Response

The first **Objective** of Wetropolis World "is to investigate this reduced (relative to Numerical Weather Prediction) physical and modelling Wetropolis World to study the pros/cons of classical (P)DEs and data-assimilation (DA) based flood predictions with ones arising from ML. Novel herein is the research application to the unique Wetropolis setting with its reduced spatial and temporal scales. The reason to study Wetropolis is its accessibility, facilitating in depth analysis in a controlled experiment." This is validation of existing yet adapted classical models and Machine Learning (ML) against a laboratory experiment with attainable extreme events. Such a laboratory validation is innovative and unique. The aim is not to develop another classical DA or ML theory, but to develop a mathematical diagnostic on what new hybrid classical-ML method is most suitable. That is applied mathematics. Relative to outside-world extreme flooding events, Wetropolis events are more attainable. Note that computer power is also shrunken, so fast prediction remains challenging. Both reviewers omitted the actual multi-disciplinary objective. Wetropolis avoids use of a computer model to create truth runs and is a rare laboratory experiment with extreme events. (NB Geometric integrators are not proposed or useful for these forced-dissipative flows.)

Objective 2 concerns expanding my flood-mitigation cost-effectiveness tool, overcoming its limitations and exploring ways to include uncertainty quantification, i.e. by using ensemble predictions, as proposed for actual case studies (with spatially-temporally varying precipitation patterns) and assessing the viability of info-gap theory. Info-gap theory herein is not an established theory and has been sharply criticised from a Bayesian point of view. Its relative simplicity has allowed a consistency check (my poster at European Geophysical Union [EGU] General Assembly 2025). Given the Knightian uncertainties involved, data-shortage may prohibit more rigorous Bayesian statistics on flooding cost-effectiveness. This will be under discussion with statisticians/data experts in the project, such as […] (colleague), […] ((co-)supervisor PhD projects on flooding; the School's PhD position would be on flooding-DA/ML alongside the RA) and […] ([…] University), and other (statistician) workshop participants. Such exploration of my tool's uncertainty aspects and of the limitations of info-gap theory will lead to an innovative diagnostic and theory for practical flood-mitigation applications.

Objective 3 does not concern "commercialisation" (instead use "educationalization-with-sales"). It concerns design of a Wetropolis board game and design of a small-scale Wetropolis demonstration set-up for educational purposes. Educationalization with actual commercial sales is mentioned as viable option beyond the 5-year project span, in order to increase the educational reach. I am not interested in making money, the tentative sales' team may be. My academic role is then to promote its reach and safeguard educational content. Interesting new detail is that in a game model the water levels/speed are coarsely discretised as integers such that the game can be rephrased mathematically as a discretisation of Wetropolis with an appropriate continuum limit (UG project 2024/2025). Most geoscience games at EGU2025 were freely available online or sold for material costs, which format will be a first port of call. Note that showcasings at (annual) EGU games' days are milestones. Design of material requires iterations and iterations cost some money, as Wetropolis' designs(/failures) have shown.

While **Objective 4** grew out of the 2015 Boxing Day flood evacuation, major achievements and impact came through application of our tool by French civil engineers in French flood-mitigation works (aiding in convincing the relevant municipality of proposed plans), which are under construction, and by a Slovenian NGO (our 2021 Impact Case Study). Incidentally, I will also ask these engineers to become oversight-committee members.

Conflicts of interest: My full-time participation in the tentative project is warranted since my UG/CDT teaching will then be stopped, I am not a board member or co-I in CDT3 (my CDT1 and CDT2 board membership ends in 2025), and my participation in LIFD concerns the question how scrutiny of public-private (flood-mitigation) plans can be encouraged from an academic environment such as LIFD's. Within SoM-LIFD, we have just set up meeting with the Environment Agency (EA) to discuss both an anomaly in local flood-mitigation plans by a company/council, discovered via my graphical tool (advertised 5% extra protection is sold for 4.25M pounds while protection is to date seen to be only 2%) and, more importantly, to include and develop my tool for EA's national tool kit. That process is time-consuming (involving circa 5 FOIs and complaints, the latter being the only format the EA's front desk acts upon). While the EA had also observed that 2.36% is not 5%, that 5% was approved by reviewing scientists in another funded large project, wherein the same company/council is a (paying in kind or in cash) collaborator. The EA was not yet able to openly question that 2%-versus-5% issue, presumably due to a lack of back-up. It is exactly to avoid such (potential) conflict of interests that I explicitly do not want to be a paid private or academic consultant. How to shape the named Centre for Advice is debated within […], since such centres have existed before; a variety of options changing over time seems best, including part-time placements as well as bespoke study groups.

Career: Beyond (i.e. not during) the project, as final career aim, I proposed that I would like to become an unpaid part-time scrutineer or controller of flood-mitigation plans, using the Team's advanced academic and practical insights, based as independent academic within an academic institution. ('Scrutineer" is more apt than "consultant".) That would avoid observed conflicts of interest and allow colleagues and UG/PhD students to learn from such scrutiny experiences within our academic environment. For all Team members involved, our experiences will be evaluated in UoL's/LIFD's existing mentoring schemes.

Conclusion: Not all academics need to develop mathematical theories. Some academics have to test and adapt mathematical theories (here for civil engineering) in their own innovative validation environments and bring their findings into the public realm by influencing and informing policies and the public (NB the call specifications are broad). Within the multi-disciplinary context of flood mitigation, let me do that with this EPSRC-open-plus fellowship.