Geophysical Research Abstracts
Vol. 12, EGU2010-10624, 2010
EGU General Assembly 2010

Climate change induced changes on suspended sediment transport in Danish rivers

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The HIRHAM regional climate model suggests an increase in temperature in Denmark of about 3°C and an increase in mean annual precipitation of 6–7%, between a control period 1961–1990 and scenario period 2071–2100. Modeled increases of >40% in precipitation in winter months and decreases of >30% in august and September will induce larger changes than the mean annual changes indicates. The changes in precipitation, temperature and consequently evapotranspiration are modeled to increase the mean annual water discharge by an average of 12% in Danish rivers. The increase can be >40% during winter months in some catchments. During the dryer periods in august and September decreases of up to 40% are modeled. The largest percentical changes are estimated to occur in clayey catchment, who has relatively flashy flow regimes. This change of climate will affect the suspended sediment transport in rivers, directly through erosion processes and increased river discharges and indirectly through changes in land use and land cover. Erosion processes will be affected both in the catchment and within the river perimeter. Erosion will be affected indirectly through changed land use and land cover and through changes in land and agricultural management. Climate-change-induced changes in suspended sediment transport are modeled for five scenarios on the basis of modeled changes in land use/land cover for two Danish river catchments: the alluvial River Ansager and the non-alluvial River Odense. The five scenarios reflect different responses to climate change for different land uses. Changes in suspended sediment transport are modeled using month specific or multi monthly rating curves. The use of rating curves is shifted in time on the basis of modeled growing season lengths for different crops and natural areas. Rating curves are shifted in the way that, if for example sowing dates are modeled to shift forward one month the use of rating curves also shifts.
Mean annual suspended sediment transport is modeled to increase by 17% in the alluvial river and by 27% in the non-alluvial for steady-state scenarios. Increases by about 9% in the alluvial river and 24% in the non-alluvial river were determined for scenarios incorporating a prolonged growing season for catchment vegetation. Shortening of the growing season is found to have little influence on mean annual sediment transport. Mean monthly changes in suspended sediment transport between -26% and +68% are found for comparable suspended sediment transport scenarios between the control and the scenario periods. The suspended sediment transport increases during winter months as a result of the increase in river discharge caused by the increase in precipitation, and decreases during summer and early autumn months.