

Data, Surfaces, Uncertainty

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AMS Mines 2021

Summary

- NCAR Large Ensemble
- Mapping the Ionosphere
- US Census
- Additive Manufacturing (aka 3D printing)

Challenges:

- Building statistical models for large problems and actually computing the beasts!
- Applications often demand nonstandard methods.

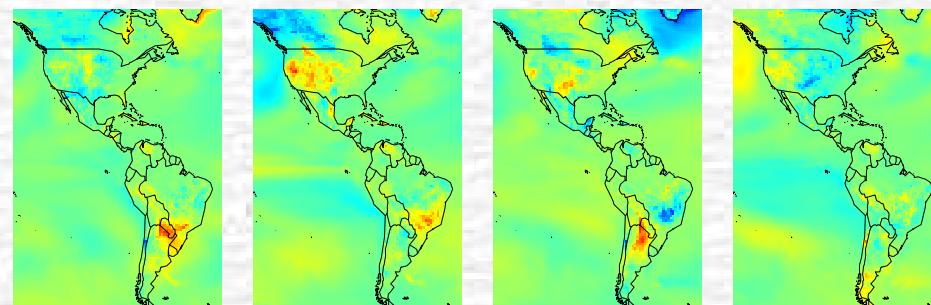
Climate models

Summary fields from a large set of model runs

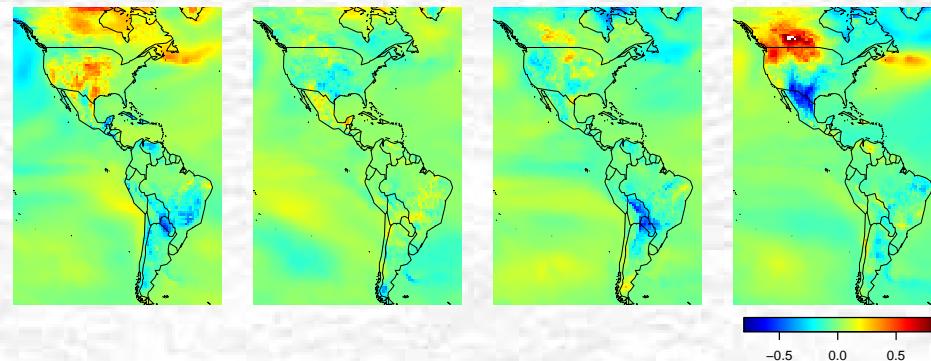
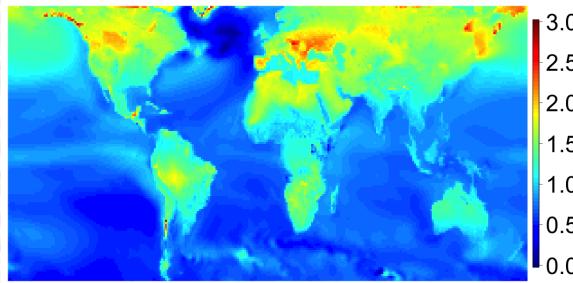
Cheyenne NCAR



