



Supplement of

The value of multi-source data for improved flood damage modelling with explicit input data uncertainty treatment: INSYDE 2.0

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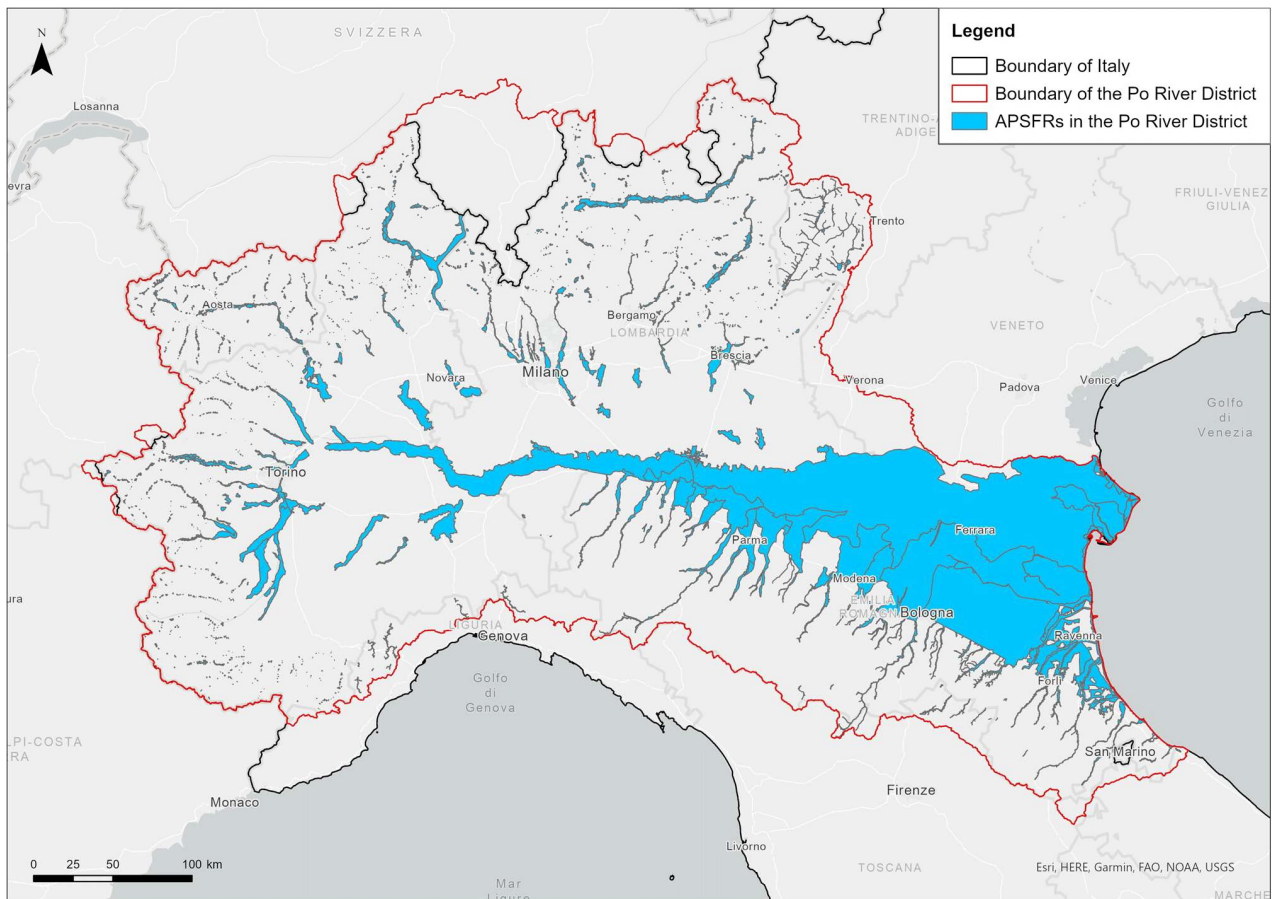


Figure S1. Overview of the Po River District, with indication of Areas of Potentially Significant Flood Risk (APSFRs).

