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Sandia National Laboratories

Development of Pyrolysis Reaction Mechanisms for Peat

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Lightening Talk

U.S. DEPARTMENT OF ENERGY | NNSA

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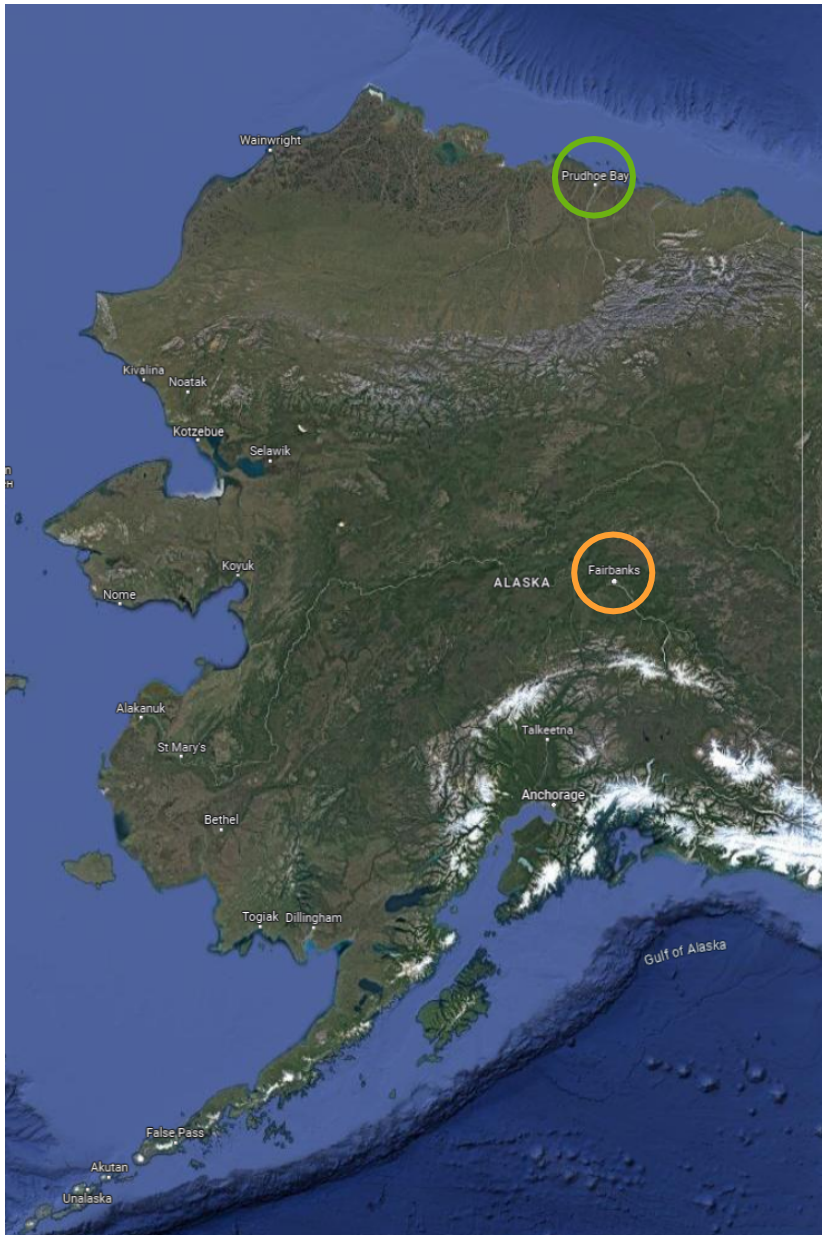
Harvesting Peat from Alaska

