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## PROBLEM STATEMENT: Urgent Computing in Volcanology

- Real-time demands for early warning and rapid impact forecasts
- Complex simulations, data acquisition, assimilation and analysis
- Bottlenecks for a solution

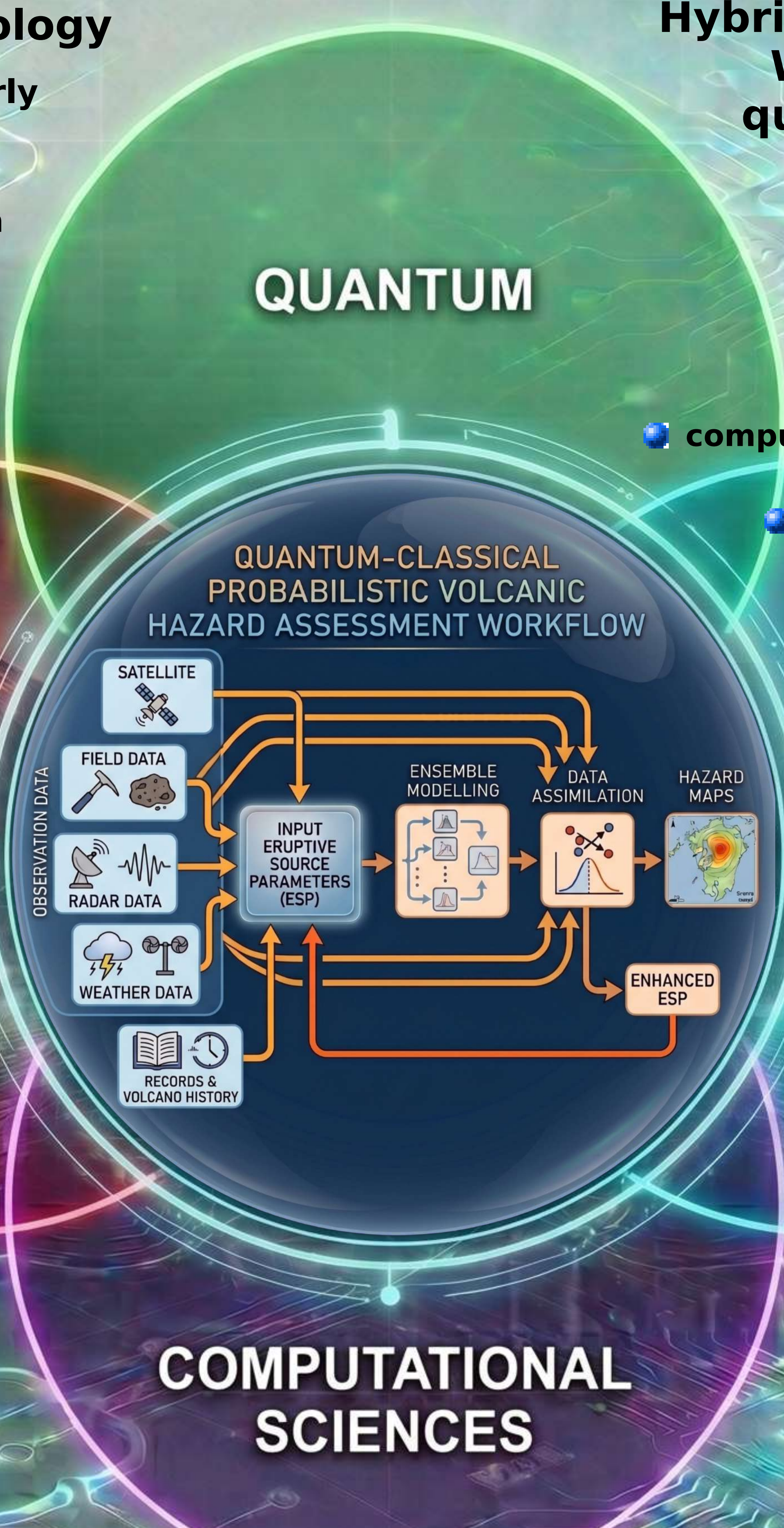
## PROPOSED SOLUTION: Hybrid Quantum-Classical Workflow, leveraging quantum technologies

- enhanced sensors
- ensemble and random sampling for probabilistic modeling
- approaches for high parallelization
- computing concepts for numerical modeling speedup
- methodologies for weather prediction
- algorithms for complex data assimilation
- exploring QML for complex physical solvers

## VOLCANOLOGY

### ROADMAP

- 1) SOTA Review:** Evaluate current quantum formulations, algorithms, and hardware,
- 2) Software testing,**
- 3) Workflow Audit:** Identify bottlenecks in existing volcanic hazard assessments,
- 4) Algorithm Reformulation:** Adapt classical data assimilation for quantum optimization,
- 5) Modeling Speedup:** Research quantum speedup for numerical modeling,



## MATHEMATICS

## COMPUTATIONAL SCIENCES

- (6) Workflow Integration:** Merge theoretical results into a practical hybrid workflow,
- (7) Atmospheric Synergy:** Integrate advanced weather models with Prediction Science teams,
- (8) Validation:** Benchmark against classical studies,
- (9) HPC Benchmarking:** Assess performance on hybrid Quantum-HPC platforms,
- (10) Operational Trial:** Application to use cases.

### KEY ADVANTAGES

- **Latent Reduction:** Significantly reducing data processing latency
- **Enhanced Reliability:** Superior optimization and sampling
- **Interdisciplinary Synthesis:** Bridging Quantum Science for geohazard mitigation

### NOVELTY & IMPACT

- **First of its kind:** The first hybrid quantum-classical workflow for volcanic hazard assessment
- **Scalability:** Generalizing to other urgent disaster response fields

Seeks to foster interdisciplinary discussion and collaboration

