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Managing the co-occurrence of natural hazards and pandemics with a new parallel phases DRM model

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The Disaster Risk Management Cycle (DRMC) is a common reference for the international Disaster Risk Management (DRM) community to describe the management of catastrophic anthropogenic and natural events worldwide. Implementing this approach, disaster management is described by a series of separate and consecutive phases (e.g., preparedness, response, and recovery). However, the current DRMC is not able to successfully cover the dynamics of multi-hazard risk scenarios, particularly those involving both sudden- (e.g., earthquakes or flash floods) and slow-onset hazards (e.g., pandemics or droughts).

Starting from such a complex scenario we propose a 'parallel phases' DRM model accounting for the management of interacting sudden- and slow-onset hazards. The framed 'parallel phases' model allows to overcome the limitations of the existing models when dealing with complex multi-hazard risk conditions. We supported the identified limitations analysing Italian Red Cross data dealing with past and ongoing emergencies including the COVID-19 pandemic. Key findings from the analysis involve: (i) the spatial-temporal differences between sudden-onset events and pandemic disaster management; (ii) the high demand for emergency response resources during pandemics in comparison to other emergencies; (iii) the need for the DRM system to adjust the response to cope with the pandemic seasonality; (iv) the system over-exposure to pandemic response activities reducing the number of resources for preparedness and entering the system into an unpreparedness negative loop.

Overall, the combination of the key findings that emerged from the management of the COVID-19 pandemic in Italy brought out three main guidelines for advancing multi-hazard DRM by applying our 'parallel phases' model:

- **Managing the system with parallel phases.** A 'parallel phases' DRM allows the system to exploit the low emergency intensity of the slow-onset hazards seasonality for preparedness actions while also preparing for any other hazard that can have relevant impacts on the system. Such an approach allows the DRM system to escape from an unpreparedness negative loop.
- **Keeping the DRM system capacity far from depletion.** The DRM system can learn how to efficiently deploy the available resources keeping its capacity far from total depletion. If the DRM system is able to save part of its capacity, it can continue with the increase of internal resources while also making them available for international mutual support in case of multi-hazard risk. Such a condition triggers a positive loop in the increase of the DRM capacity.
- **Impact-based forecasting for multi-hazard disaster risk management.** The implementation of multi-hazard seasonal impact-based forecasts fosters the planning of appropriate anticipatory actions, combining the prediction of slow-onsets waves with the seasonality of sudden-onsets.

Overall, the proposed 'parallel phases' model is able to capture the complex management dynamics to deal with the increasingly frequent slow-onset and multi-hazard events, introducing a change of perspective from the cyclic, consecutive-phases, and single-hazard DRM approach. For this reason, the 'parallel phases' model can strengthen and boost current and future international policies on multi-hazard DRM towards an effective implementation at a local scale.