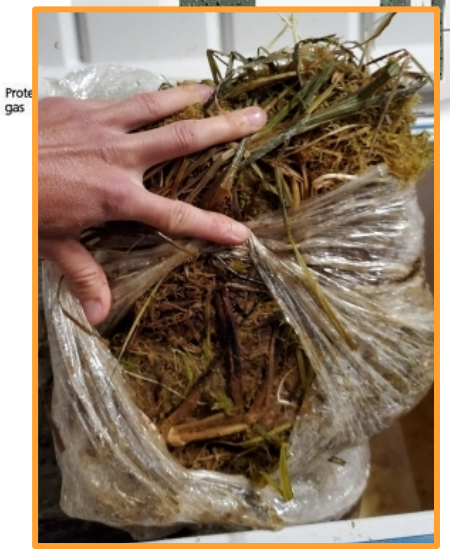
Near Prudhoe Bay

Near Fairbanks



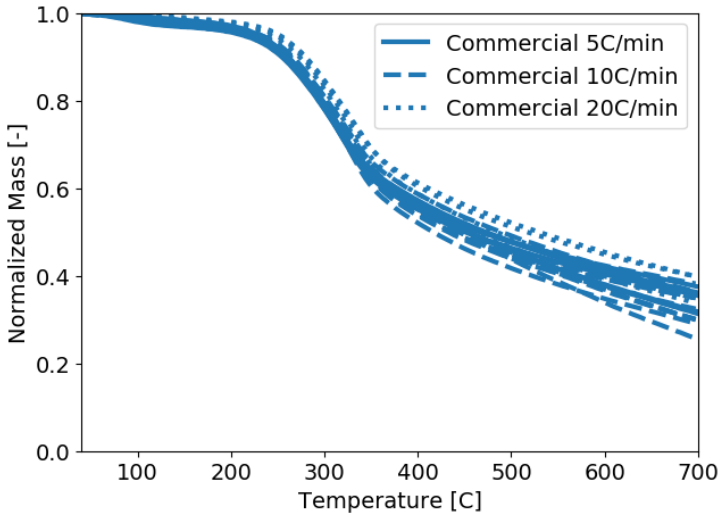
TGA Methodology

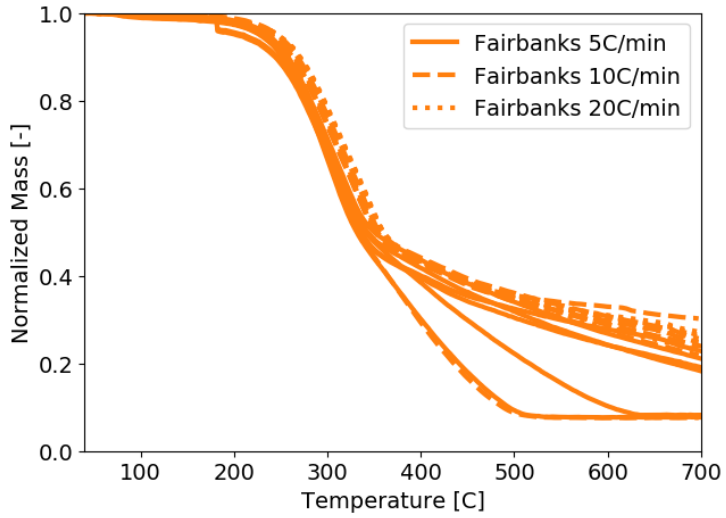
- Test a small sample of the material (5 mg) in a TGA (thermogravimetric analysis)
- Sample is heated at a known rate (5, 10, 20 K/min), temperature and mass are recorded
  - Held at 40°C for 30 min to stabilize temp and mass
  - Heated to 700°C, held for 15 min
  - N_2 atmosphere, Al_2O_3 crucibles
- From this data, reaction parameters can be determined
- Peat samples:
  - Three samples tested: Commercial Canadian Sphagnum Moss, Fairbanks, Prudhoe Bay
  - Prudhoe Bay site tested at 3 depths: 0-6cm, 6-15cm, 15-22 cm approx.
  - Ground using ball mill to fine powder
  - Oven dried at 80°C
  - Commercial peat: 3 replicates, Natural peat: 5+ replicates



