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In models we trust: how collaboration helped make a useful and accurate model for particulate matter deposition in indoor heritage

Josep Grau[1], L. Mazzei[2], D. Thickett[3], C. Vlachou-Mogire[4], S. Signorello[5], M. Strlič[1]

[1] Institute for Sustainable Heritage, University College London, London, UK
[2] Department of Chemical Engineering, University College London, London, UK
[3] English Heritage, UK
[4] Historic Royal Palaces, UK
[5] Wellcome Trust, UK

Environmental models are usually distrusted, and for good reasons: their visually appealing results make strong statements that mask the great uncertainties associated with them and veil the absolute dependence on input parameters. But there is a way to produce reliable and useful models of the most complex kind, and this is through careful validation, and close collaboration with heritage partners and end-users of predictions.

We developed a computational fluid dynamics model of particulate matter deposition in indoor heritage environments. Collaboration between UCL and heritage institutions informed all the stages of the process, from the model conception to its experimental validation. We have used the model very successfully to simulate the deposition of fine particles in the Wellcome Collection, Apsley House and the Wellington Arch, the last two managed by English Heritage, and coarse dust in the Hampton Court Palaces, managed by Historic Royal Palaces. All these case studies were much more than mere applications of the model; they constituted scientific collaborations that were based on interdisciplinary communication.

The different stages of the project - planning of monitoring, data collection and interpretation, definition of case studies, post-processing and communication of results- were shaped by the inputs of the scientific and heritage partners. The result is a model that can inform decision making, that has already produced useful and accurate predictions, and that has remarkable industrial applications.

Our achievements -and mistakes- provide many insights on the collaborative nature of Heritage Science, and how can it contribute solutions that are both practical and rigorous - even using the most complex and visually appealing of modelling tools.