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Josef Strobl and Ainura Nazarkulova

Downscaling Climate Data and Change Scenarios for Hydrological and Landcover Modeling in Mountainous Regions

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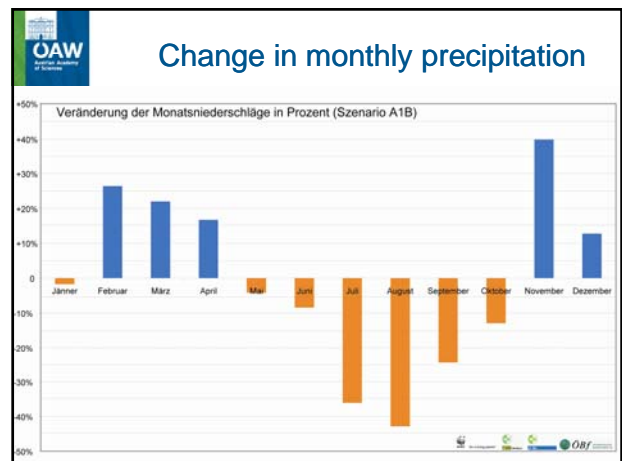
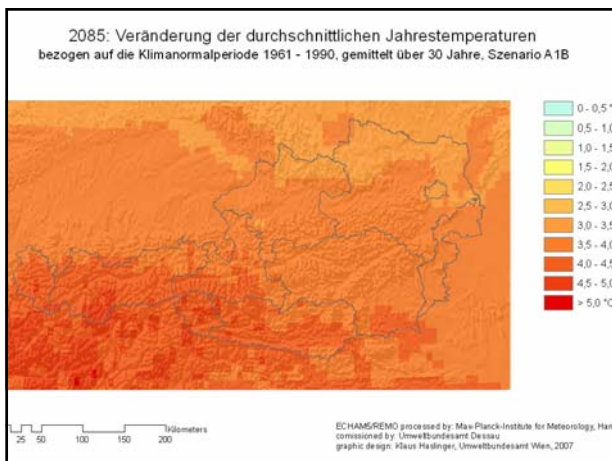
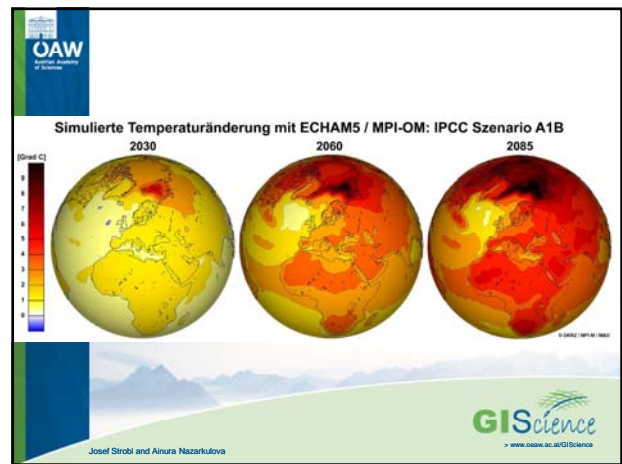
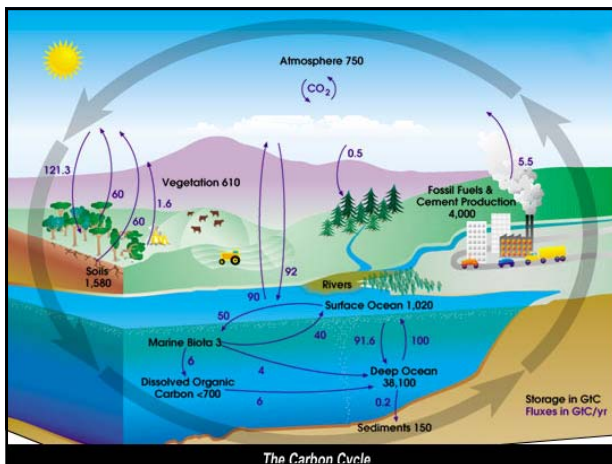
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Contents