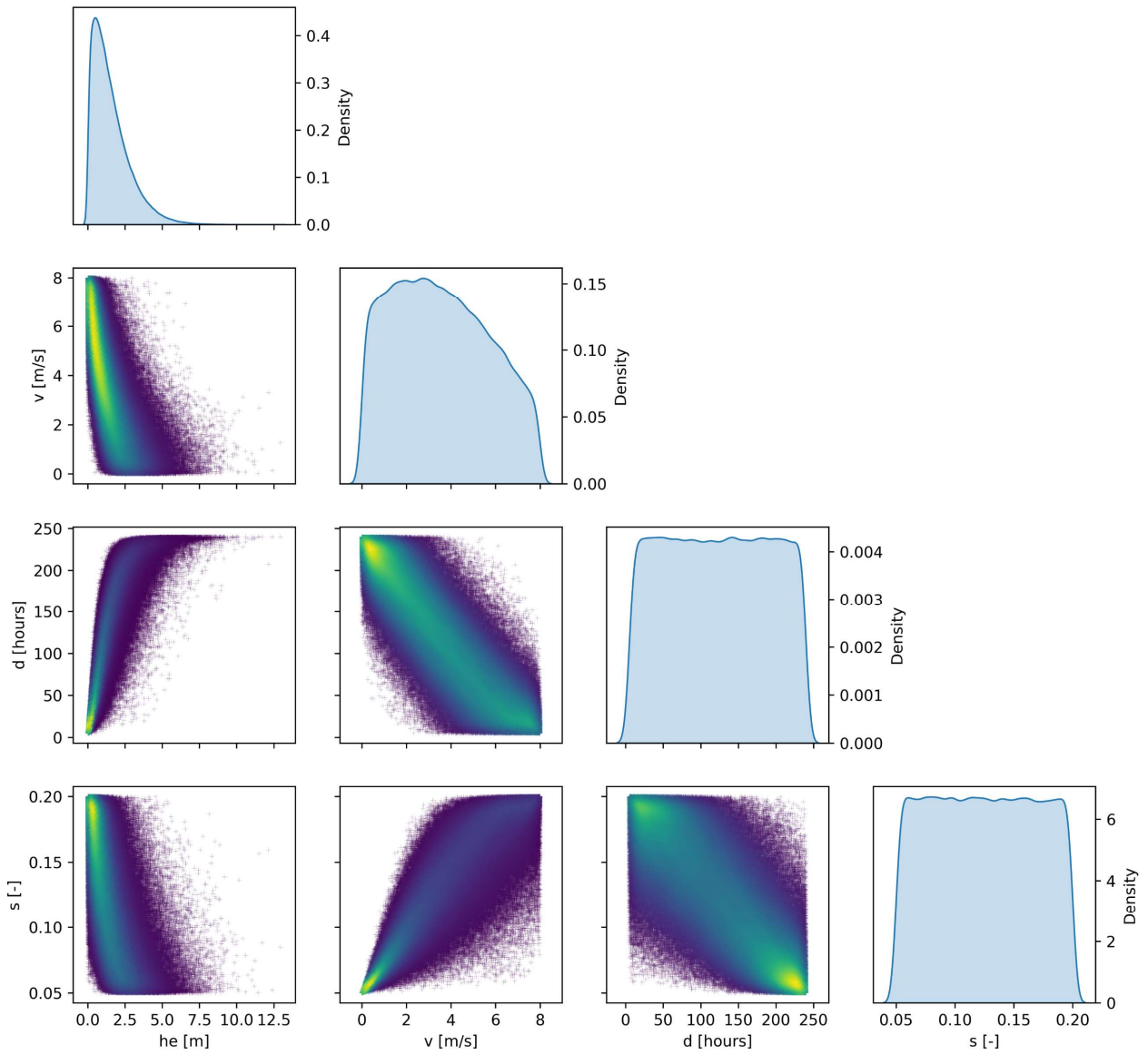


Figure S2. Pairwise relationships assumed for the generation of the extended synthetic dataset: hazard variables (water depth (h_e), flow velocity (v), inundation duration (d) and sediment load (s)).

