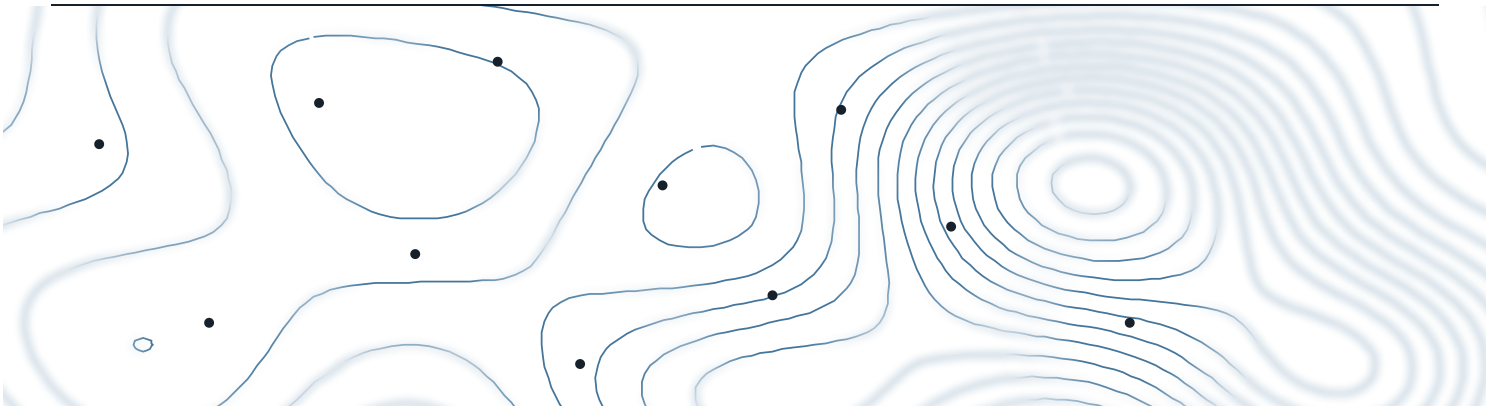
CALL FOR PAPERS

Special Issue of *Cartography and Geographic Information Science*



Contours are sharp near observations and blur where data are sparse.

Seeing Uncertainty

Modeling, Visualizing, and Communicating Uncertainty in Spatial Analysis and GeoAI

Full papers due 30 September 2027. Submissions open January 2027 through the CaGIS online submission system.

RATIONALE AND SCOPE

Spatial analyses and GeoAI models now drive decisions in disaster response, urban planning, public health, and environmental management, yet most of their outputs reach users as a single map with no indication of how much to trust it. A flood extent, a land-use classification, or a predicted risk surface looks equally certain everywhere, even when its reliability varies sharply across space.

Uncertainty in spatial analysis is not uniform. It arises from the data (measurement error, sampling gaps, scale and aggregation effects), from the model (spatial non-stationarity, nonlinearity, distribution shift between regions), and from the mismatch between the special properties of spatial data and the assumptions of standard machine learning. Conventional, global uncertainty summaries can report that a model is well calibrated on average while hiding regions where it systematically fails.

Recent advances make it possible to address this gap. Distribution-free methods such as conformal prediction, Bayesian and ensemble deep learning, and spatially explicit uncertainty quantification (UQ) can now produce location-specific uncertainty estimates with statistical guarantees. Explainable AI (XAI) adds a complementary view by revealing why a model is uncertain in particular places.

Quantifying uncertainty, however, is only half of the problem. An uncertainty estimate is useful only if people can see it, understand it, and act on it. This is where cartography and visual analytics are essential. The cartographic community has a long tradition of uncertainty visualization research, including foundational work published in this journal, but this tradition has rarely been connected to the new generation of UQ methods emerging from GeoAI. Spatial analysts and cartographers often work in parallel rather than together.

This special issue aims to bridge the two communities. It invites contributions that **model** uncertainty in spatial analysis and GeoAI, **visualize** it through maps and visual analytics, and **evaluate** how uncertainty information shapes interpretation, trust, and decisions. We particularly welcome work that treats visualization not as the last step of an analysis, but as a means of auditing, diagnosing, and improving spatial models throughout the analytical pipeline.

TOPICS OF INTEREST

We invite original research, review, and perspective articles on topics including, but not limited to, the following.

MODELING UNCERTAINTY IN SPATIAL ANALYSIS AND GEOAI

- Spatially explicit and geographically adaptive uncertainty quantification, including conformal prediction for spatial data
- Bayesian, ensemble, and probabilistic deep learning for geospatial prediction
- Uncertainty under spatial heterogeneity, non-stationarity, and distribution shift across regions
- Uncertainty in remote sensing and Earth observation AI, including geospatial foundation models
- Propagation of data, scale, and aggregation uncertainty (e.g., MAUP) through analytical workflows
- Linking explainability and uncertainty: why and where models are uncertain

VISUALIZING AND COMMUNICATING UNCERTAINTY

- Cartographic design for uncertainty: visual variables, bivariate and value-suppressing maps, and novel encodings

- Visual analytics for diagnosing, auditing, and comparing spatial models and their uncertainty
- Interactive and multi-scale exploration of prediction and uncertainty surfaces
- Uncertainty communication in AI-generated and automated maps

EVALUATING UNCERTAINTY IN USE

- User studies on how map readers perceive and interpret uncertainty
- Effects of uncertainty visualization on trust, risk perception, and decision-making
- Uncertainty-aware decision support for disasters, climate, health, and urban planning
- Benchmarks, evaluation metrics, and reproducibility for spatial UQ
- Ethical and social dimensions of communicating (or hiding) uncertainty in maps

IMPORTANT DATES

Call opens
January 2027

Abstracts (optional, to guest editors)
31 May 2027

Full papers due
30 September 2027

First-round decisions
December 2027

Final decisions
April 2028

Publication
Online upon acceptance

SUBMISSION

Manuscripts should follow the CaGIS instructions for authors and be submitted through the journal's online system, selecting this special issue. All submissions undergo the journal's standard peer review. Papers co-authored by a guest editor will be handled independently by another editor. Authors are welcome to send an optional abstract to the guest editors by 31 May 2027 to check fit with the issue.

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Questions about the special issue are welcome by email to any of the guest editors.