First 8 out of 30 ensemble members



Ensemble mean

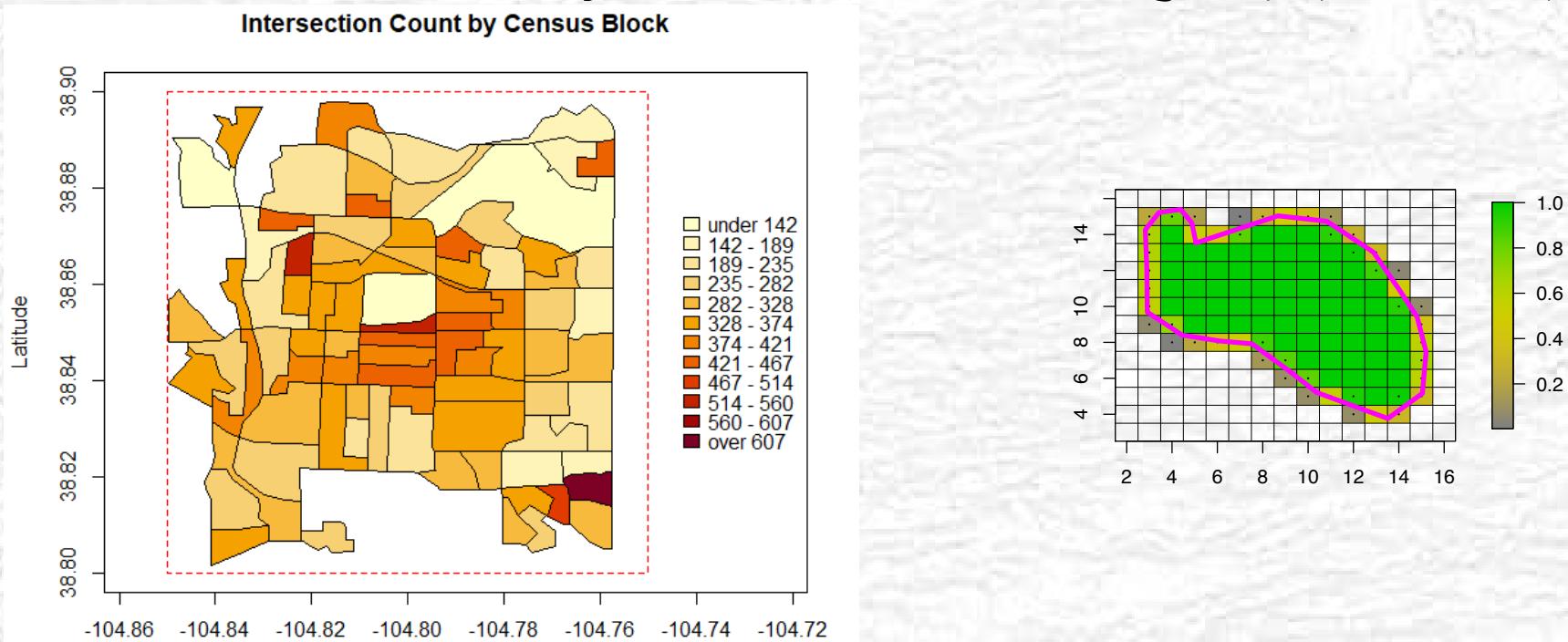


Goal: Simulate additional fields efficiently that match the spatial dependence in this 30 member ensemble.

Build a statistical emulator of this part of the model.