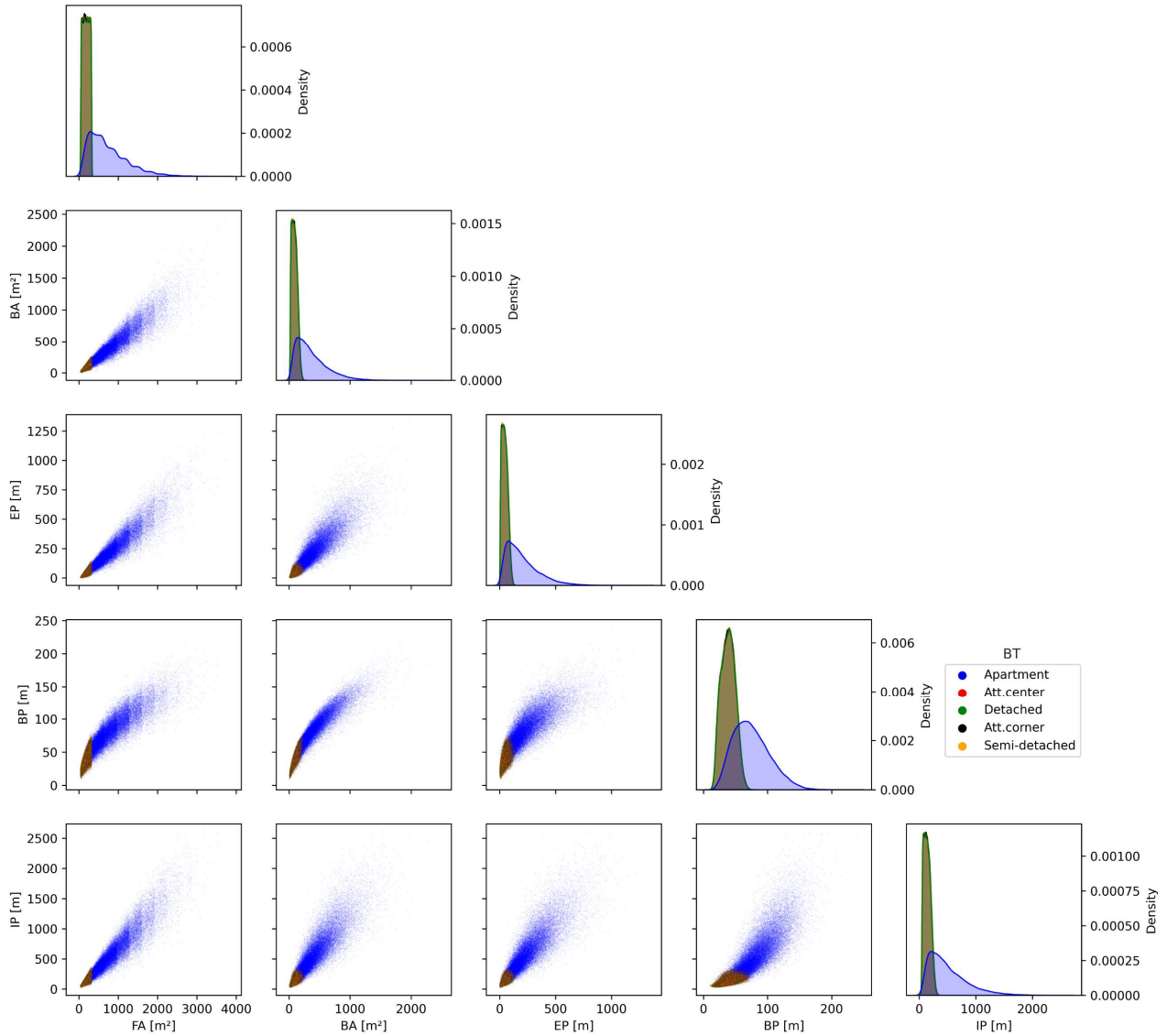


Figure S3. Pairwise relationships assumed for the generation of the extended synthetic dataset: extensive building variables (footprint (FA) and basement (BA) area; external (EP), internal (IP) and basement perimeter (BP)). Uniform distributions are instead assumed for the other categorical variables in the extended dataset.