- ✦ Demand for medium-to-large scale data and scenarios
- ✦ Approaches to downscaling
- ✦ Innovation and improvements

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Application Domains

- # Climate change impact analysis
- # Hydrological analysis
 - # Hydropower
 - # Irrigation potential
- # Land Use dynamics
- # Carrying capacity

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Scales

- # GCM .. 150-300km
- # RCM .. tens of km
- # Local Modeling (catchment, community, ...) .. 1km and better
- > Scale change is not trivial!

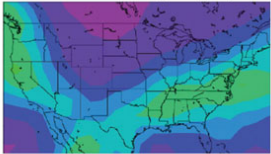
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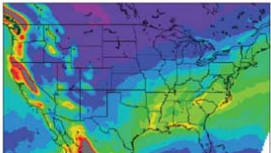
http://www.southwestclimatechange.org/files/ccc/figure/downscaling.jpg

Global climate model (GCM) outputs



↓ downscaling techniques ↓

Regional climate and weather models



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Spatial Downscaling

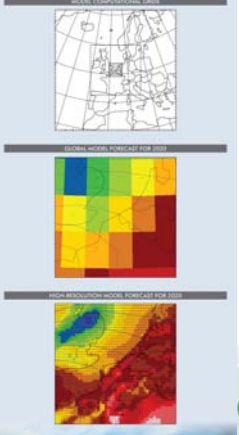
Downscaling is a method for obtaining high-resolution climate or climate change information from relatively coarse-resolution global climate models (GCMs). Many impacts models require information at scales of 50 km or less, so some method is needed to estimate locally relevant information.

Statistical downscaling first derives statistical relationships between observed local scale variables and larger (GCM) scale variables, using simulation methods, regression analysis, or neural network methods. Future values of variables obtained from GCM projections of future climate are then used to drive the statistical relationships and so estimate the local details of future climate.

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GLOBAL CLIMATE MODEL OUTPUT

REGIONAL CLIMATE MODEL OUTPUT FOR 2020

FROM REGIONAL MODEL PROJECTIONS FOR 2020

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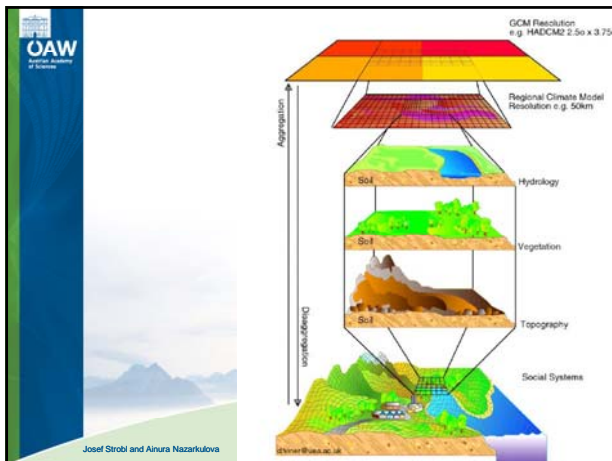
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Approaches to Downscaling

- # From GCM to Regional C.Models = ,dynamical downscaling'
- # Statistical Downscaling
 - / Interpolation (Regression, Kriging, ...)
 - / Neural Networks
 - / Support Vector Machines
 - / **GIS-based / numerical rules**
- # Sensitivity Analysis

