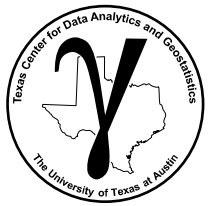

Open Source Spatial Data Analytics in Python with GeostatsPy II

Spatial Uncertainty Modeling with GeostatsPy

Lecture outline . . .

- **Spatial Simulation PostSIM**
- **Workflow with GeostatsPy**

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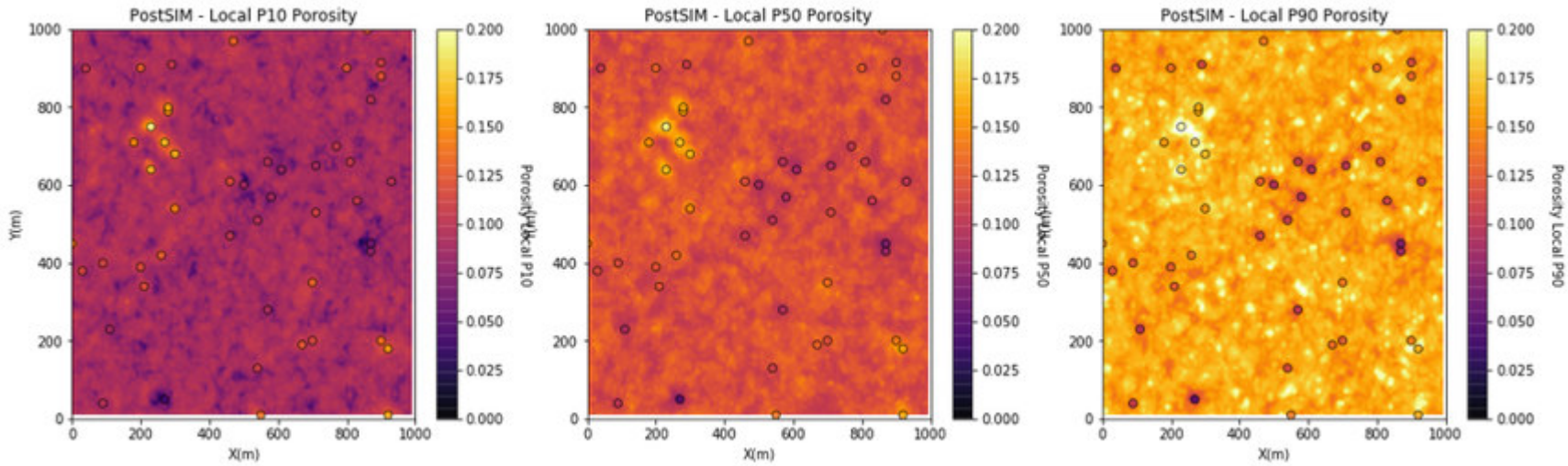
Motivation

Summarization and communication of spatial uncertainty.



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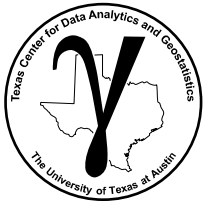

Recorded Lectures

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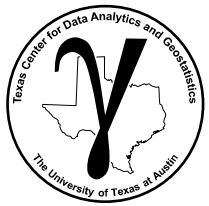

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Summarizing Uncertainty Over Multiple Realizations

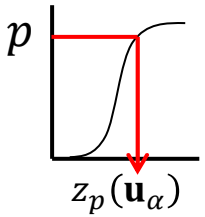
Multiple Realizations

- Visualizing / Communicating Uncertainty
- We need practical workflows to summarize over multiple realizations
- Local uncertainty maps provide measures of local uncertainty suitable to support decision making (more on this later)

