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Towards a virtual observatory for ecosystem services and poverty alleviation

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Over the last decades, near real-time environmental observation, technical advances in computer power and cyber-infrastructure, and the development of environmental software algorithms have increased dramatically. The integration of these evolutions, which is commonly referred to as the establishment of a virtual observatory, is one of the major challenges of the next decade for environmental sciences. Worldwide, many coordinated activities are ongoing to make this integration a reality. However, far less attention is paid to the question of how these developments can benefit environmental services management in a poverty alleviation context. Such projects are typically faced with issues of large predictive uncertainties, limited resources, limited local scientific capacity. At the same time, the complexity of the socio-economic contexts requires a very strong bottom-up oriented and interdisciplinary approach to environmental data collection and processing. In this study, we present three natural resources management cases in the Andes and the Amazon basin, and investigate how "virtual observatory" technology can improve ecosystem management. Each of these case studies present scientific challenges in terms of model coupling, real-time data assimilation and visualisation for management purposes. The first project deals with water resources management in the Peruvian Andes. Using a rainfall-runoff model, novel visualisations are used to give farmers insight in the water production and regulation capacity of their catchments, which can then be linked to land management practices such as conservation agriculture, wetland protection and grazing density control. In a project in the Amazonian floodplains, optimal allocation of the nesting availability and quality of the giant freshwater turtle are determined using a combined hydraulic model and weather forecasts. Finally, in the rainforest of the Yasuni Biosphere Reserve , Ecuador, biodiversity models are used to quantify the impacts of hunting and logging on community composition and wildlife populations.