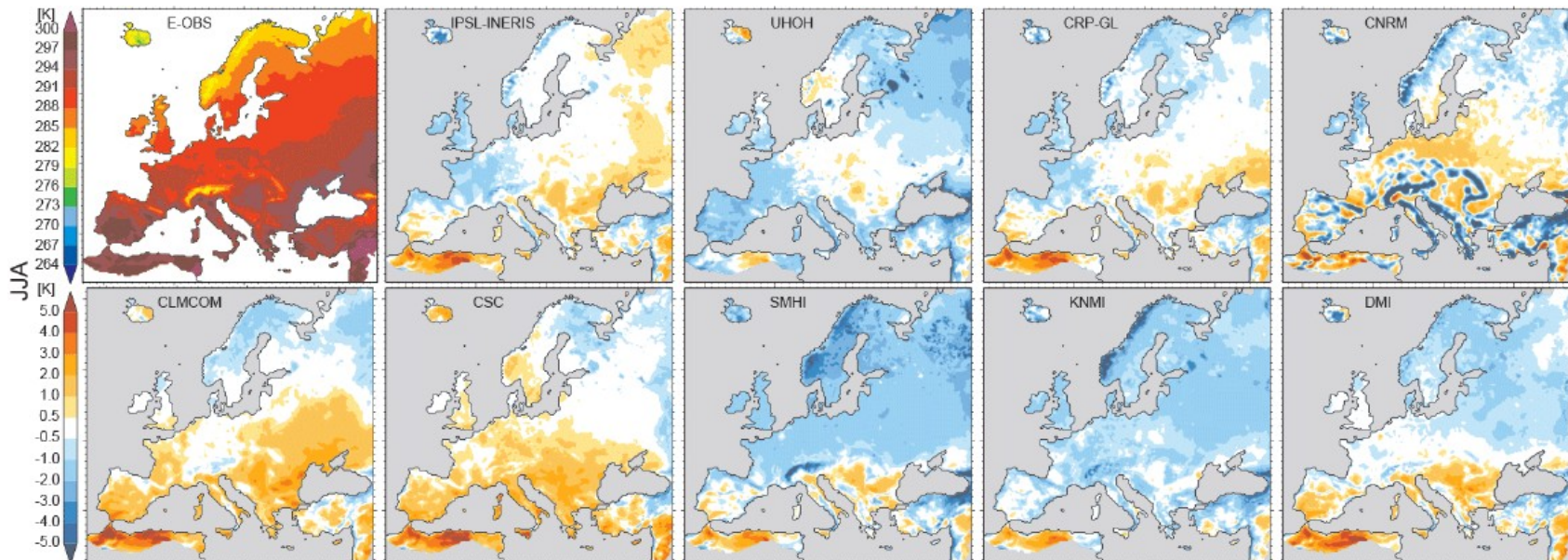
Systematic bias in model-intercomparisons

