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SMART CITIES AND TERRITORIES DIGITAL TWINS

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ABSTRACT

The main characteristic of a city or a territory, in terms of predictability, is its extreme complexity. The existence of numerous interconnected and interacting systems, of large spatial and temporal dimensions, presenting different granularities (systems of systems) and subjected to uncertainties and imprecisions that propagate within, makes modeling particularly complex. If we add to this the main protagonists, humans, whose behavior eludes deterministic models, the objective of achieving the desired level of diagnosis, prognosis, and support for decision-making is considerably limited.

This mini-symposium revisits the different technological bricks enabling the construction of digital twins of cities and territories, needing for an efficient alliance between physics-based and data-driven models, the former involving advanced model order reduction and regression technologies based on physics-based model solutions, and the latter based on data-assimilation and physics-informed machine-learning to fill the predictions to observations gap.

The large time and space scales that those systems involve, need important computational resources (high performance and quantum computing), the collection of smart (useful) data properly assimilated into the physics-based and data-driven model, as well as an appropriate verification and validation technologies for supporting control and decision making.

The resulting digital twins (prototypes and instances) should serve for optimal planning and operation, the former asking for advanced generative AI techniques, the latter more concerned by using predictive AI for static and dynamic systems enabling monitoring, diagnosis, prognosis and decision-making, covering both every-day operation and crises management and mitigation. The role of humans will be carefully considered.