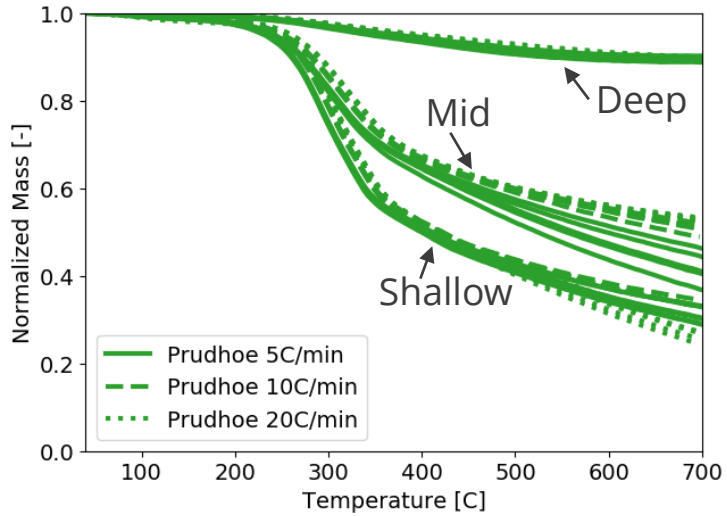
Two Methods of Optimization

Method 1: Individual Peat





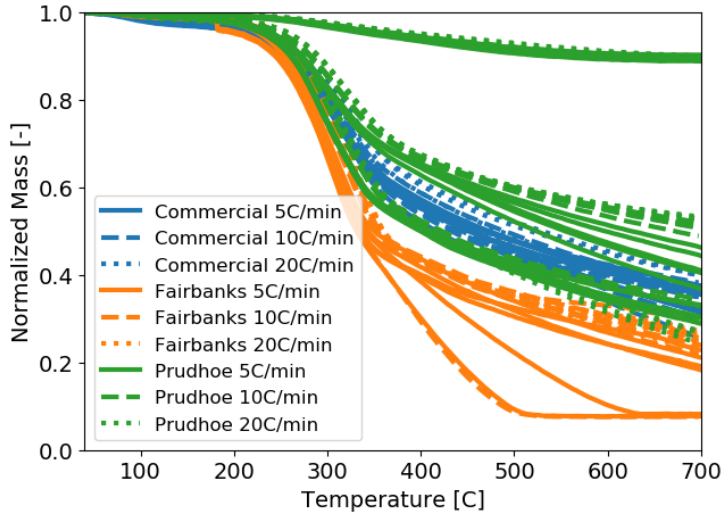
Output: Three Parameter Sets



Method 2: All Peat

Why?