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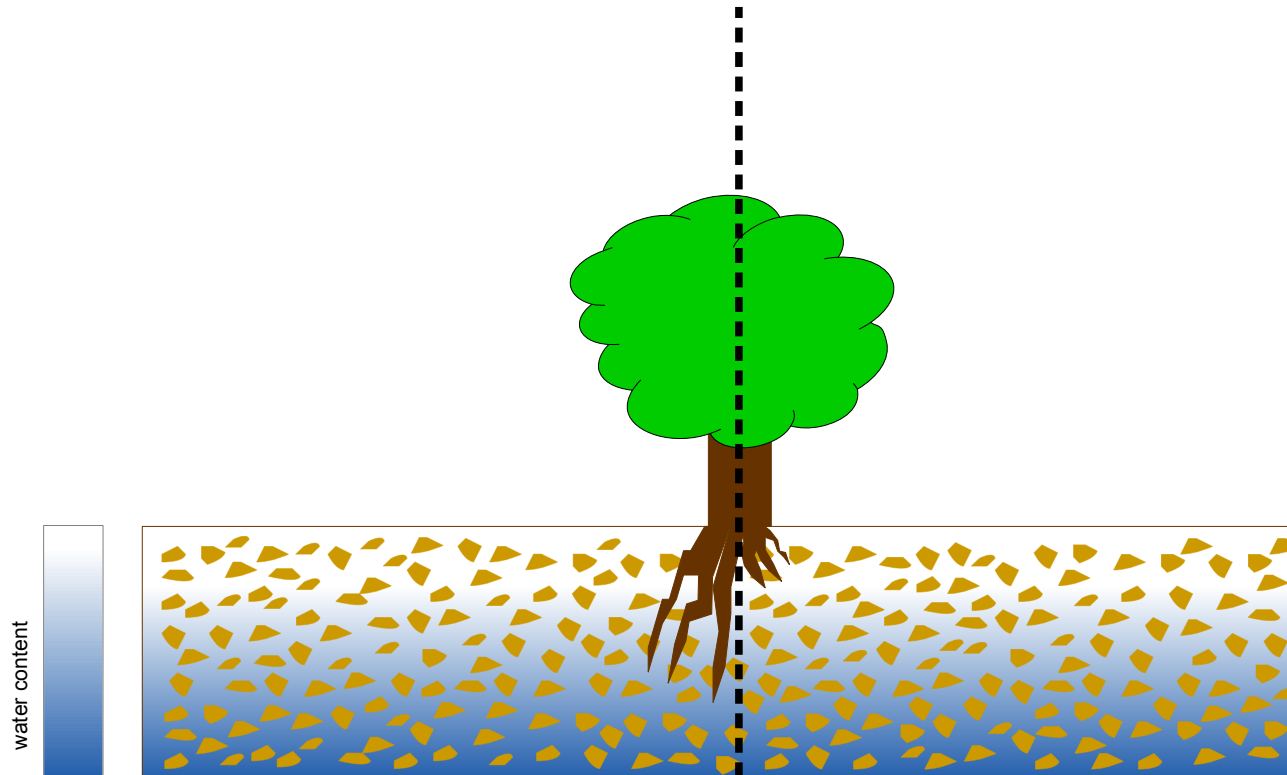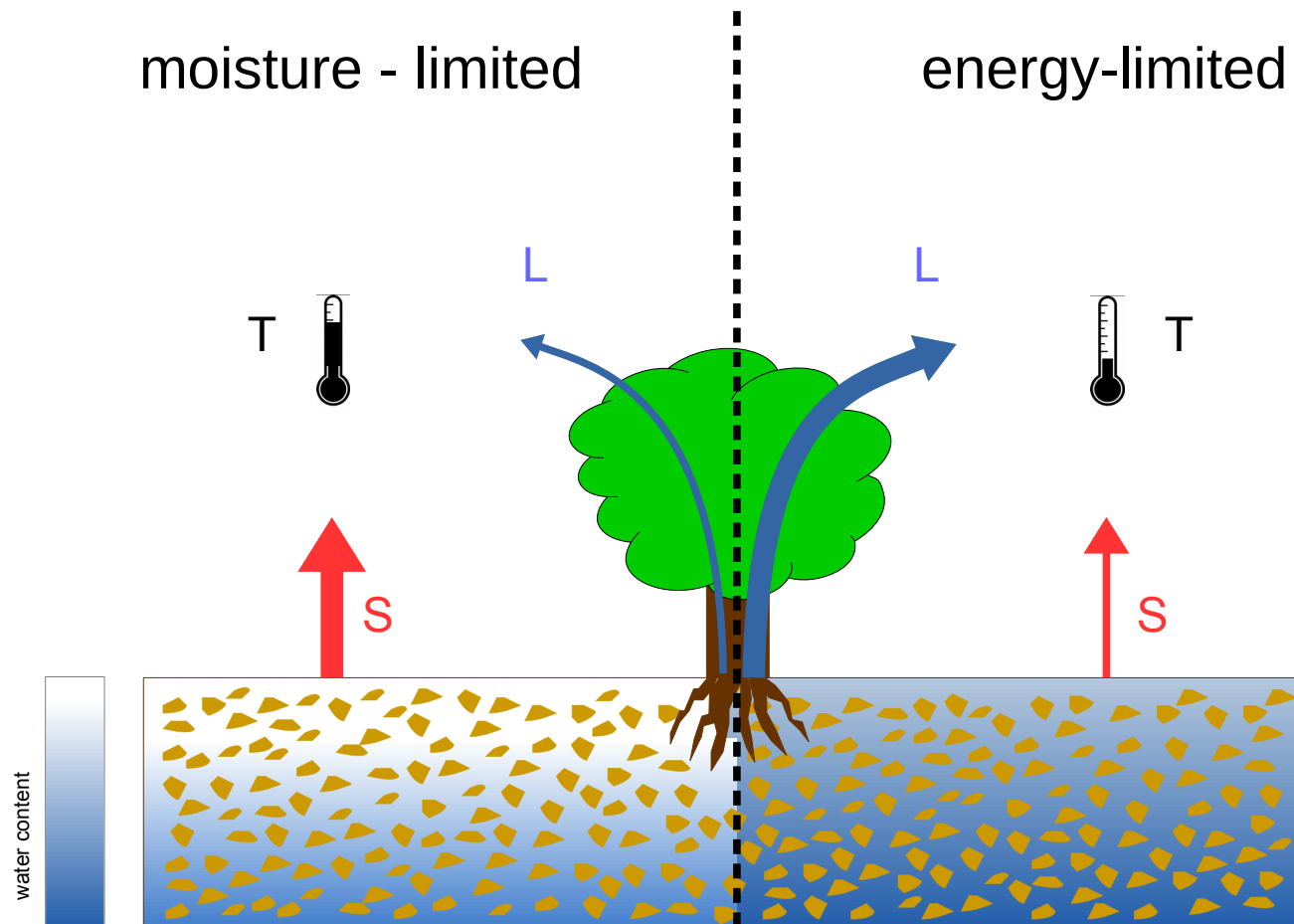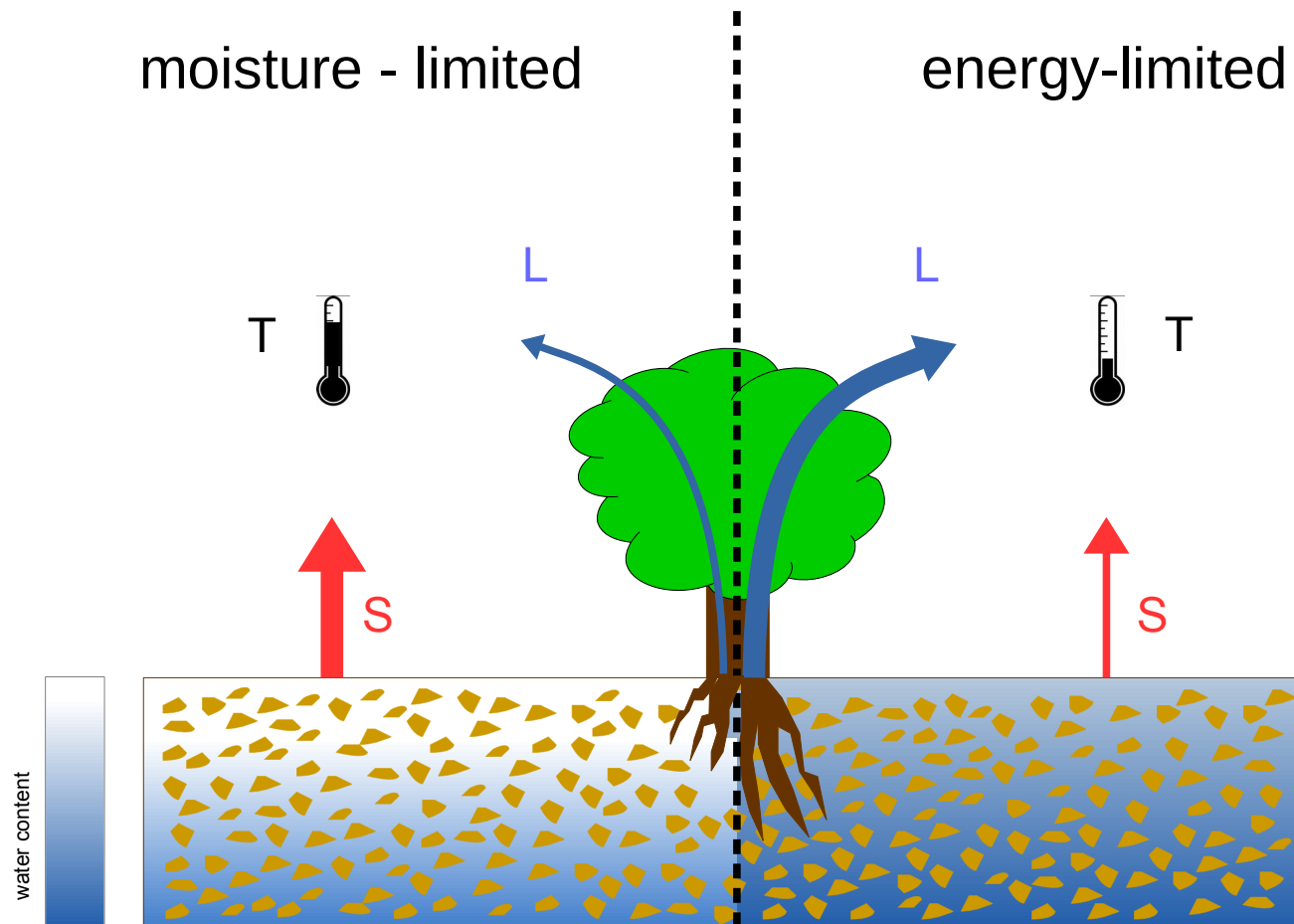
→ **stochastic root depth variation**
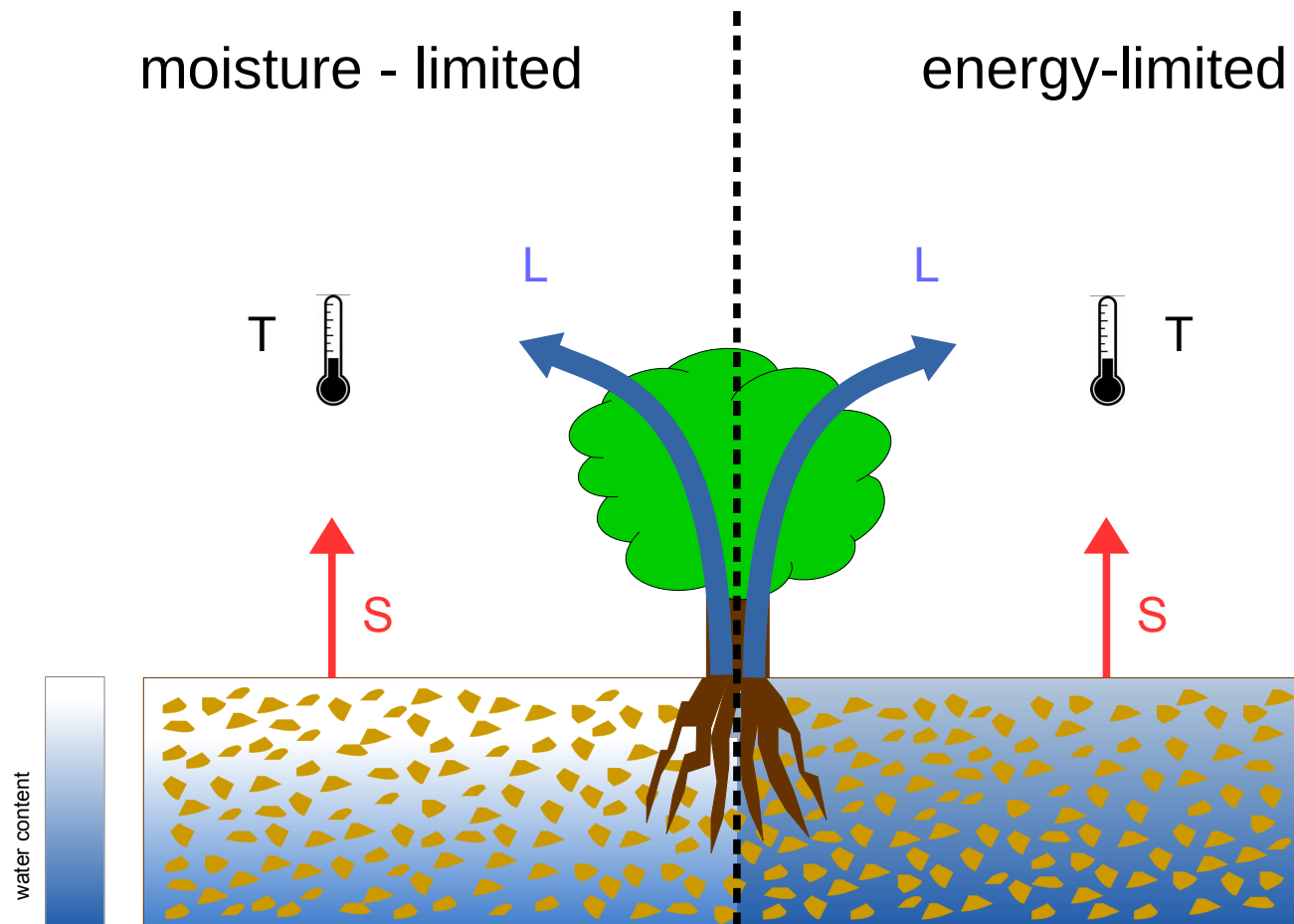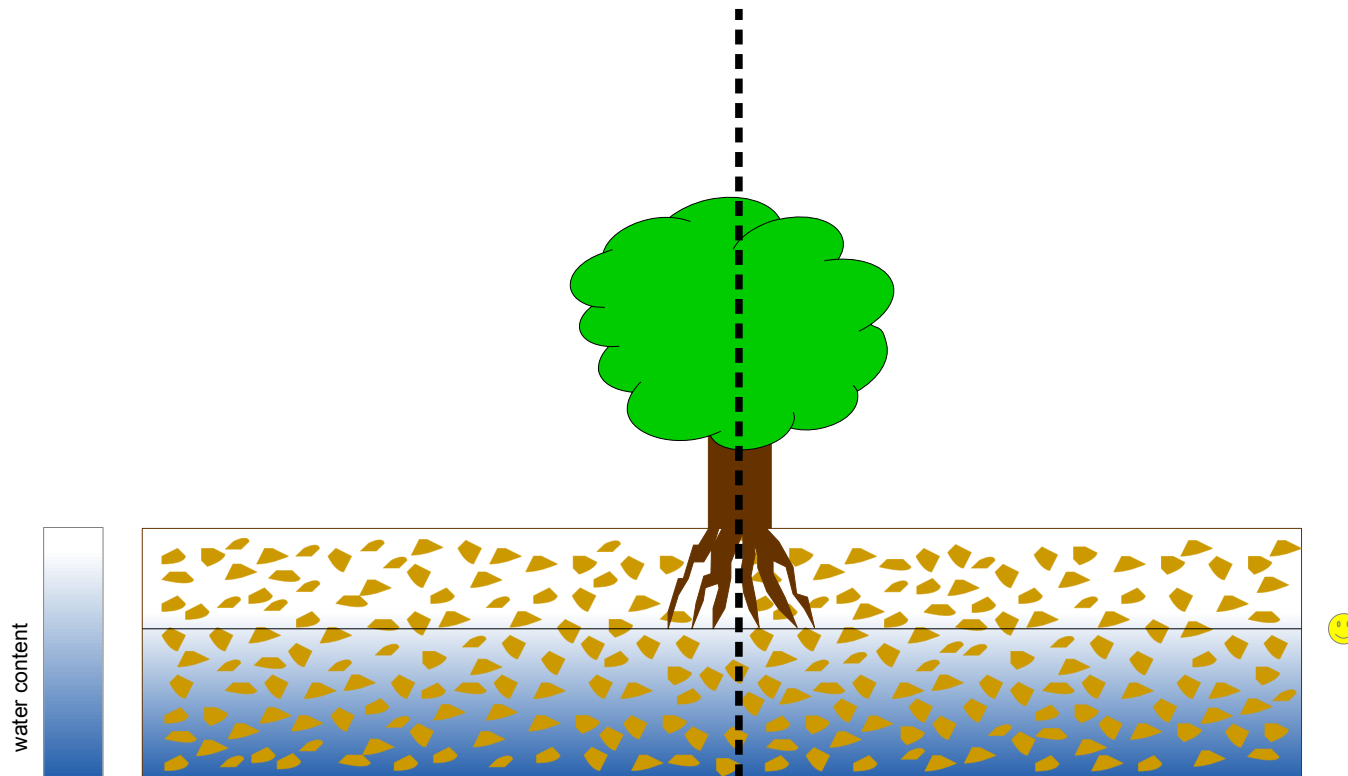
Stochastic Parameterization