Example of assumed damage mechanism for internal plaster removal

Internal plaster is considered to be removed if one (or more) of these conditions occur:

- long duration flood: longer residence time enhances water penetration into the plaster; the fragility function is shown in Figure S4;
- contaminated water ($q=1$): plaster replacement is usually required in case of contaminated water; in such scenarios, the damage ratio is considered to be 1;
- level of maintenance is “average” or “poor” (i.e. $LM \leq 1$), which implies a more vulnerable plaster, even under short duration floods and/or absence of contaminants in the water. In these cases, the damage ratio is considered to be 1.

The function is probabilistic. If more than one of the conditions mentioned above occur, the damage ratio considered is the maximum among the three. The underlying assumption is that the most unfavourable condition dominates the damage mechanism, independently of the others.

The height considered in the calculations for plaster removal is equal to the internal water depth plus 1.0 m due to capillary rise.

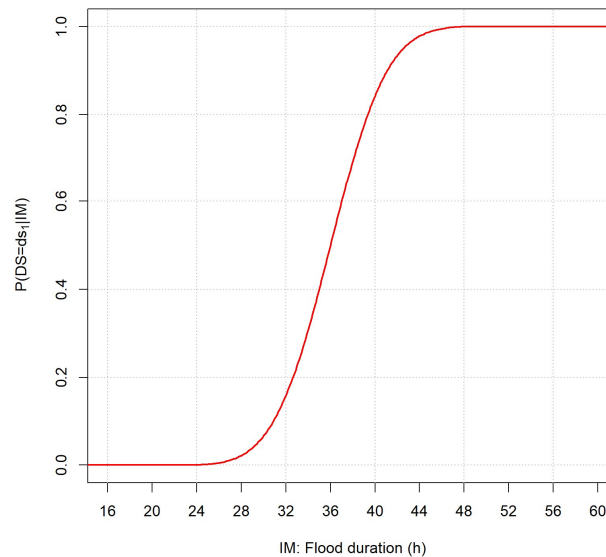


Figure S4. Fragility function for internal plaster relative to inundation duration.

Example of assumed damage mechanism for external plaster removal

External plaster is considered to be removed if one (or more) of these conditions occur:

- long duration flood: longer residence time enhances water penetration into the plaster; the fragility function is shown in Figure S4;
 - high velocity flow: higher flow velocities cause more serious damage to exterior plaster; the fragility function is shown in Figure S5;
 - contaminated water ($q=1$): plaster replacement is usually required in case of contaminated water; in such scenarios, the damage ratio is considered to be 1;
 - level of maintenance is “average” or “poor” (i.e. $LM \leq 1$), which implies a more vulnerable plaster, even under short duration floods and/or absence of contaminants in the water. In these cases, the damage ratio is considered to be 1.
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The function is probabilistic. If more than one of the conditions mentioned above occur, the damage ratio considered is the maximum among the four. The underlying assumption is that the most unfavourable condition dominates the damage mechanism, independently of the others.

The height considered in the calculations for plaster removal is equal to the internal water depth plus 1.0 m due to capillary rise.

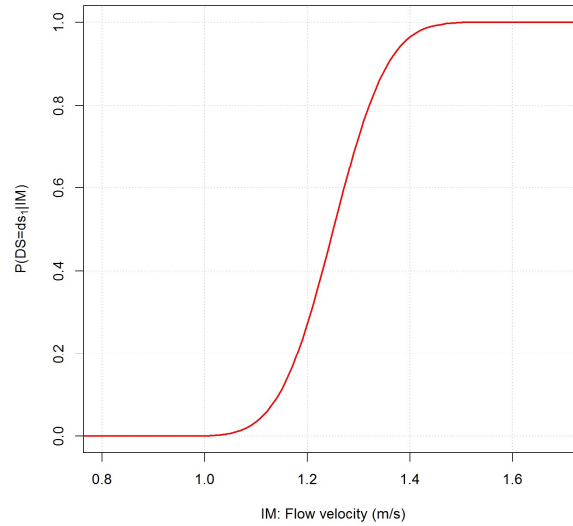


Figure S5. Fragility function for external plaster relative to flow velocity.