Summarizing Uncertainty Over Multiple Realizations

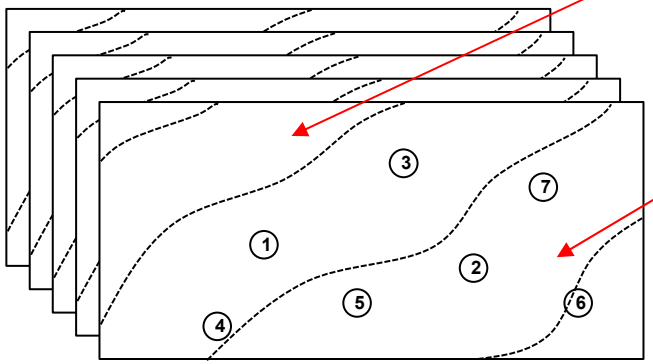
Method:

- Scan over all the realizations and scenarios
- Calculate the local distributions of uncertainty at each location
- Calculate statistical summary over each location and place in a map / model



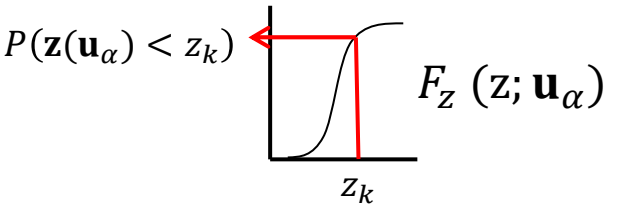
What is a specific percentile outcome at this location?

$$z_p(\mathbf{u}_\alpha) = F_z^{-1}(p; \mathbf{u}_\alpha)$$



What is the local probability of exceeding a threshold at this location?

$$P(\mathbf{z}(\mathbf{u}_\alpha) > z_k) = 1 - F_z\,(z_k; \mathbf{u}_\alpha)$$



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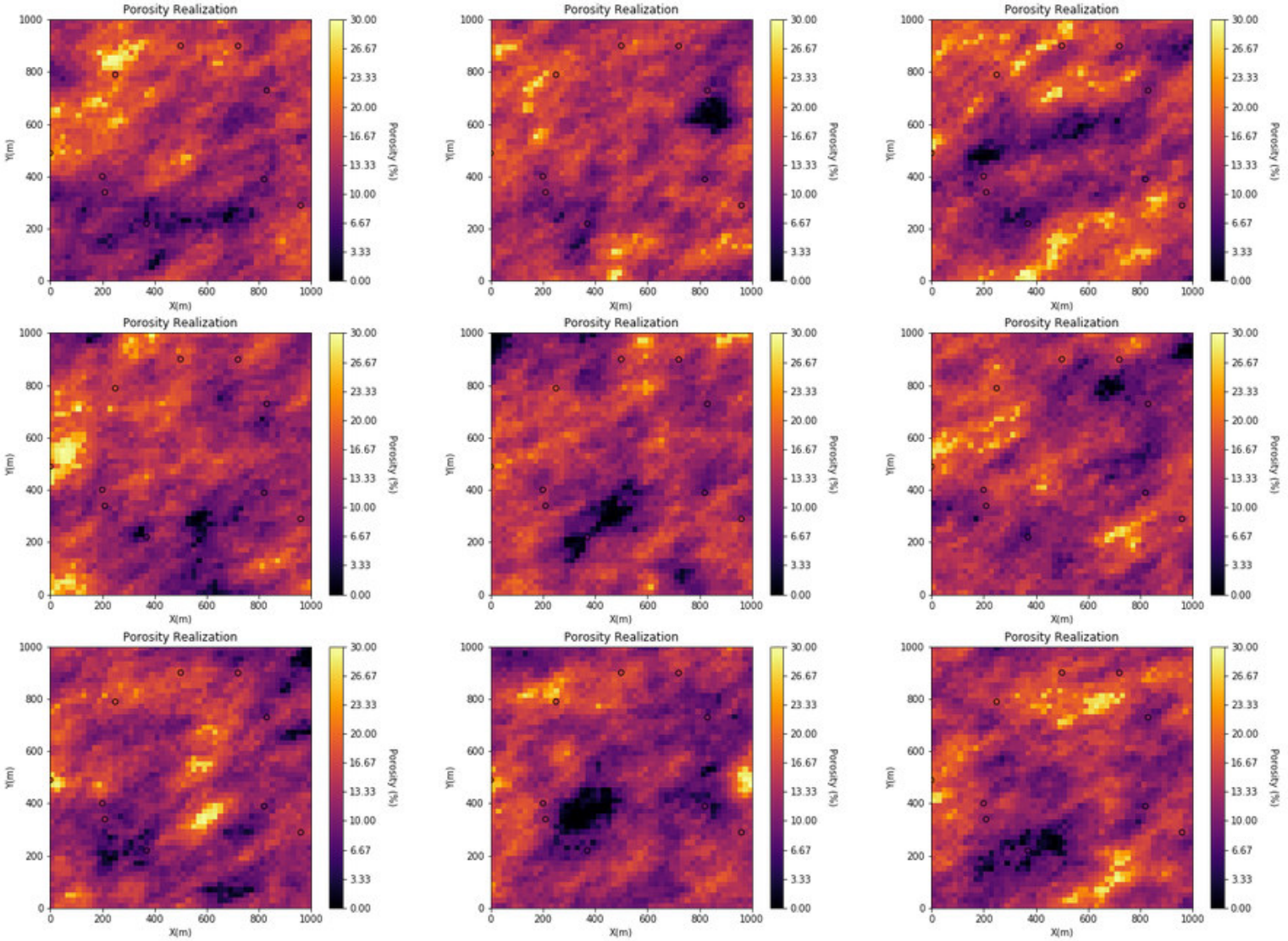
Local Uncertainty Example