Expected Effects

moisture - limited

energy-limited

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Expected Effects

moisture - limited · energy-limited

Expected Effects

moisture - limited   energy-limited

Expected Effects

moisture - limited

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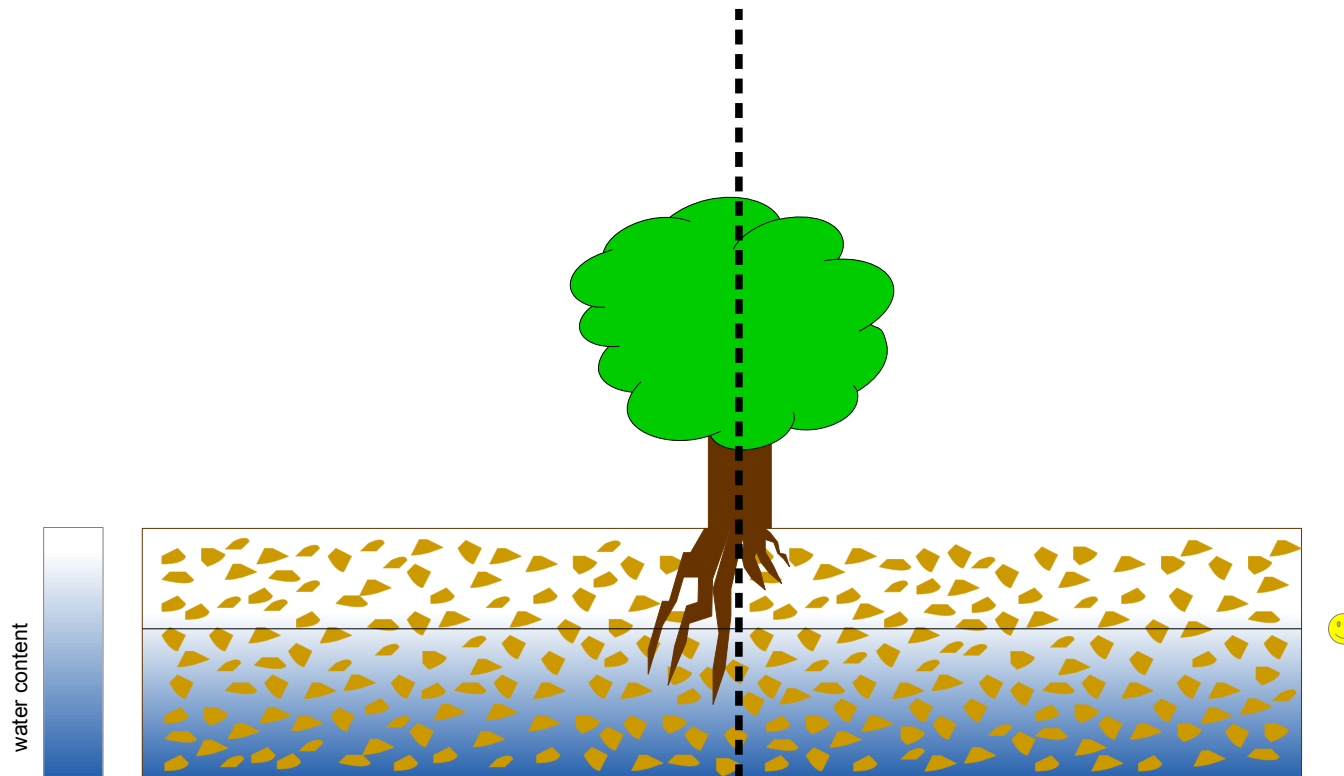
Expected Effects

