Why quantum? · The next problems

Today Q-Flood tells you where the risk is; the next problem is the best set of actions — that's where the quantum layer is pointed.

1 Which basins to watch together

Measured · pre-registered

Which sub-basins saturating at the same time cause the worst downstream delay? Kelantan pilot: 20 basins, groups of 3 → **1,140** combinations. A real network has hundreds of basins and larger groups → trillions (groups of 10 from 100 basins: ≈ 1.7×10^{13}).

2 Where to put the next sensors

First step measured · pre-registered

15 of 200 candidate sites: C(200, 15) ≈ 1.46×10^{22}. Sites interact, so picking the individually best ones misleads. First step (pre-registered Amendment 4, real MY/TR data, IBM Heron + Origin Wukong): hardware beat random in 48 of 48 instances; it did not beat an equal-mean-energy classical sampler, and the exact classical solution takes milliseconds.

3 Operating gates, pumps and reservoirs together

Roadmap

Before a storm: how much to pre-release from which reservoir, which gates, in what order — so downstream peaks don't coincide. Every choice changes the others; today this is done by experienced operators and rules of thumb. Can be approximated as a QUBO.

4 Crew and resource allocation

Roadmap

Limited pumps, sandbags and crews; many at-risk provinces; roads that may close. Which allocation minimises expected damage? The same “best combination under constraints” shape.

5 (Later, for utilities) Leak zones (DMA) and maintenance scheduling

Roadmap

Partitioning a network into district metering areas, or sequencing 300 maintenance jobs under crew and outage constraints — the same mathematics; the drinking-water side of WaterMatica.

What they share: the number of options explodes, the options interact, and a wrong “good enough” answer is costly. This is the problem class quantum optimisation targets; the same QUBO form already runs on IBM and Origin hardware.

A scenario count is not a solve time; today classical solvers make these decisions and the quantum layer runs in the shadow. Quantum-ready. We will claim superiority only if a pre-registered test proves it.