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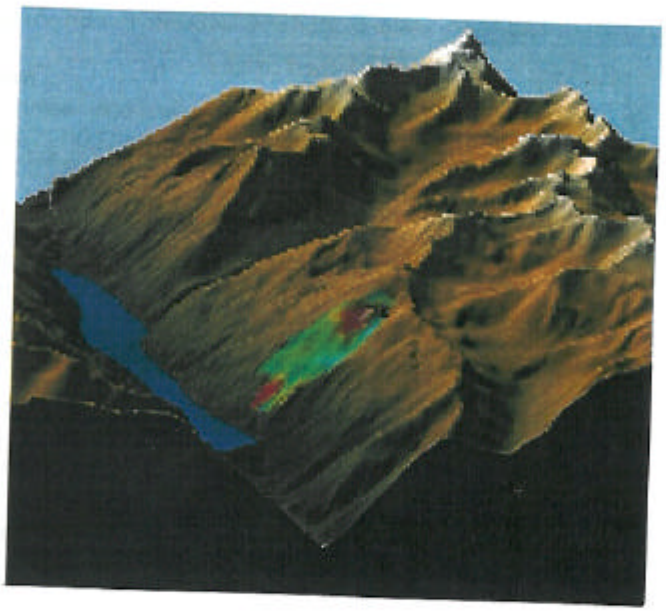

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The Regional Model of Hermagor District: Endogenous Development and Exogenous Change Simulations.

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During 1988 and 1993 statistical models of Hermagor district – a mountainous area with 800 km² and 25,000 inhabitants, situated in Carinthia/Austria – were developed. The models should be integrated to an overall model of Hermagor district (Breiling 1993) to anticipate the major challenges for the regional development. Modelling is usually applied in a particular field of expertise, e.g. to assess the probability or impacts of flooding or to forecast the timber harvest of the region, but not in comprehensive planning and related decision making. The acceptable uncertainties of specialist models can easily reach unacceptable levels in an integrated overall model of a region. Following topics with associated couples were important for our considerations to the model development:

1. Interest: economy and environment
2. Region: inside and outside
3. Change: observed and forecasted
4. Integration: complete or partial
5. Scenarios: bad and good

1) Interest: economy and environment
The basic idea is to describe socio-economic and environmental development parameters in parallel. For this purpose we develop three specialised models, one describes "economy" with help of an economic-demographic model, one explains "environment" with help of a hydrological model and a third one depicts the "economy-environment" interaction with help of a land use model. Our first idea was to develop well functioning specialist models and then to integrate them in a quantitative way to the overall model. We succeeded to simulate impacts in the case of the economic-demographic model (Breiling, Charamza 1994), but could not come up with satisfying results in the case of the hydrological and land-use model of the region, mainly because of reasons described under point 3).

2) Space: inside & outside
We differ between inside and outside of a region. The size of the region is determined from the beginning. Certain factors influence from within, others govern from outside. Our specialised models describe inside development and assume exogenous factors as stable in time. In the next stage we consider even a change of the exogenous factors and use global climate change scenarios. This change has an impact on all our specialised models. We can either quantify an impact in one or all specialist models. Inside one can locally influence the situation while outside an influence is negligible. The model shows also possibilities to counteract an expected event from inside the region, while the cause of this event can rest outside.

3) Dynamics: observed & forecasted

In our case we use the period 1951 to 1991. All our data was recorded during this period. However, the intervals of taking data varied. In the case of population or land use data, new entries came only once in a decade, while hydrological and meteorological data was taken from daily records. Time series of a decade could either contain only 2 or a maximum of 3653 data entries (in the case of precipitation and run off data). In the case of hydrology there was only a 14 years period of overlapping of precipitation and run-off data available, too short to serve our concept. Based on the observation length of 40 years, forecasting may give reliable results for half of this period or 20 years. Climate change scenarios with forecast horizons of 50 years and more have to be adjusted to our local forecasting period.

4) Integration: complete or partial

While a specialist model forces the cause-effect relation in its own competence area, the integrated model can show aggravating and trade off effects between several factors and evaluate the specialised model. The more specialised models we employ, the richer the range of alternatives we can choose from will be. Integration refers to different topics of interest and their spatial and dynamic significance. All data had to be related to Hermagor district and the period 1951 to 1991. A complete integration soon turned out to be an unachievable job. Nevertheless, we could see why the linking of different specialised models did not work and what could be done to improve it. Finally, we were able to partially integrate some of our topics and to interpret the outcome in a more precise way than without the help of modelling.

5) Scenarios

The aim of the overall model is to demonstrate under what condition a certain kind of a “good” or “bad” development can happen. One can test scenarios of scientists (for example global climate change research) or decision makers (wishes of local politicians) and combine their expectations in a future reference point. Can regional economic growth continue even under conditions of warming? Does the construction of more lifts for skiers pay off if there will be a major warming in the next decades? Can the number of catastrophes increase as a consequence of extreme weather events and decreased resilience of the local environment? Is additional safety provision necessary? Will there be enough money to finance safety provisions?

One can examine, if and under what conditions an endpoint can be reached. For example, we can simulate a reduction of the population with x% or a destabilisation of y% of land in z years and describe ways how such a situation could happen. The outcome differed widely according to our assumptions of certain parameters. Rather small events could aggravate to large costs. Even under conditions of a doubling of CO2 in the atmosphere landscape destabilisation could be balanced by improved forest or water management.

In conclusion, integrated modelling can play a more important role. Planning can become increasingly more powerful in giving appropriate information concerning the many alternatives to a possible future. It helps to better manage complexity and to reduce surprise. While we cannot cover all topics that are relevant for the regional development in an integrated model we will cover increasingly more topics once we have started to construct it. We can set larger or smaller regional borders or concentrate on a longer or shorter future. Our view on space and time scales will then become an equally important subject for integration. The cause-effect relation is not limited to the same regional scale, but covers everything from local to global. While threats may arise from the global scale, we should see opportunities in the local one.

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