moisture - limited

Expected Effects

moisture - limited
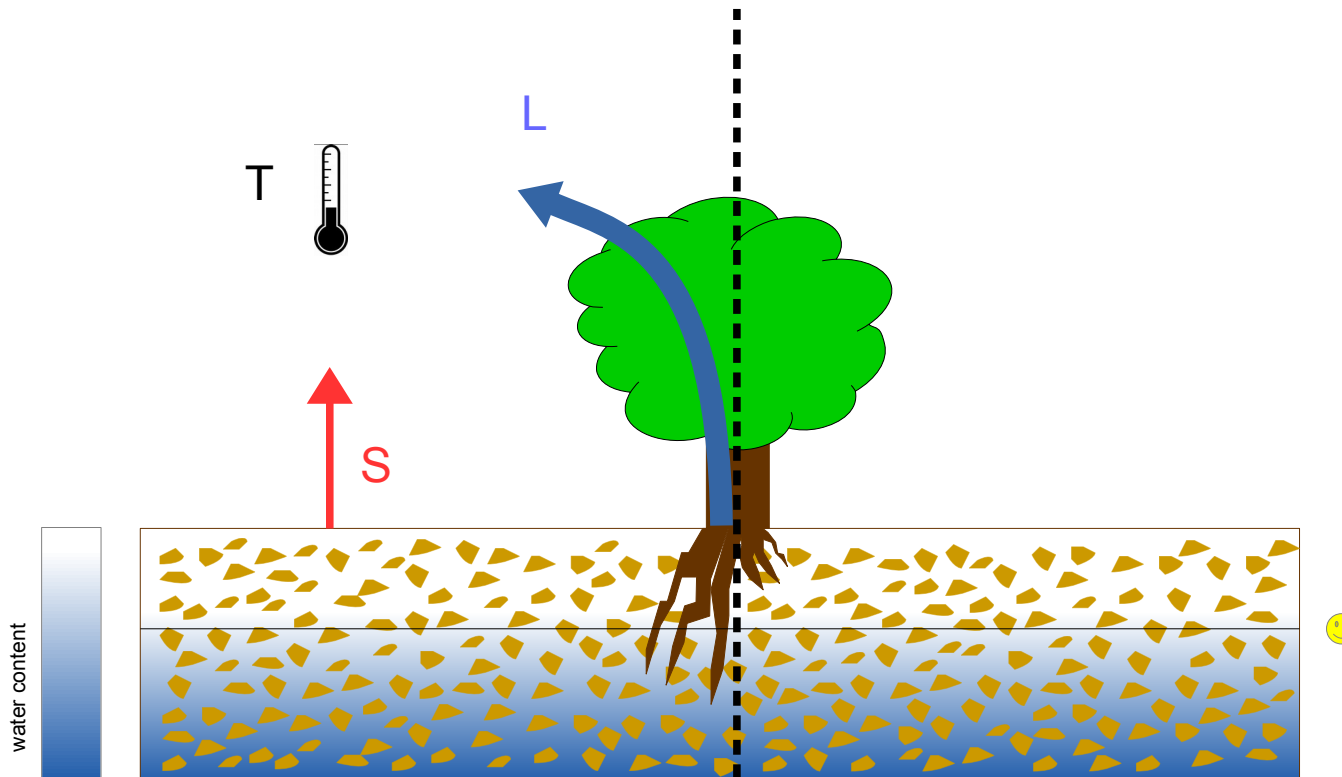
Institute of Meteorology and Climate Research – Troposphere Research
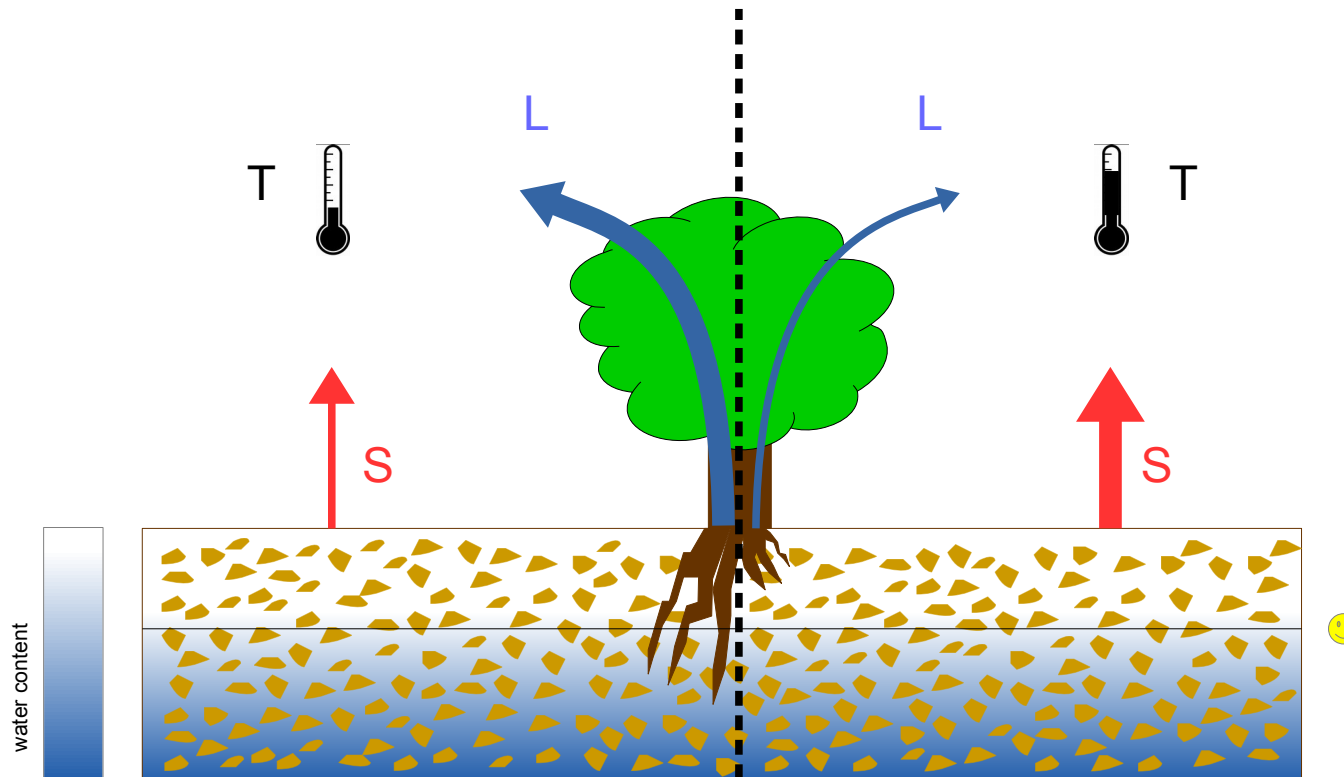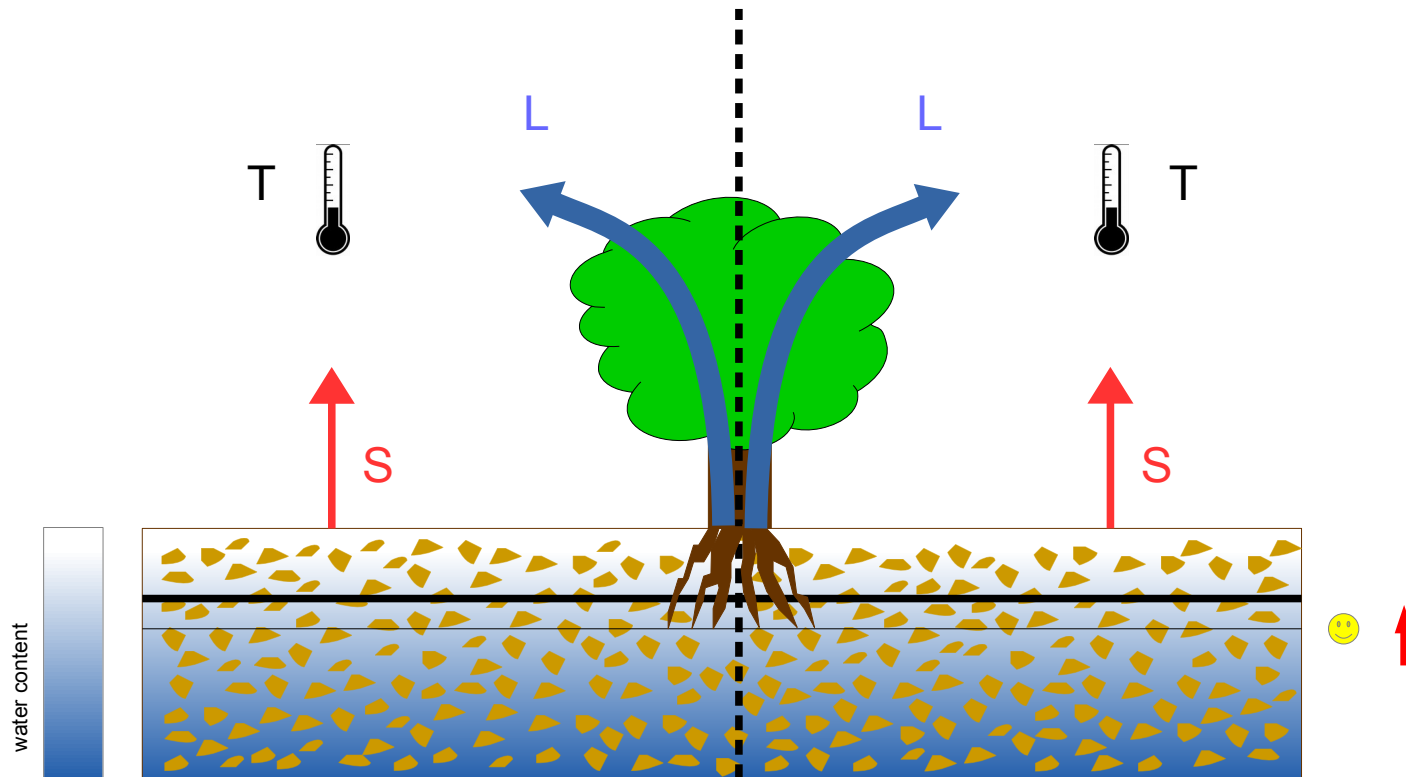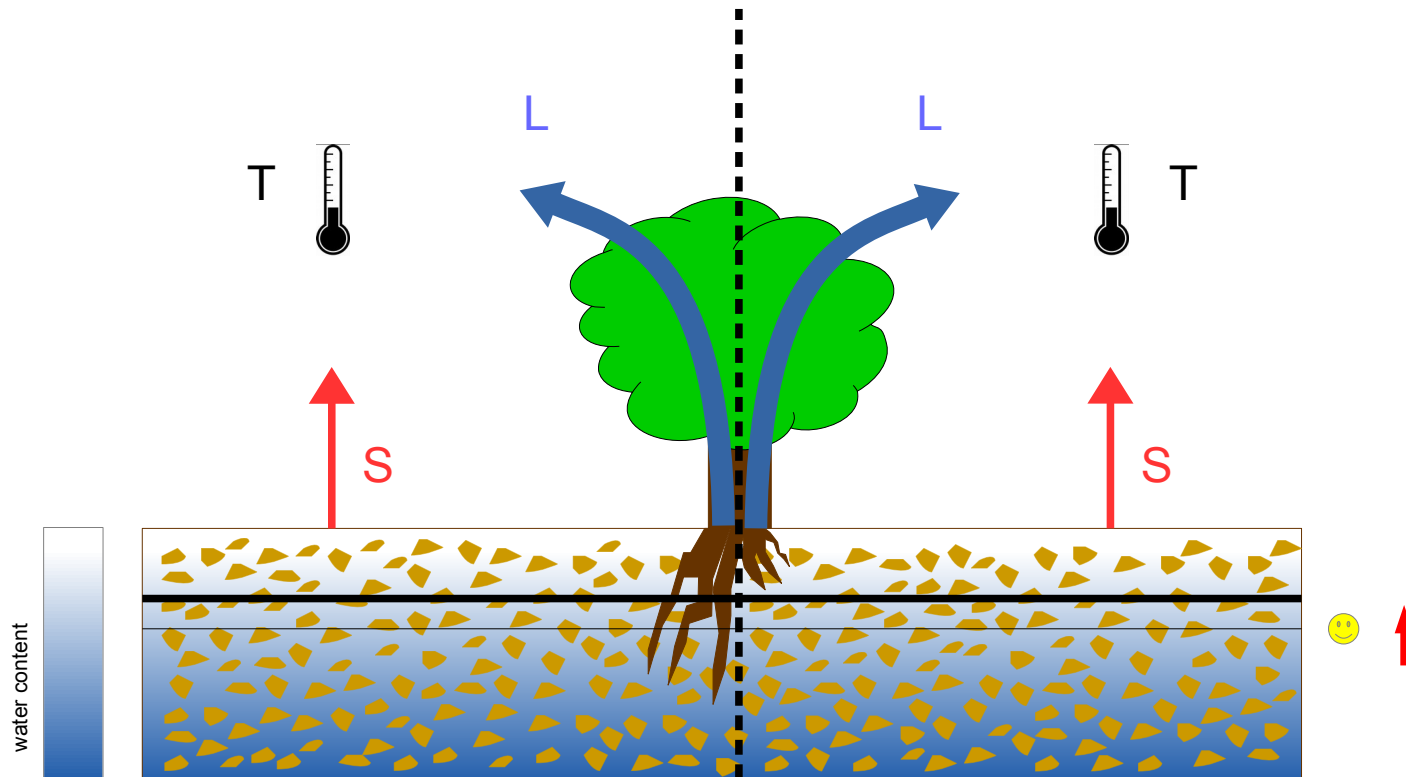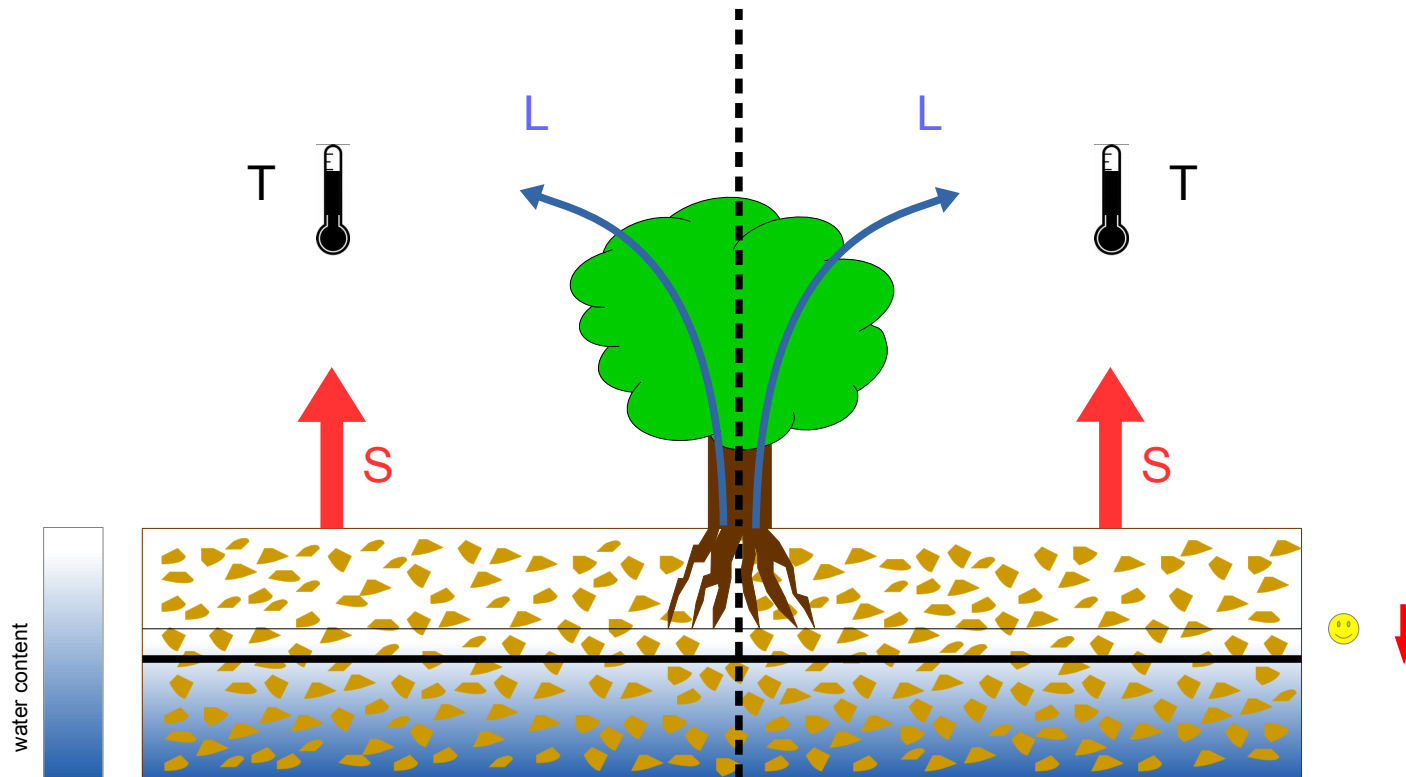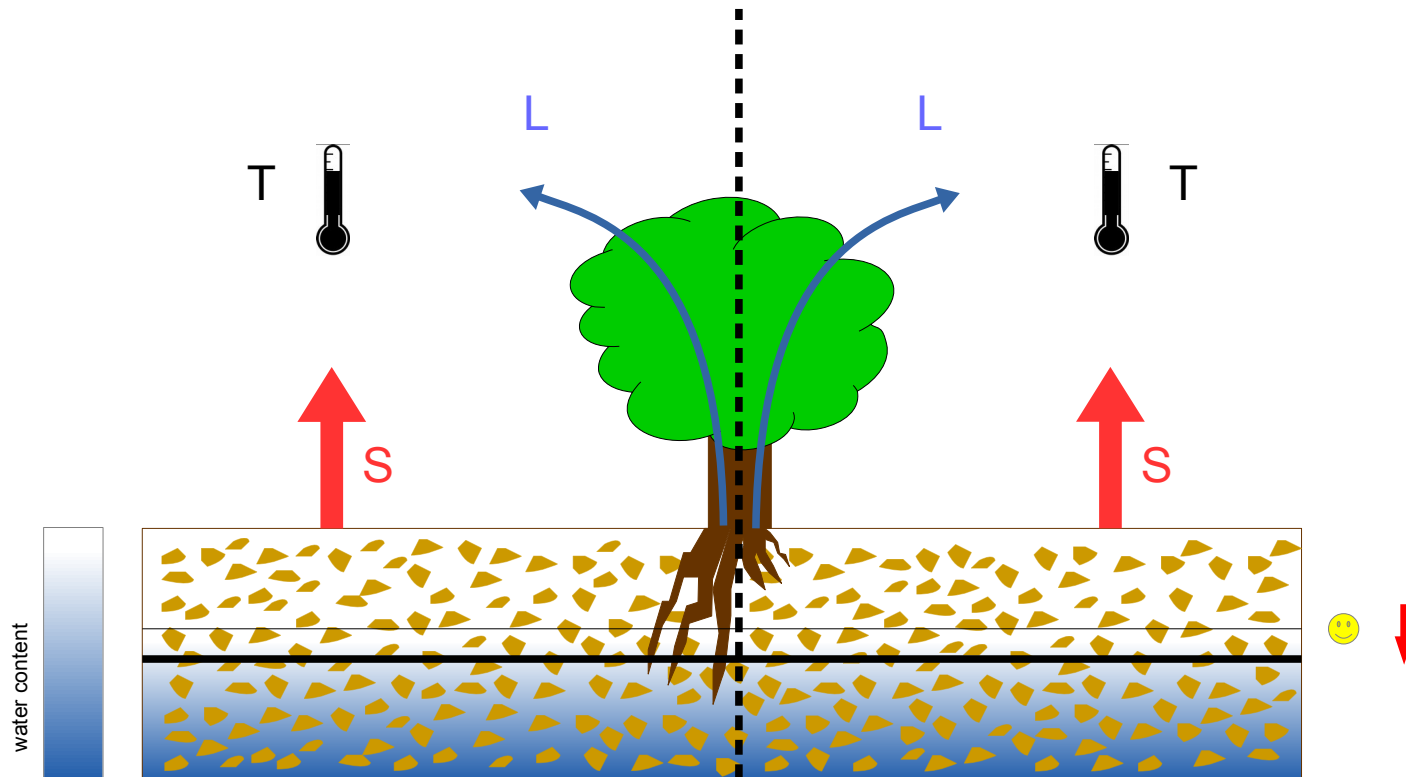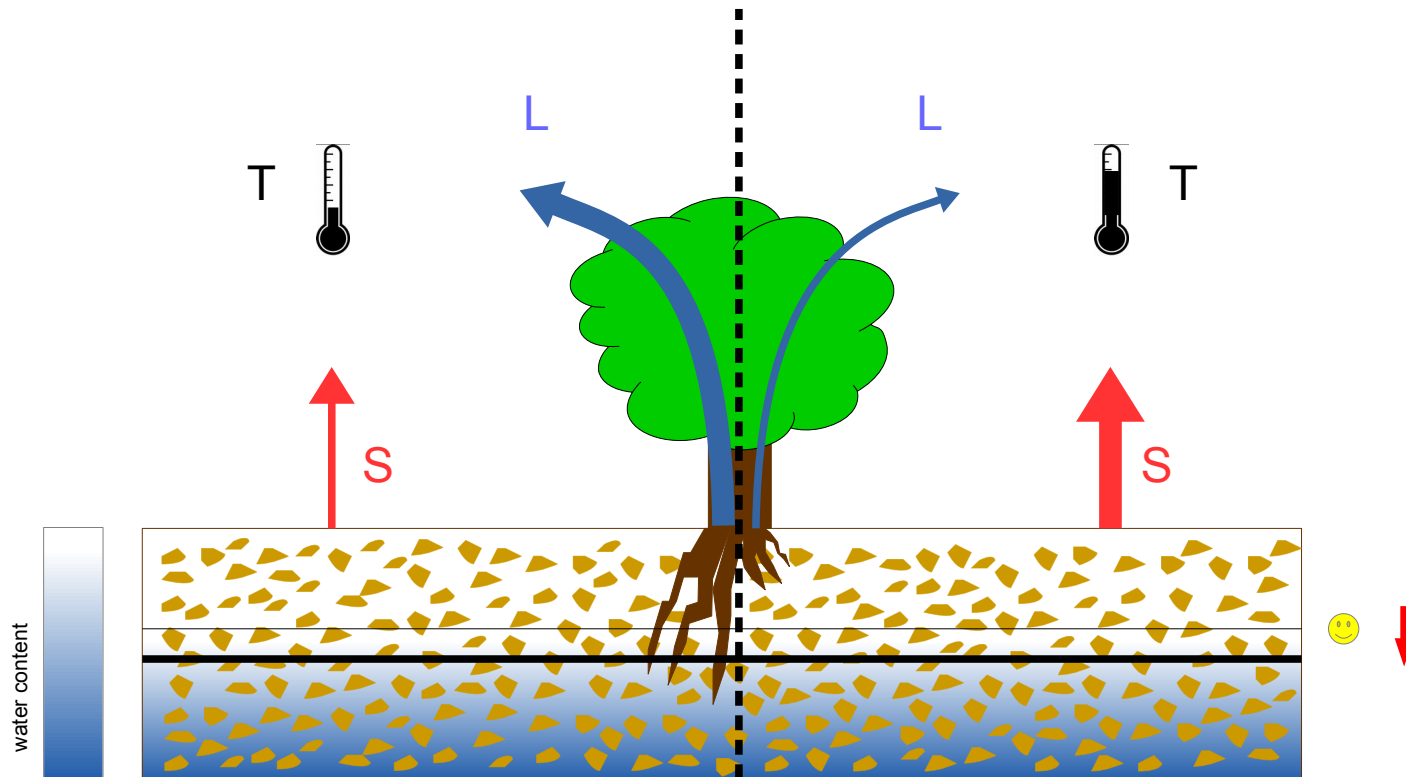
moisture - limited