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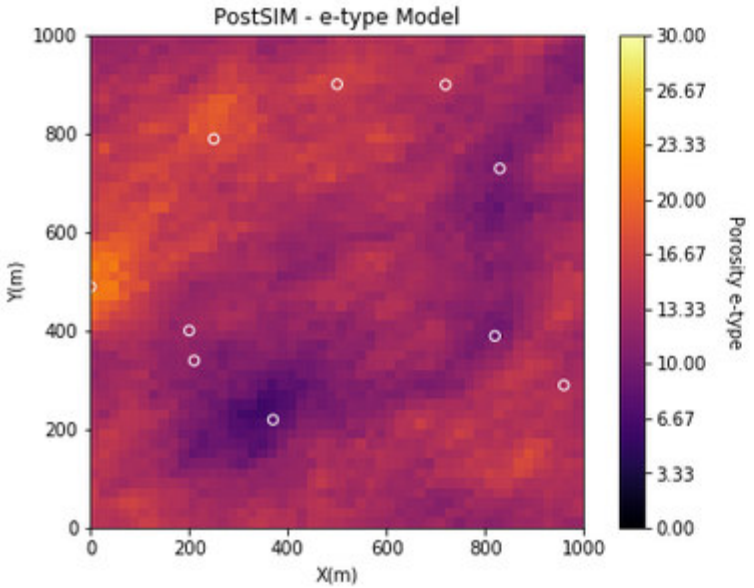
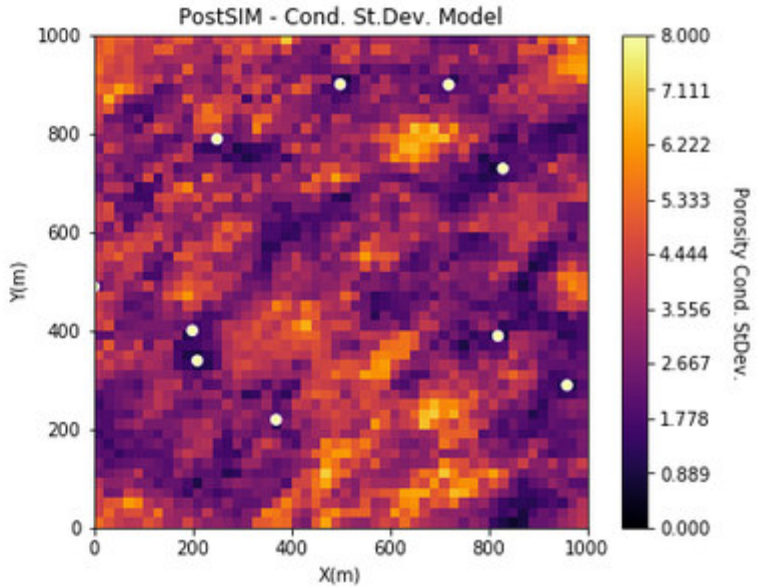
9 Realizations of porosity

