Geophysical Research Abstracts
Vol. 17, EGU2015-812-2, 2015
EGU General Assembly 2015

Towards an equitable allocation of the cost of a global change adaptation plan at the river basin scale: going beyond the perfect cooperation assumption

Corentin Girard (1), Jean-Daniel Rinaudo (2), and Manuel Pulido-Velázquez (3)

(1) Universitat Politècnica de València, Research Institute of Water and Environmental Engineering (IIAMA), Department of Hydraulics and Environmental Engineering, Spain (cogi@posgrado.upv.es), (2) BRGM. French Geological Survey, Montpellier, France (jd.rinaudo@brgm.fr), (3) Universitat Politècnica de València, Research Institute of Water and Environmental Engineering (IIAMA), Department of Hydraulics and Environmental Engineering, Spain (mapuve@hma.upv.es)

Adaptation to global change is a key issue in the planning of water resource systems in a changing world. Adaptation has to be efficient, but also equitable in the share of the costs of joint adaptation at the river basin scale. Least-cost hydro-economic optimization models have been helpful at defining efficient adaptation strategies. However, they often rely on the assumption of a "perfect cooperation" among the stakeholders, required for reaching the optimal solution. Nowadays, most adaptation decisions have to be agreed among the different actors in charge of their implementation, thus challenging the validity of a perfect command-and-control solution. As a first attempt to over-pass this limitation, our work presents a method to allocate the cost of an efficient adaptation programme of measures among the different stakeholders at the river basin scale. Principles of equity are used to define cost allocation scenarios from different perspectives, combining elements from cooperative game theory and axioms from social justice to bring some "food for thought" in the decision making process of adaptation.

To illustrate the type of interactions between stakeholders in a river basin, the method has been applied in a French case study, the Orb river basin. Located on the northern rim of the Mediterranean Sea, this river basin is experiencing changes in demand patterns, and its water resources will be impacted by climate change, calling for the design of an adaptation plan.

A least-cost river basin optimization model (LCRBOM) has been developed under GAMS to select the combination of demand- and supply-side adaptation measures that allows meeting quantitative water management targets at the river basin scale in a global change context. The optimal adaptation plan encompasses measures in both agricultural and urban sectors, up-stream and down-stream of the basin, disregarding the individual interests of the stakeholders. In order to ensure equity in the cost allocation of the adaptation plan, different allocation scenarios are considered. The LCRBOM allows defining a solution space based on economic rationality concepts from cooperative game theory (the core of the game), and then, to define equitable allocation of the cost of the programme of measures (the Shapley value and the nucleolus). Moreover, alternative allocation scenarios have been considered based on axiomatic principles of social justice, such as "utilitarian", "prior rights" or "strict equality", applied in the case study area. The comparison of the cost allocation scenarios brings insight to inform the decision making process at the river basin scale and potentially reap the efficiency gains from cooperation in the design of adaptation plan.

The study has been partially supported by the IMPADAPT project /CGL2013-48424-C2-1-R) from the Spanish ministry MINECO (Ministerio de Economía y Competitividad) and European FEDER funds. Corentin Girard is supported by a grant from the University Lecturer Training Program (FPU12/03803) of the Ministry of Education, Culture and Sports of Spain.