Expected Effects

moisture - limited

Expected Effects

moisture - limited

Institute of Meteorology and Climate Research – Troposphere Research
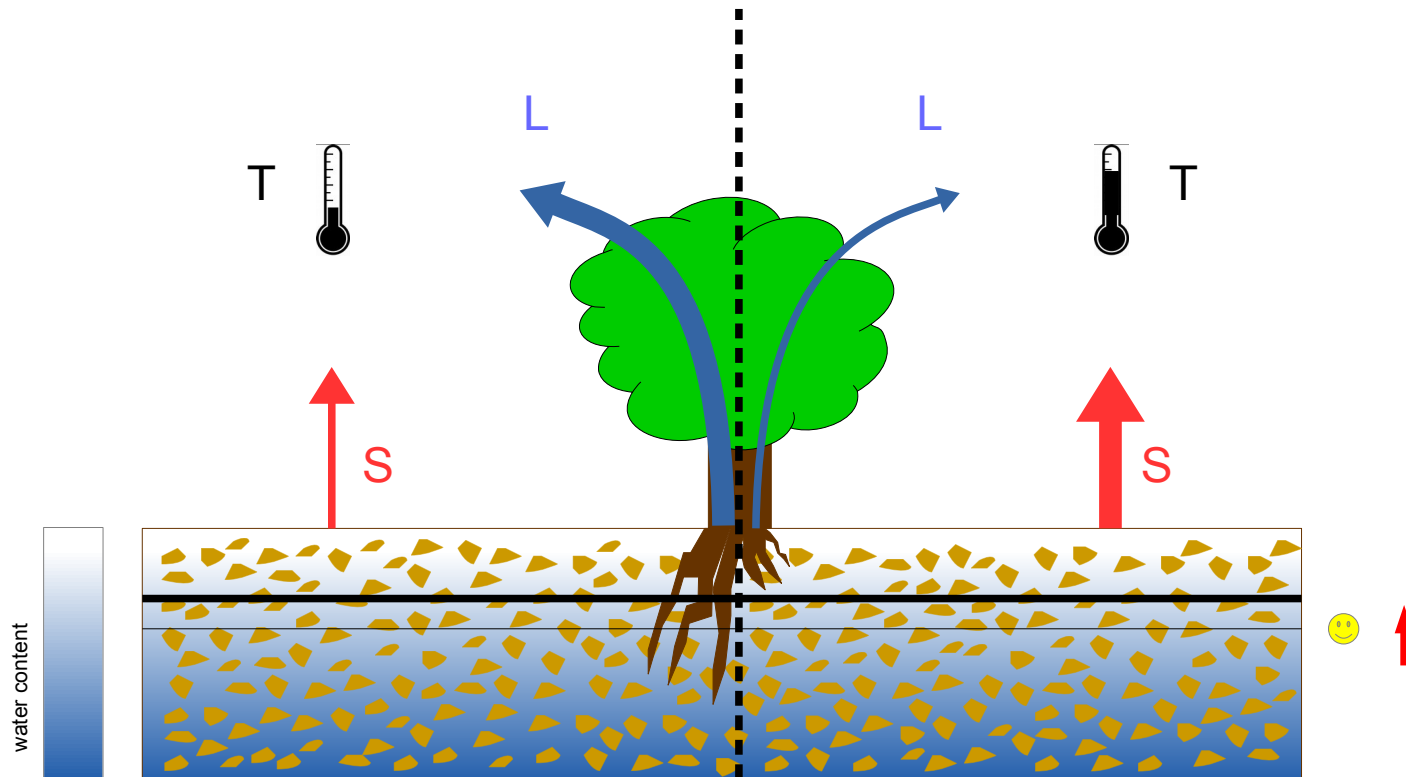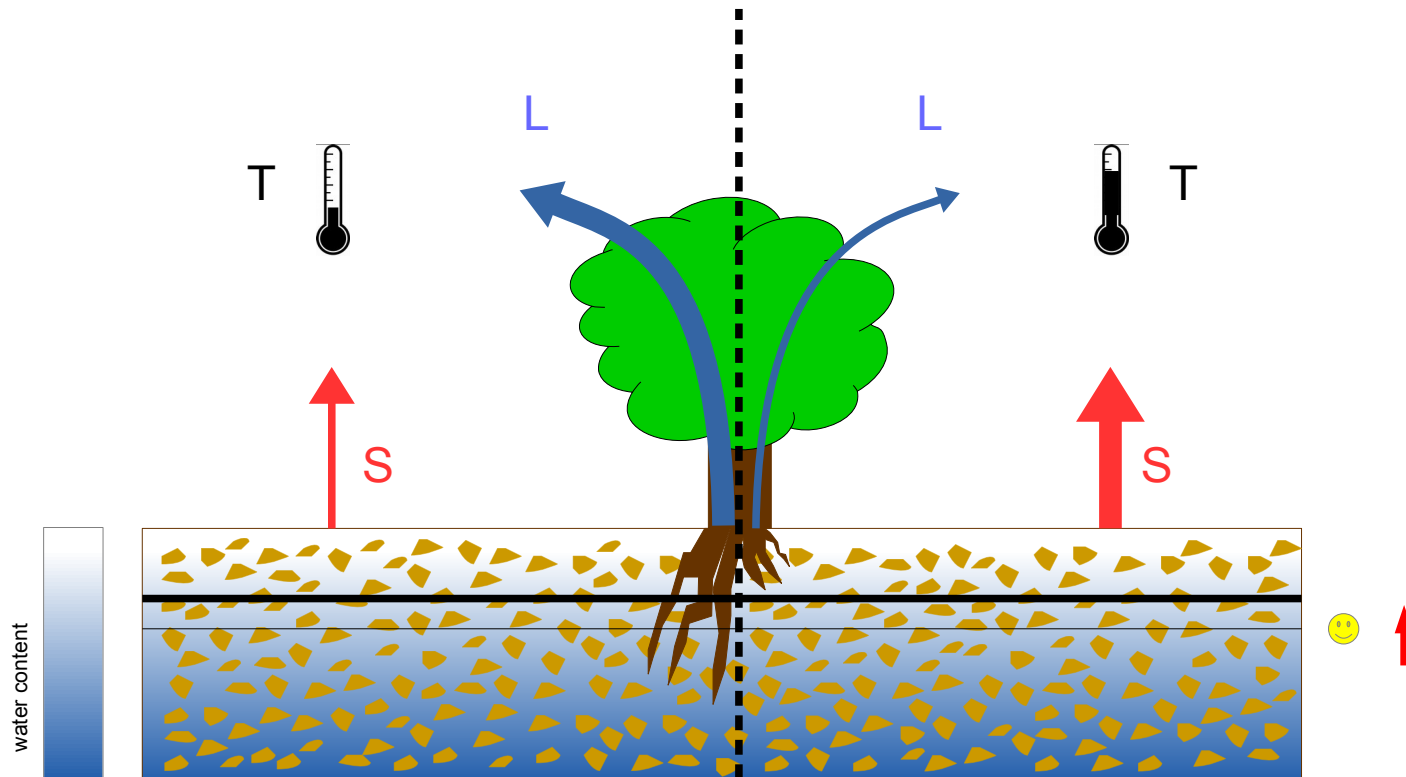
Expected Effects