To test the theory that the pyrolysis reactions are common across peat types

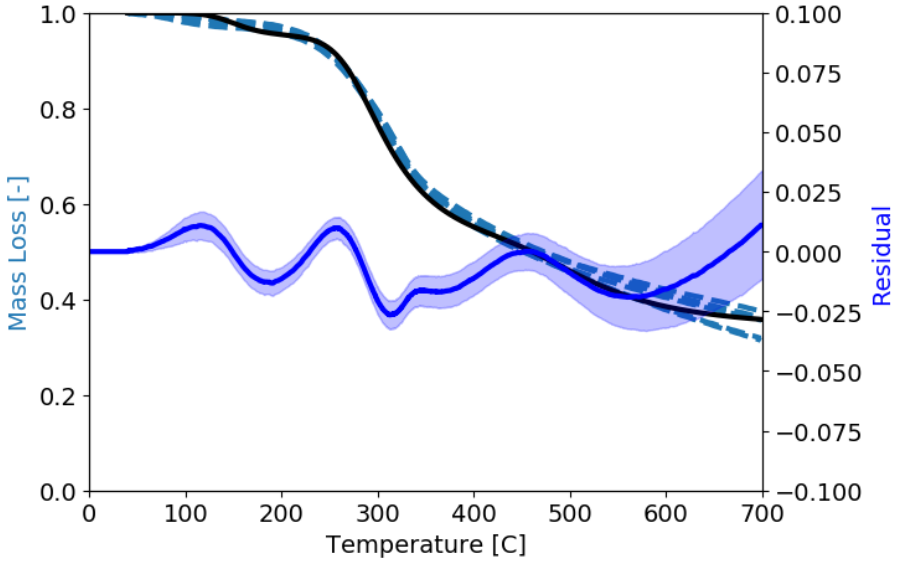


Output: One* Parameter Sets

* Moisture content and inorganic content are optimized on a per peat type basis

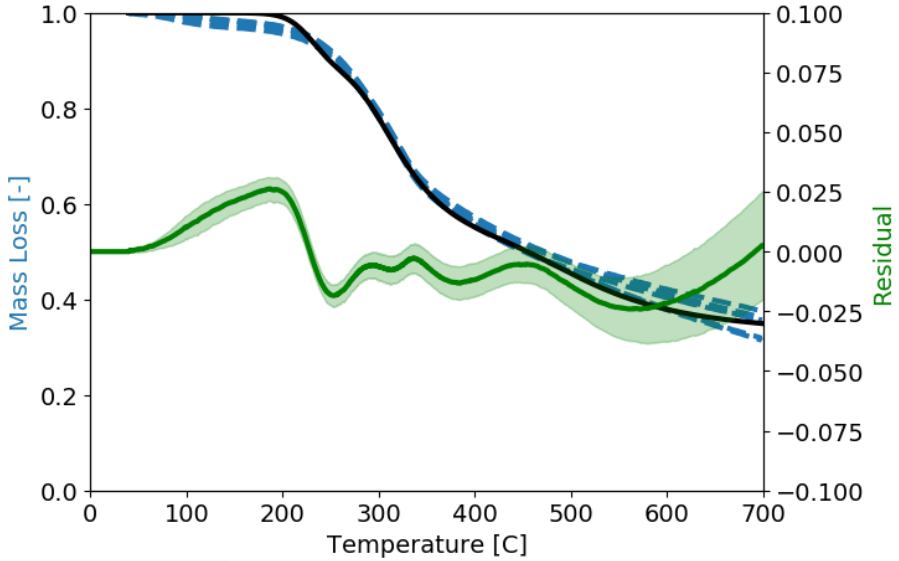
5 C/min commercial peat

Optimizing using **only** commercial peat



Averaged over time:
Residual = 0.009±.008

Optimizing using **all** peats



Averaged over time:
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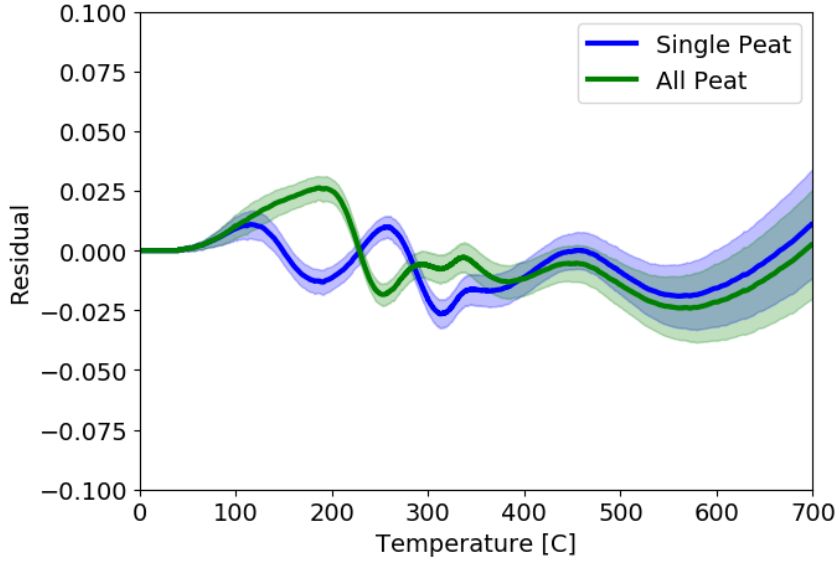
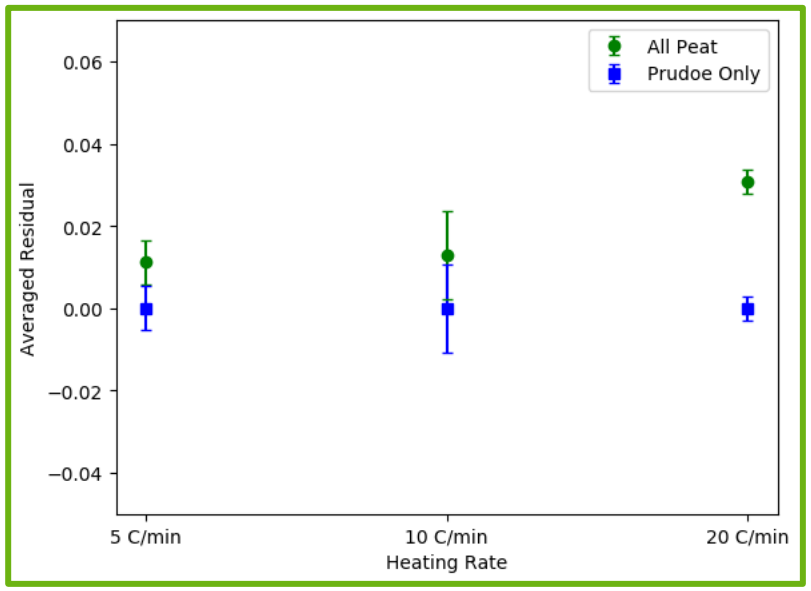
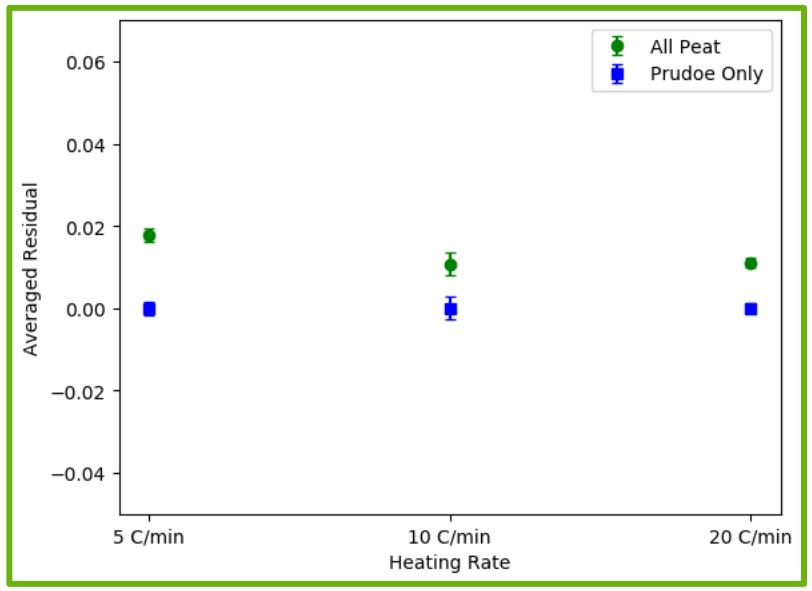


