Institute of Fluid Mechanics
and Environmental Physics
in Civil Engineering

Bachelor Thesis Topic - Conceptual model development of cryohydrogeological processes in alpine regions

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Introduction

Qinghai-Tibet Plateau (also known as the 'Water tower of Asia') is threatened by climate warming. Due to its high elevation (average 4000 m.a.s.l), it experiences temperature twice the global average. The high temperatures results in permafrost degradation.

The permafrost thaws and freezes seasonally due to the influx of heat energy from the ground surface. The groundwater flow increases as the hydraulic conductivity in the active layer increases. The pore water phase change from liquid to ice causes variation in the thermal parameters of the soil. Snow deposition on the surface also influence the characteristics of the subsurface. Several models exist that can implement these cryohydrogeological processes.

ATS (Advanced Terrestrial Simulator) simulates cryohydrogeological processes: thermal and hydraulic subsurface processes with freezing/thawing, surface energy balance, overland flow with ice and snow deposition/melting processes. The model requires the definition of it's dimensionality, mesh size, boundary conditions, initial conditions and time step size.

The Yakou catchment is located at the tip of the Northeastern Qinhai-Tibet plateau with an area of 1.4 km^2. It has an average elevation of 4050 m (range: 3900 m - 4300 m). The catchment divides into the up-slope, middle-slope, and riparian zone based on the elevation and vegetation. The Yakou meteorological station is located in the up-slope region. Several parameters are measured at the Yakou meteorological station.

The Master thesis main goal is to develop a conceptual model based on ATS code capabilities and available data.

Research Questions

- What are physical processes that need to considered in alpine regions?
- What are the physical processes that can be modelled by ATS?
- What are the feasible conceptual models that can be simulated by ATS based on the available data?

Monthly Milestone Plan

- Literature review
- Learning ATS model capabilities
- Evaluate the available data
- Conceptual model development
- Thesis preparation - writing and presentation

Beneficial Skills

- Background knowledge - Hydrogeology and Numerical methods in fluid mechanics

Contact Information

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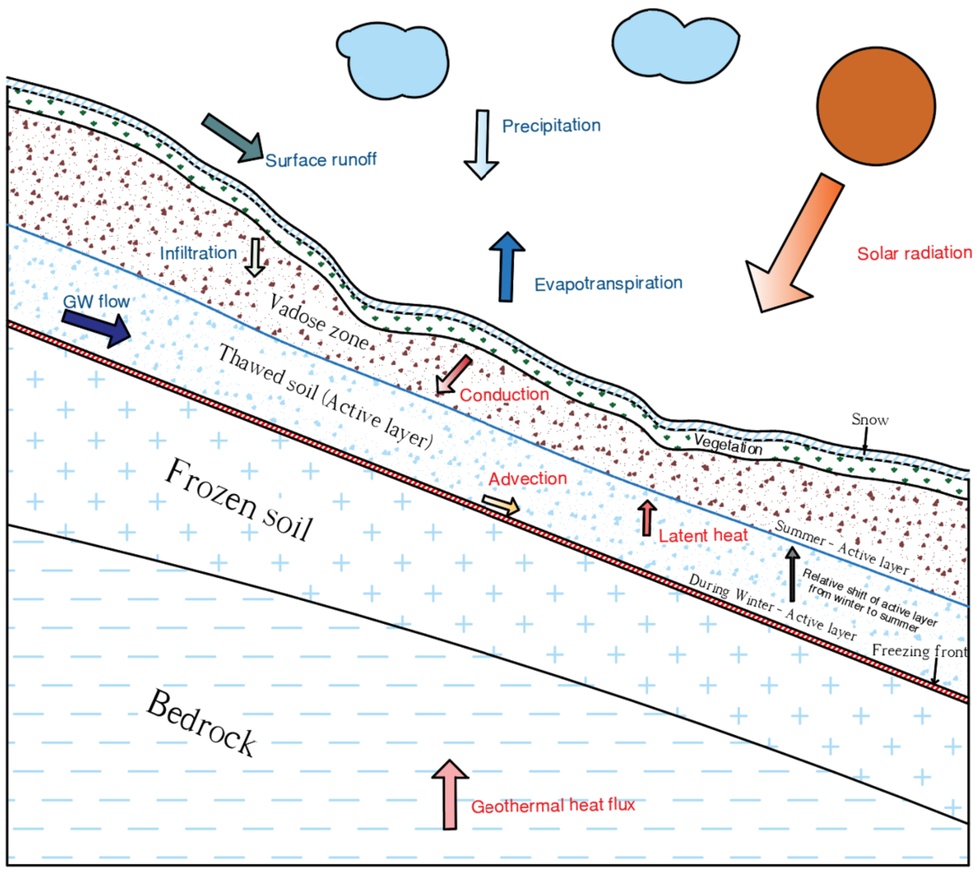
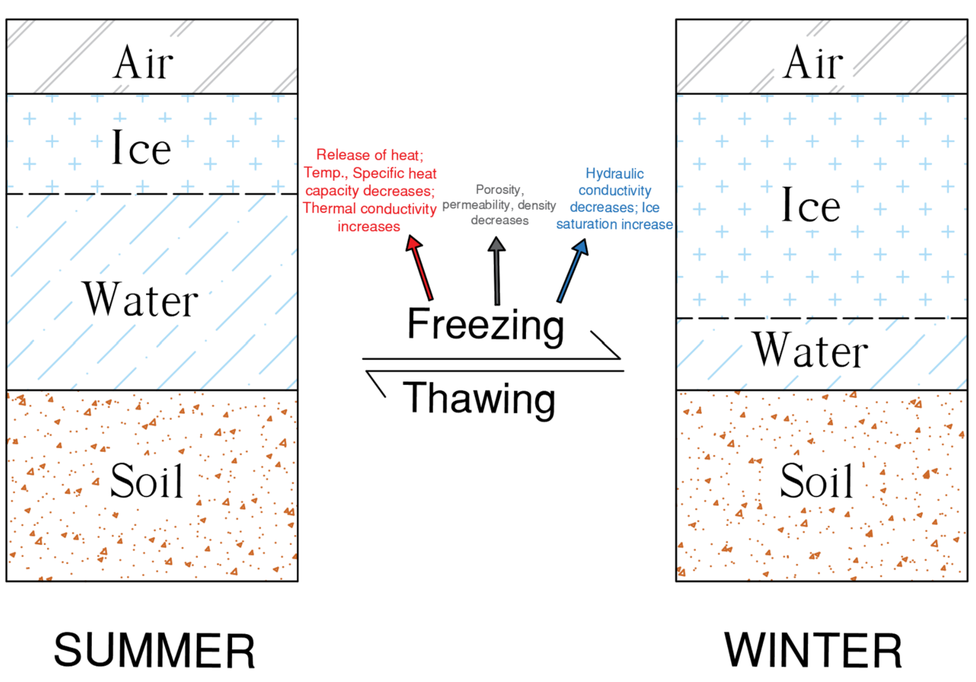
TransTiP Project

The IRTG "Geoecosystems in transition on the Tibetan Plateau" (TransTiP) is an international research training program which grants German and foreign students an international education within the cooperative environments of Technische Universität Braunschweig, Leibniz Universität Hannover and Friedrich Schiller University Jena. TransTiP project main research interests are on Sediment fluxes, Carbon fluxes, Water fluxes and water quality. Our project focuses on water fluxes on different scales in alpine catchments.





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