moisture - limited

→ reduced cold bias

moisture - limited

moisture - limited

moisture - limited

Expected Effects

moisture - limited

→ reduced warm bias

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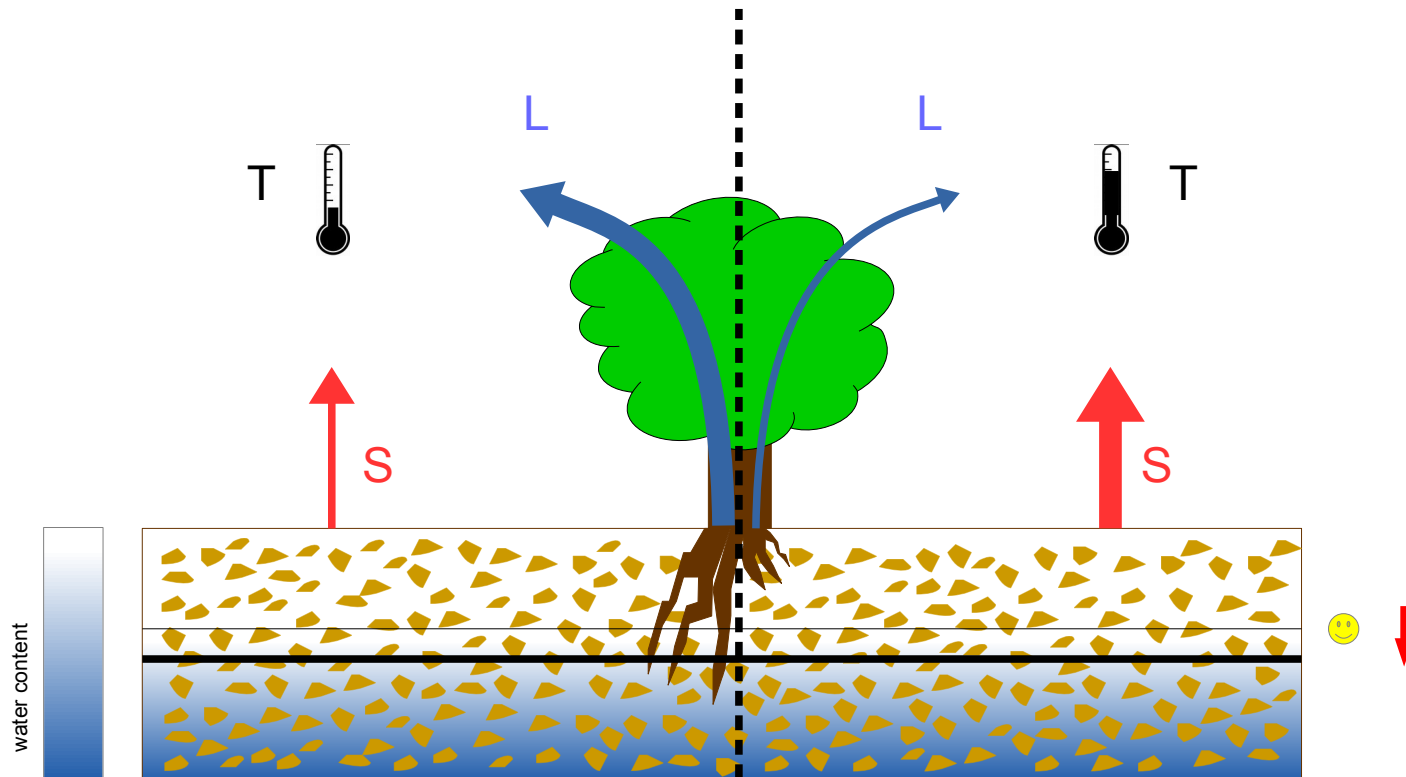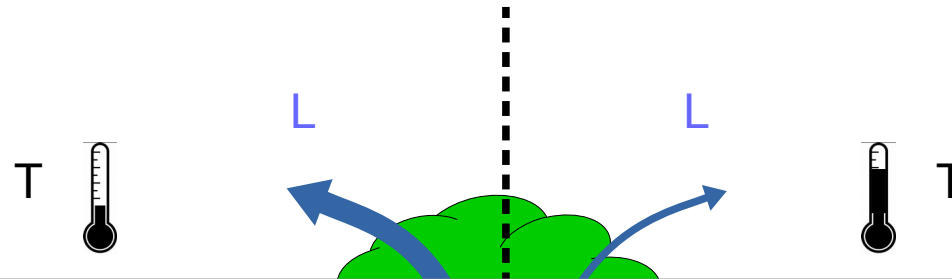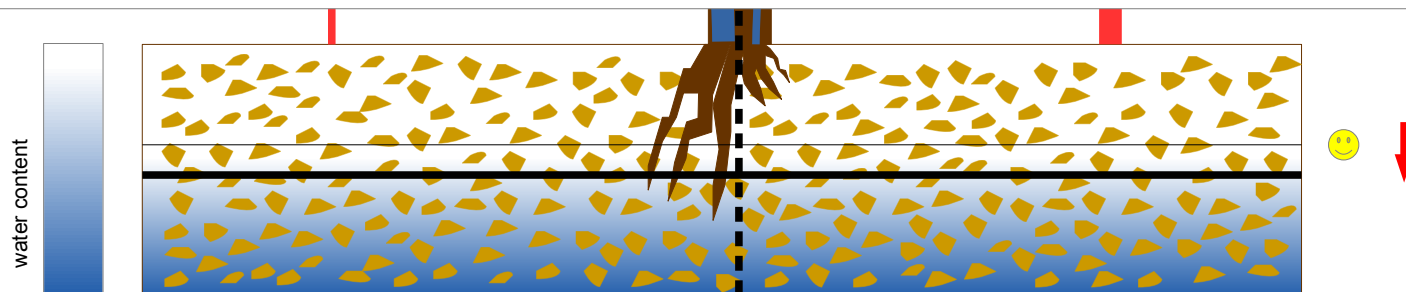
Expected Effects

moisture - limited

→ method affects simulation results only if biases are caused by soil moisture
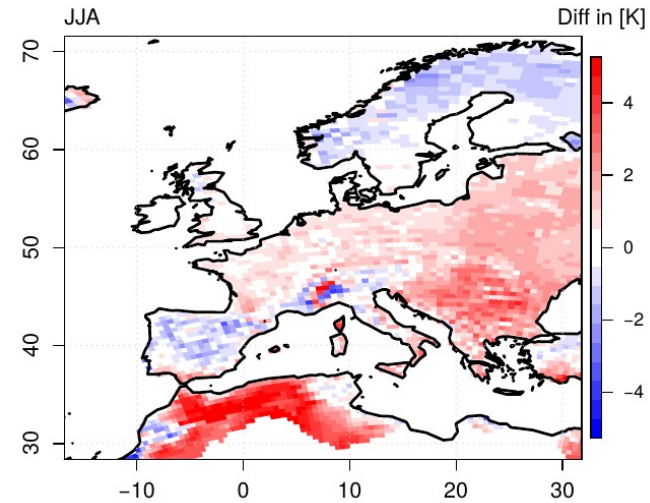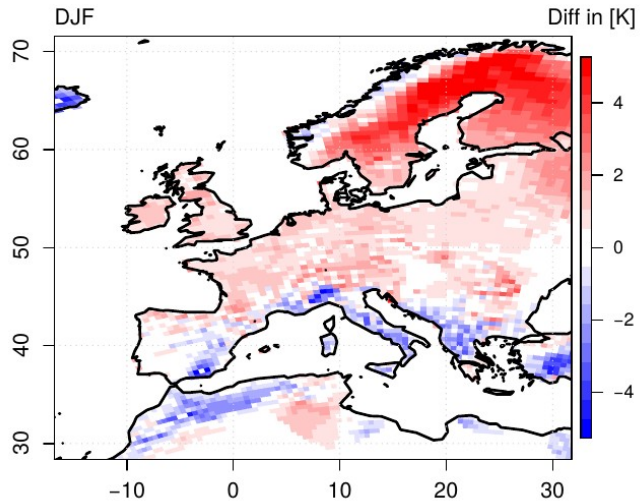→ previously mentioned requirements are fulfilled
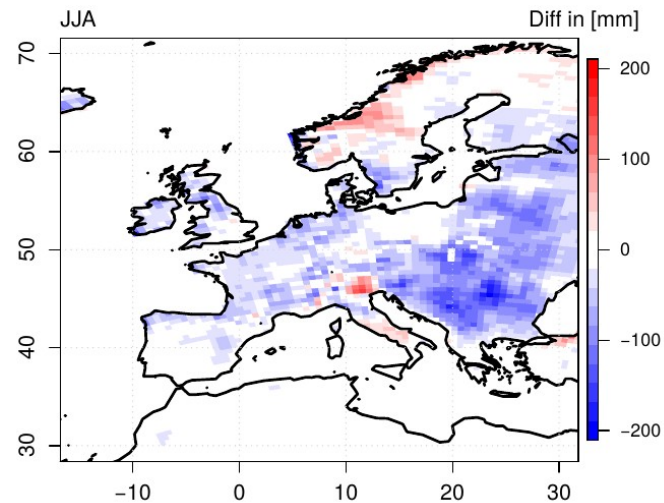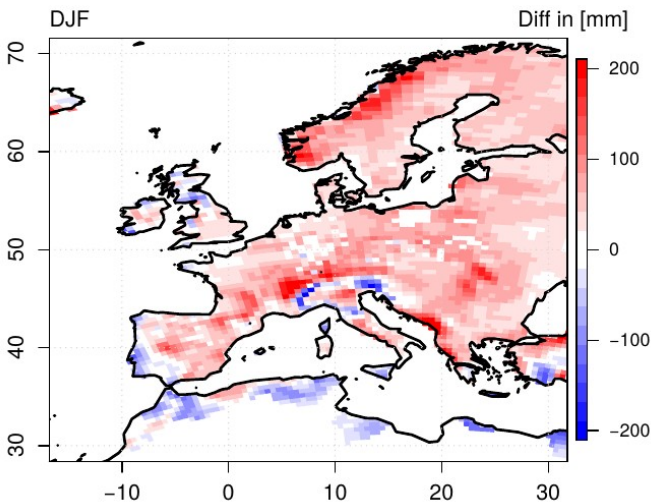
Stochastic Parameterization - Setup

