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What amount of flood damages miss assessment methods by negelecting induced damages on activity?

P. Brémond and F. Grelot
UMR G-EAU, IRSTEA, France (pauline.bremond@irstea.fr)

Assessing damages due to natural hazards on specific assets is crucial, specifically to appraise the efficiency of adaptation measures. These damages are usually classified as direct damages while they result from the contact of flood water on assets [1]. In this classification, direct damages also include losses due to the disruption of production processes.

As they result from propagation in time, at an asset's scale, we name afterward induced damages, the losses due to the disruption of production processes and direct damages, the damages on physical production factors. This avoids also confusion with indirect damages which occur at meso and macro scales outside the flooded area.

Existing methods to appraise damages generally pay little attention to induced damages [2]. Moreover, when they are considered, they are usually roughly estimated but rarely modelized. Considering that evaluating induced damages at asset scale requires important efforts to model processes and additional data, we propose to evaluate the relevance of this approach on a case study: farms located in floodprone areas of the Rhône River downstream.

On agricultural areas, flood damage evaluation is often reduced to the loss of harvest. But, this is not representative of all the damages endured by farms [3], specifically the damages due to the disturbance of farm activity after flooding [4].

EVA is a model we designed to evaluate flood damages on farms, including induced ones. Direct damages are appraised using classical damage functions for every farm components i.e. crop, soil, orchard, building, equipment, soil. Our main contribution consists in modelling farm organization with and without flooding. For instance, production task distribution is related to crop management sequence; the needs of workforce, equipment and inputs are linked to production tasks. After flooding, conditions to carry on production change: more workforce can be required due to additional cleaning tasks and external equipment can be necessary due to the direct damages. If farmers have no access to these additional resources (workforce and equipment), some production tasks cannot be achieved. Induced damage are evaluated by the loss of added value resulting from the undoing of these tasks. Thus, EVA enables us to simulate direct damages on each farm components and induced damages on activity.

EVA is applied to evaluate damages on three farm types, differing by their production (arboriculture, vineyard, garden-wheat), in five flood prone areas of the Rhône River downstream. In this context, we compare induced damages to the total amount of damages simulated for four spatial configurations:(1) the whole of the landplots and the building are flooded, (2) the whole of the landplots but not the building are flooded, (3) 50 % of the landplots and the building are flooded, (4) 50 % of the landplots but not the building are flooded. Depending on the spatial farm localization and hydrologic context, taking into account induced damages reveals critical as they can represent a large share of total damages. Finally, we discuss the relevance of this approach according to the needs of decision makers to manage flood risk.

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