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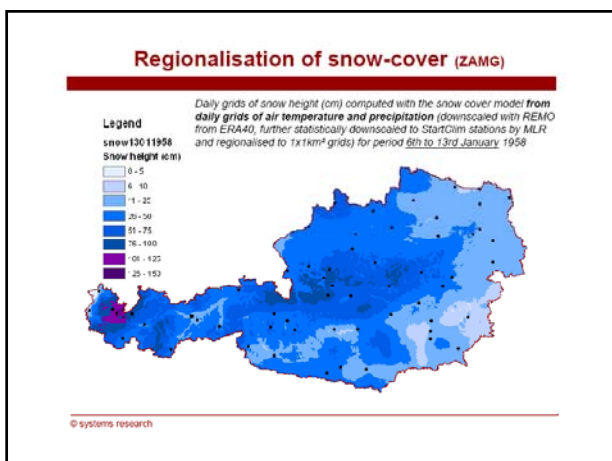
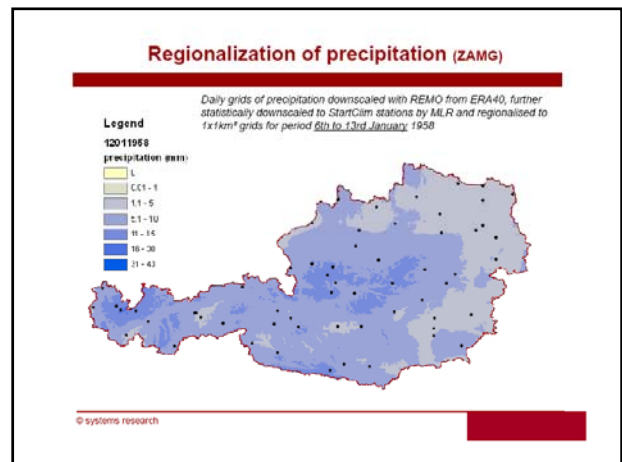
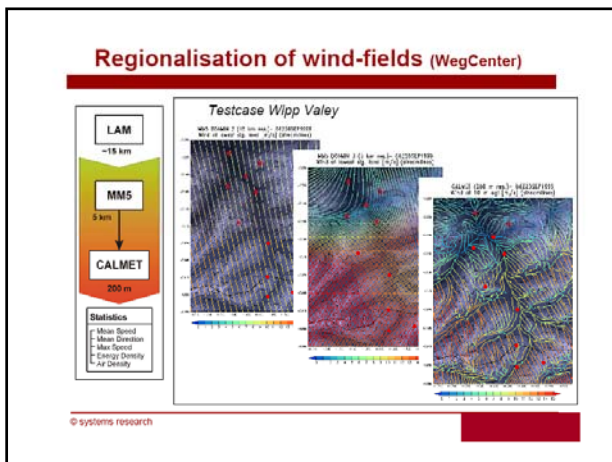
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Key Assumptions

- Climate change 'signal' available
- Region / local behavior is known and will not change significantly (stable relationship predictor-predictand)
- Scaling / calibration parameters are available
- Relationships are retained

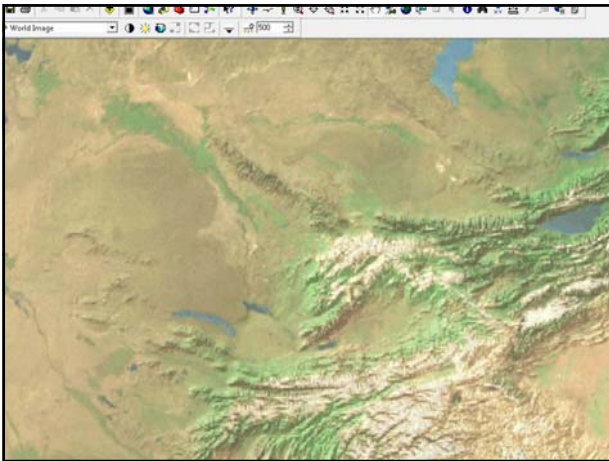
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Inputs to Downscaling

- Digital Terrain Models
- Sensor data
- Area (catchment) balances
- Gradients, and
- ... other 'rules'

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Special Cases

- ✓ Extreme events
- ✓ Change in principal patterns
 - ✓ Different feedback mechanisms
- ✓ Predominance of local climates

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Global Change— Future Environments

Geoinformatics – our main set of tools!