- Model: CCLM-VEG3D

- 3 ERA-Interim driven stochastic simulations are performed for the period 1979-2015 (EURO-CORDEX, 0.44°)

- Root depths are varied once a year (first day of the year)
  → seasonal soil moisture memory is preserved

- Results are compared to a reference run with unperturbed root depths

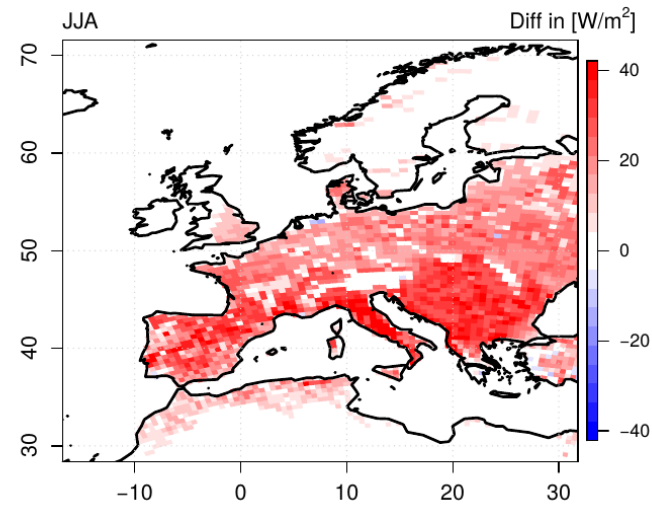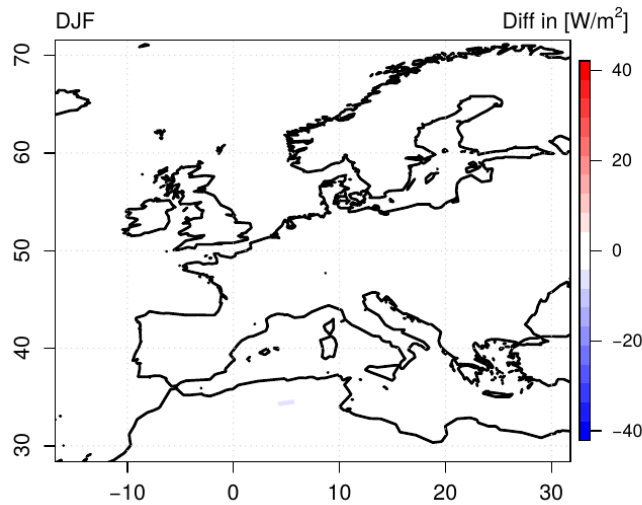- E-Obs is used for the model validation

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Reference Simulation

temperature

precipitation
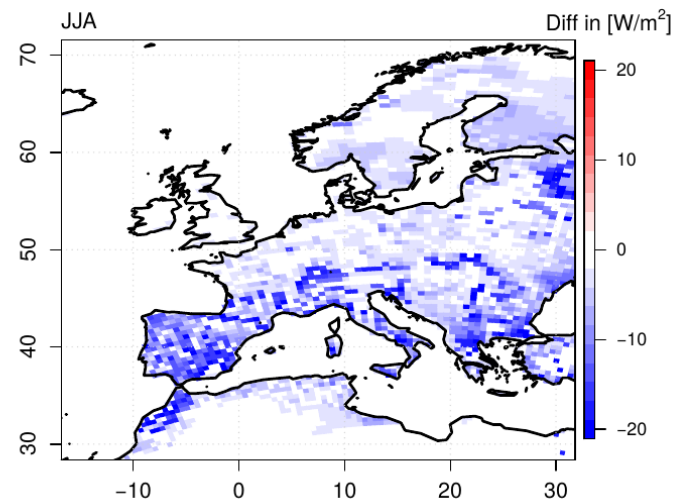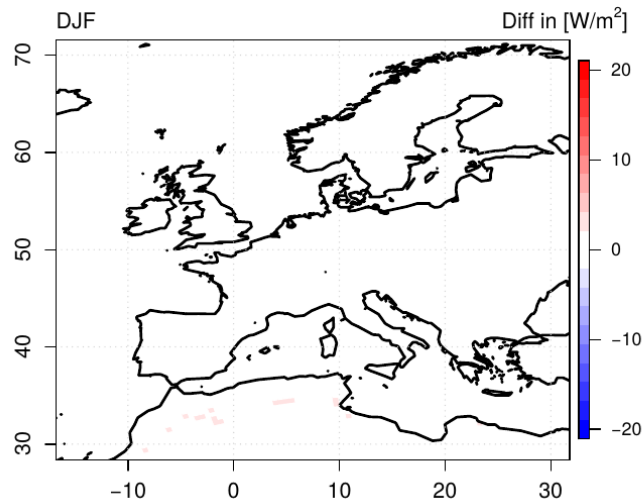
Institute of Meteorology and Climate Research – Troposphere Research
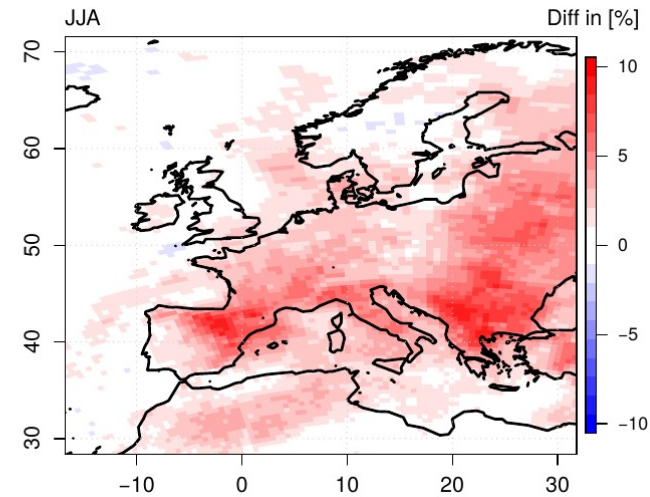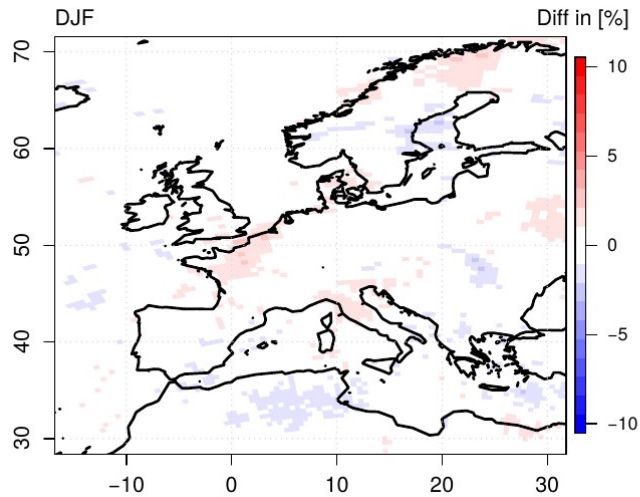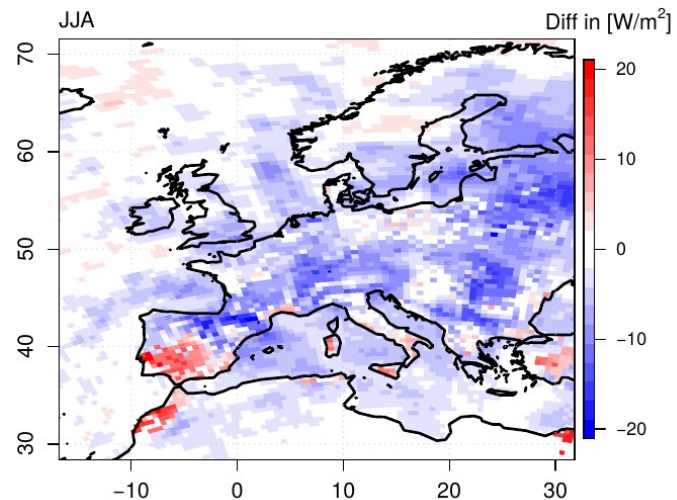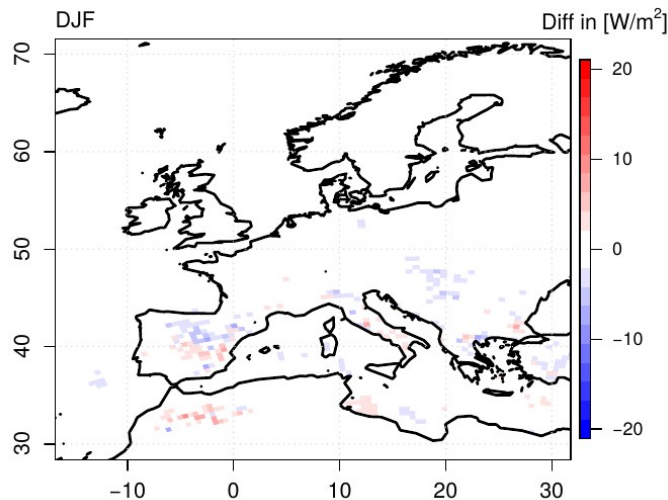
Stochastic Simulations – turbulent heat

