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Integration of spatially explicit climate-adaptation measures with a land use model

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Climatic changes are expected to have important implications for land-use patterns, especially in coastal areas and river basins. Land use, on the other hand, also influences the climate through its impact on, amongst others, atmospheric composition and terrestrial radiation. The complex interrelated land use/climate system is thus receiving extensive research attention around the world. In the Netherlands, the research programme 'Climate changes spatial planning' and its follow-up 'Knowledge for Climate' aim to develop an adequate and timely set of policies for mitigation and adaptation to cope with the impacts of climate change. This is done in a series of related research projects dealing with, for example, climate scenarios, water management and adaptations in agriculture, nature and inland navigation. Within the research programmes we identify climate-change driven spatial changes in land use and land development and integrate these into balanced national visions and regional solutions. Important research questions in this respect are:

- Which possible changes are to be expected in the Dutch land-use system as a consequence of climatic changes?
- What spatial adaptation and mitigation strategies are to be developed to minimize this potential impact of climate change to the various societal sectors (agriculture, nature, residences)?
- To what extent will the proposed sector-specific adaptation and mitigation measures offer the potential for synergy or conflict at the local level? The following methodological components are crucial in integrating the results from the other projects in the research program and therewith answering the research questions formulated above:
- a scenario framework, that consistently combines assumptions related to climate, population, economy and society, forms the common ground for the various adaptation- and mitigation measures;
- a detailed, calibrated land-use model that integrates the sector-specific adaptation measures into simulations of future land use;
- a set of indicators and visualisation applications that supports pinpointing the possible synergies and conflicts in (combinations) of land use.

The project, thus far, resulted in a number of publications that describe the scenario framework (Riedijk et al., 2007), the revised modelling framework (Koomen et al., 2008), its validation (Loonen and Koomen, 2008) and available indicators (Bubeck and Koomen, 2008) and 3D-visualisation options (Lloret et al., 2008). The current presentation will briefly describe the applied methodology and discuss the first results. Ample attention will be devoted to the applied Land Use Scanner model that offers an integrated view of all types of land use, dealing with urban, natural and agricultural functions. The model now simulates land-use changes at a fine (100x100 metre) grid resolution for the year 2040. Initial simulations depict possible autonomous spatial developments according to accepted socio-economic scenarios. Two main storylines are followed here: a 'global economy' world that combines a global orientation with strong economic growth and a 'regional community' world that has a more regional orientation and moderate economic growth. These scenario's correspond roughly to the well-known A1 and B2 SRES-scenarios (IPCC, 2000) and differ considerably in terms of anticipated urbanisation and spatial restrictions. These opposing socio-economic scenarios are combined with Dutch climate-change scenarios (Van den Hurk et al., 2006) and offered to a series of sector-specific adaptation projects dealing with, amongst others, nature management, flood risk and agriculture. Additionally region-specific projects study integrated adaptation programmes for individual provinces. At this moment we are integrating these project-specific results into coherent images of a climate proof country. In doing so, we recognise the benefits of a rigid modelling and scenario framework, but also experience the tremendous uncertainties related to the integrated assessment of socio-economic and climatic changes.

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