US Census

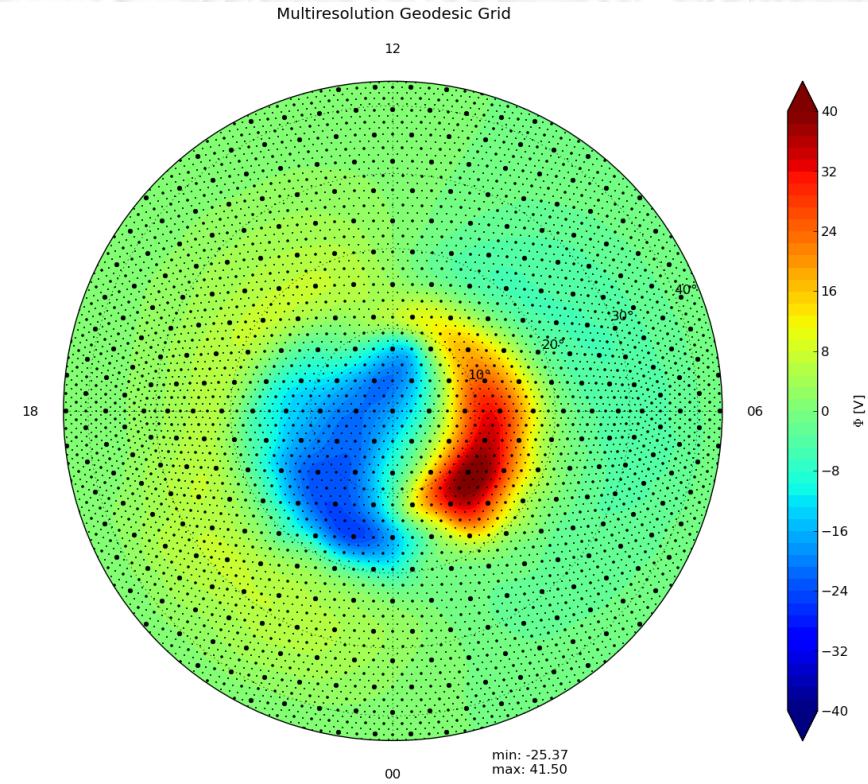
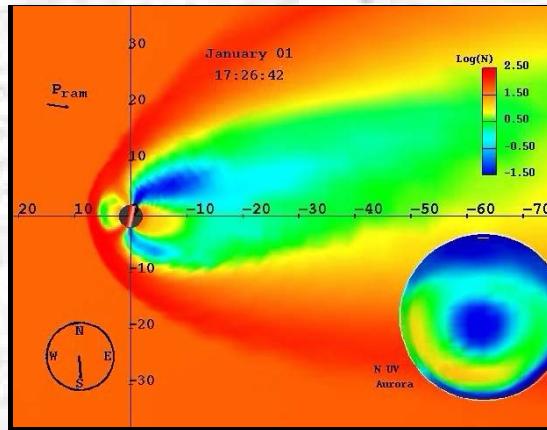
Road intersection density for US Census block groups, Boulder, CO



Goal: Develop computational methods to handle large spatial data problems when observations are quirky spatial averages.

Mapping the Ionosphere

Distribution of charged particles from the solar wind related to the electric field and currents in the upper atmosphere.



Goal: Use ground based radar station and "plasma drift" to reconstruct the electric potential function.



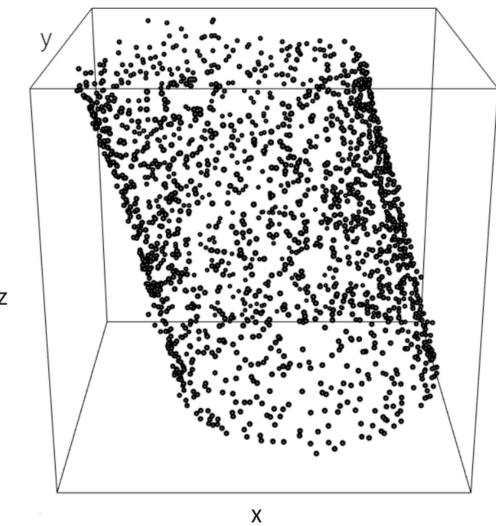
Materials and additive manufacturing

Pores in an 3D printed part.

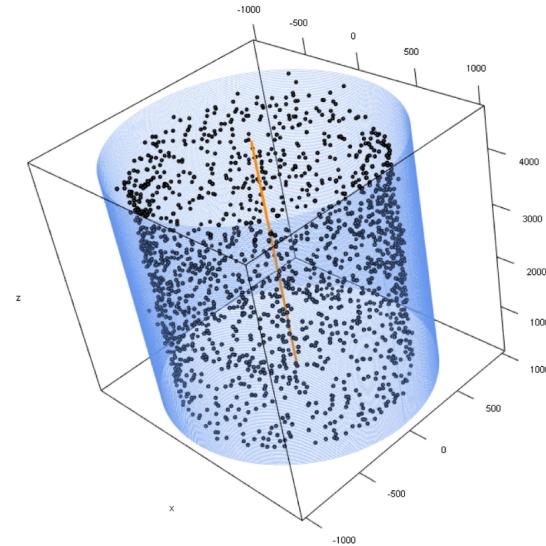
D. Barna Masters thesis

Goal: Where is the part surface?

Raw pore coordinates



Registered cylinder and its axis



Find the surface of the cylinder.

Simple example of fitting a flexible shape to irregular data.