Local Uncertainty Example

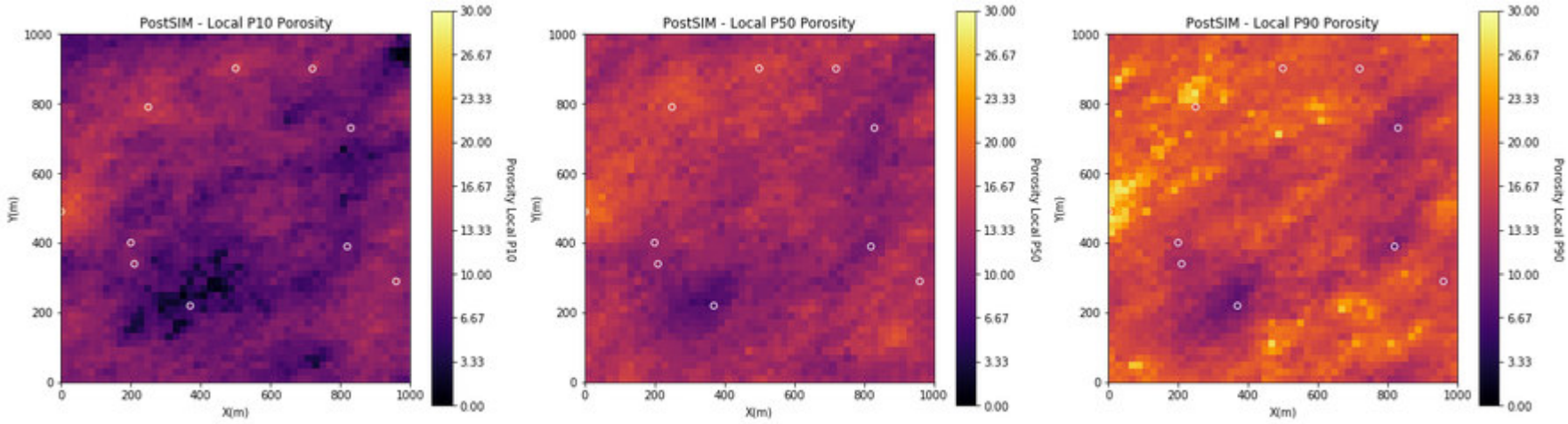




We will start with the e-type and the conditional variance.

- e-type is the local expectation, the average of the L realizations at location $\mathbf{u}_\alpha$ as we assume all realizations are equally likely.
- conditional variance is the local variance

Local Uncertainty Example



- Local percentile maps are the maps with the local percentile values sampled from the local realizations
- We can interpret these as follows, at a location if we have a local P10 of 14% porosity, then we have a 90% probability of an even higher porosity, the porosity at that location is surely high.
- Local percentiles are very convenient to understand local uncertainty. We must NOT confuse them with a percentile model (the model that is globally ranked as a specific percentile outcome).

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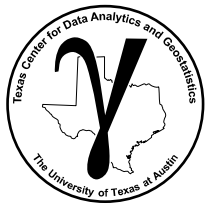

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Lecture outline . . .

