Human in the Loop of Managing Early Warning of Coupled Dynamics and Risks with Poor Observations, Incomplete Understanding and Hybrid Modeling

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Here we address coupled human-water dynamics, especially with poor observation networks and incomplete understanding, by using emerging hybrid models. Human-in-the-loop (HITL) is defined as a model approach that requires human interaction. In HITL simulation, humans are usually a component, thereby influencing water-systems outcomes, sometimes in such a way difficult to reproduce exactly. From a Brazilian case study, we combine (1) a former application of a qualitative analysis of the early warning process in disaster management (see Horita et al, 2016) with (2) a novel, plausible HITL approach, viable for issuing anticipatory alerts on flood risks at a national scale. There are more than 40,000 flood-and-landslide prone areas officially mapped in Brazil. Also, 1 in 5 Brazilian municipalities depicted strong water-risks to population from hydrometeorological processes. Official alerts issued from CEMADEN-MCTIC are delivered at the municipality scale (community focused), with high uncertainty at the catchment scale (system driven). For that reason, a new generation of HITL depicts reasonable conditions for early warning of coupling dynamics and moving scales under complex realities of growing urbanization. In this contribution, we propose a new HITL in comparison with the observation network and alert database of the National Center of Monitoring and Alerts of Natural Disasters (CEMADEN/MCTIC), with more than 3,000 real time sensors, integrated at a 10-min time scale, installed in ca. 1000 municipalities. Novel indicators from this new HITL approach, based upon surrogate variables of hazard, vulnerability and exposure of flood-prone communities of Brazilian states, are here depicted. With emphasis in the North-East Region and South-East region, we derive HITL relations to help CEMADEN-MCTIC crisis room and the decision-making process of alerts at the national scale. Because the great nature of uncertainty, complexity of factors and cascade of decision-making rules, HITL should invoke promissory pathways for hybrid modeling under incomplete understanding of coupled human-water dynamics across scales significant to stakeholders. Reference and Supplementary Material: Horita, F., de Albuquerque, J., Marchezini, V., Mendiondo (2016) A qualitative analysis of the early warning process in disaster management, Short Paper, In: Community Engagement and Practitioner Studies Session, ISCRAM 2016 Conference (proceedings), Rio de Janeiro, 2016 (http://www.agora.icmc.usp.br/site/wp-content/uploads/2016/03/horita-iscram2016.pdf)