latent

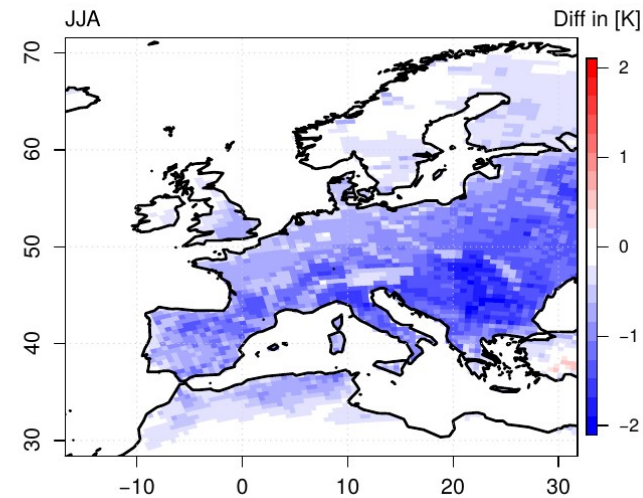sensible
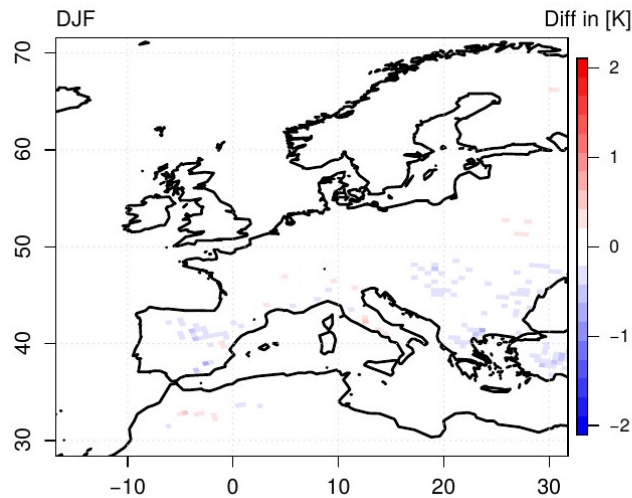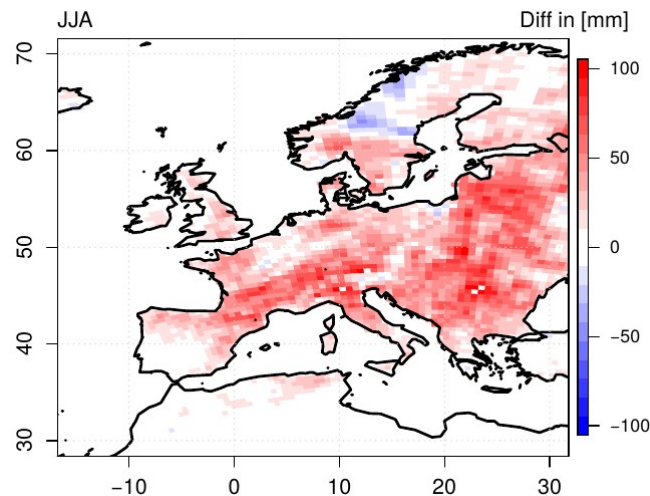
Stochastic Simulations – radiation
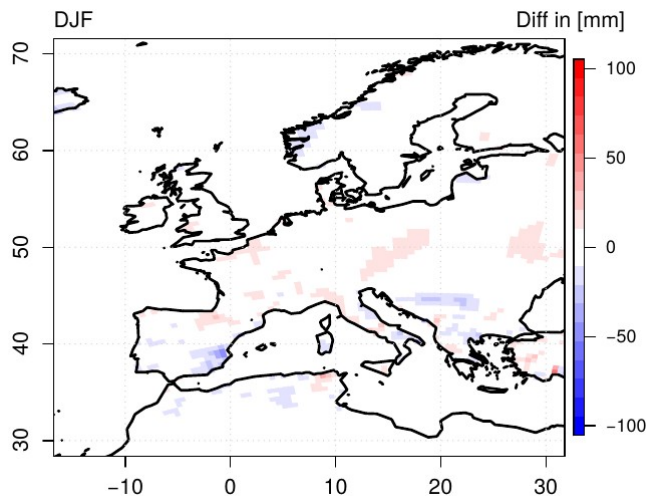
cloud
cover

sw
radiation

Stochastic Simulations – temperature/precipitation

temperature

precipitation

Institute of Meteorology and Climate Research – Troposphere Research
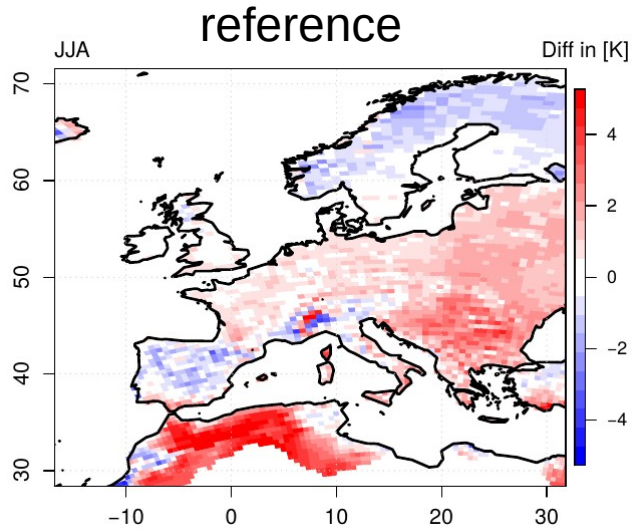
Stochastic Simulations – added value

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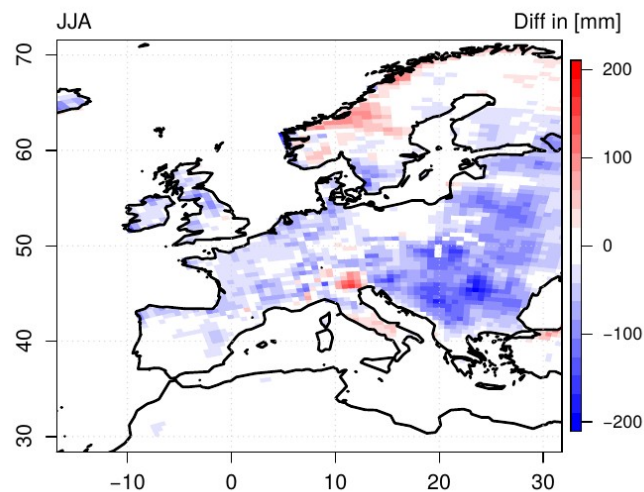
Stochastic Simulations – added value

reference   stochastic
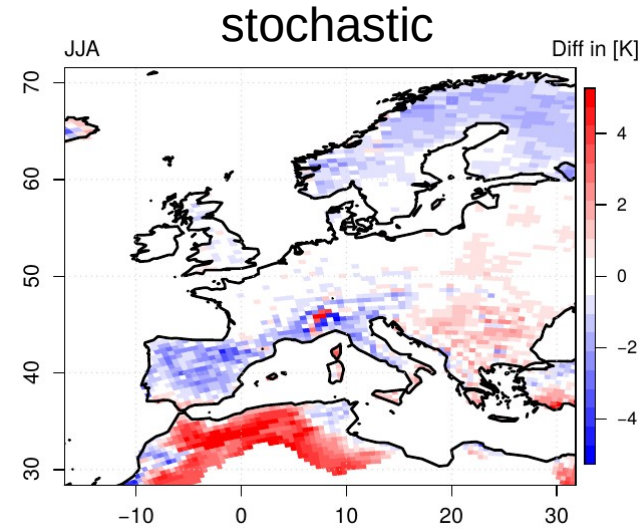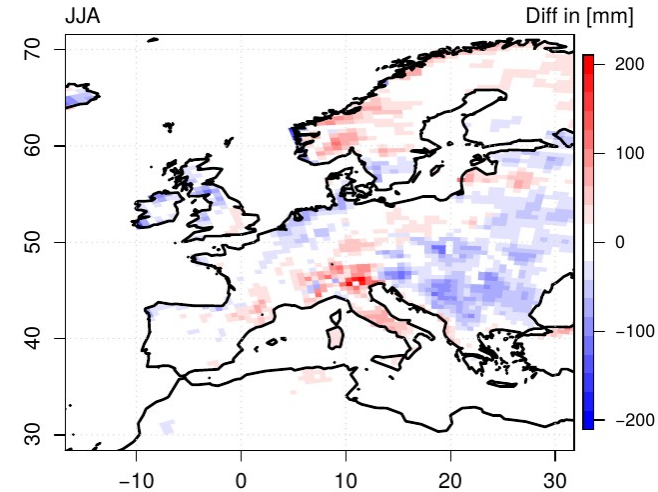
temperature
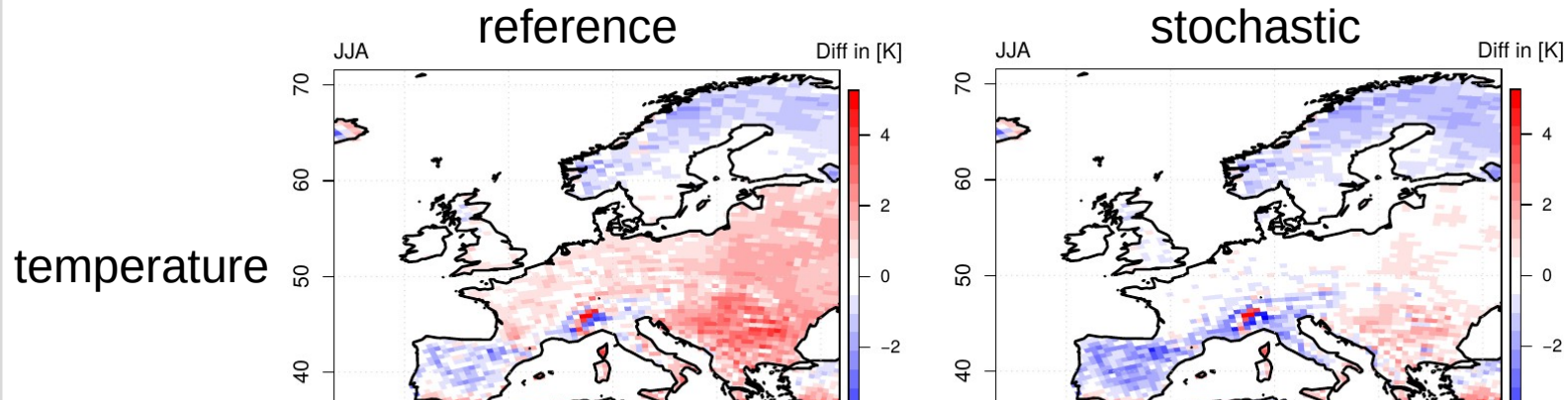
Stochastic root depth variation constitutes a simple method to mitigate systematic biases in soil-moisture limited regions, without negatively affecting other regions

precipitation