- **Workflow with GeostatsPy**

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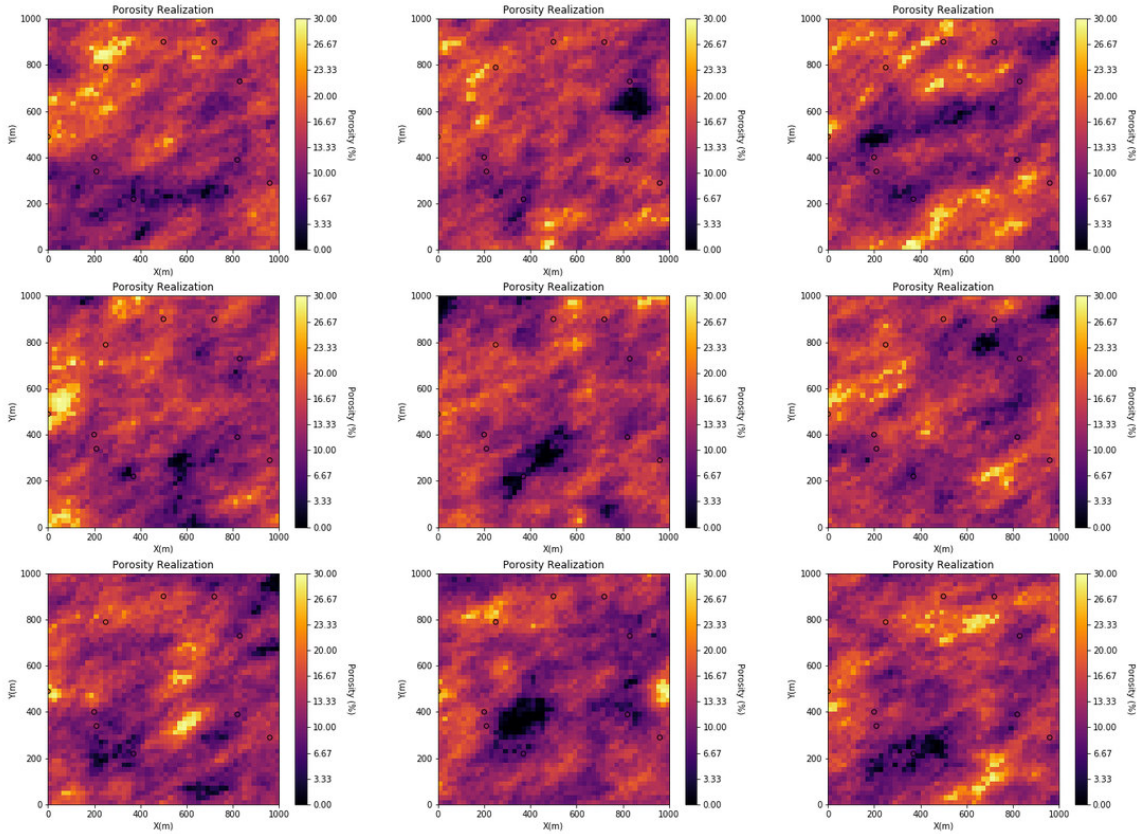
Spatial Simulation Workflow with GeostatsPy

Let's walkthrough a more thorough spatial simulation PostSIM workflow:

- specify the percentiles and threshold values
- calculate and visualize the uncertainty summarization maps



Python Jupyter variogram calculation (GeostatsPy_simulation_wPostSim.ipynb).

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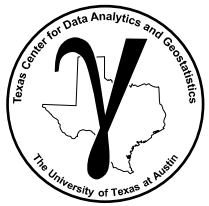

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Spatial Uncertainty Modeling with GeostatsPy

Lecture outline . . .

- **Spatial Simulation**
- **Interactive Demo with GeostatsPy**
- **Workflow with GeostatsPy**

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