Average residual over time

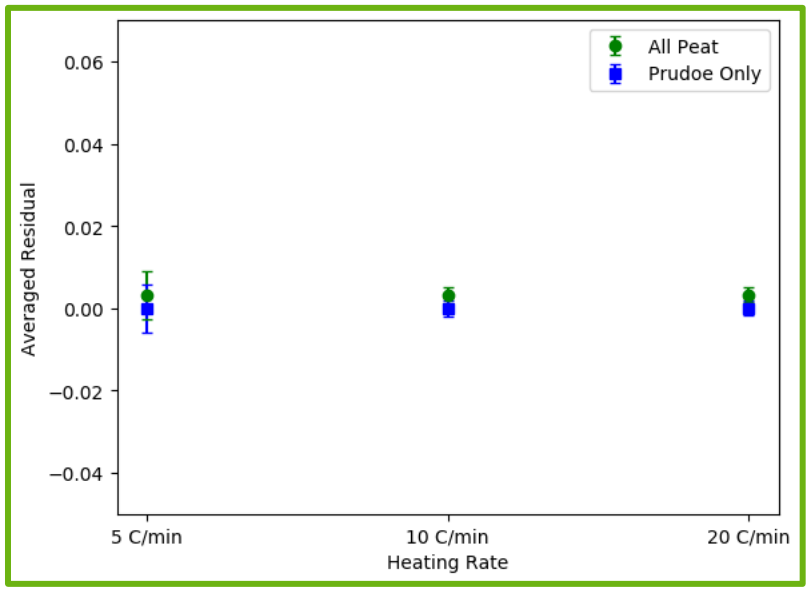
Shallow

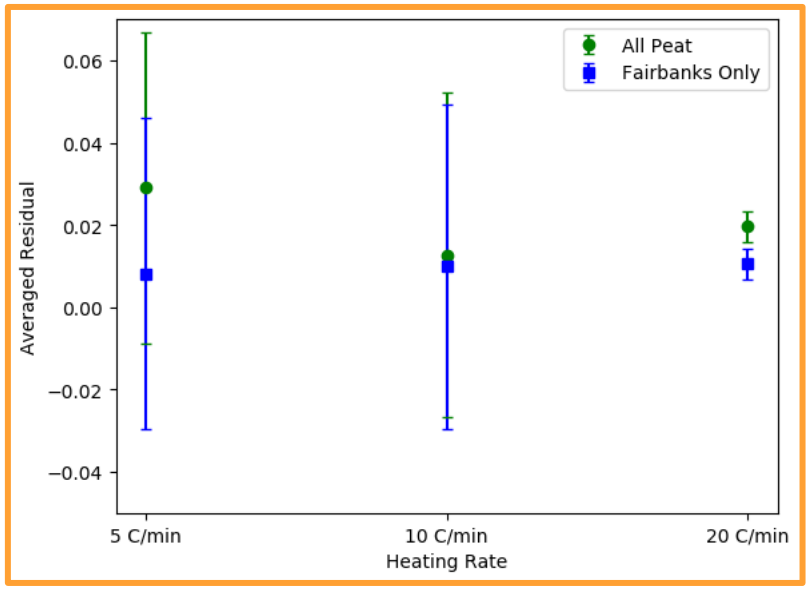


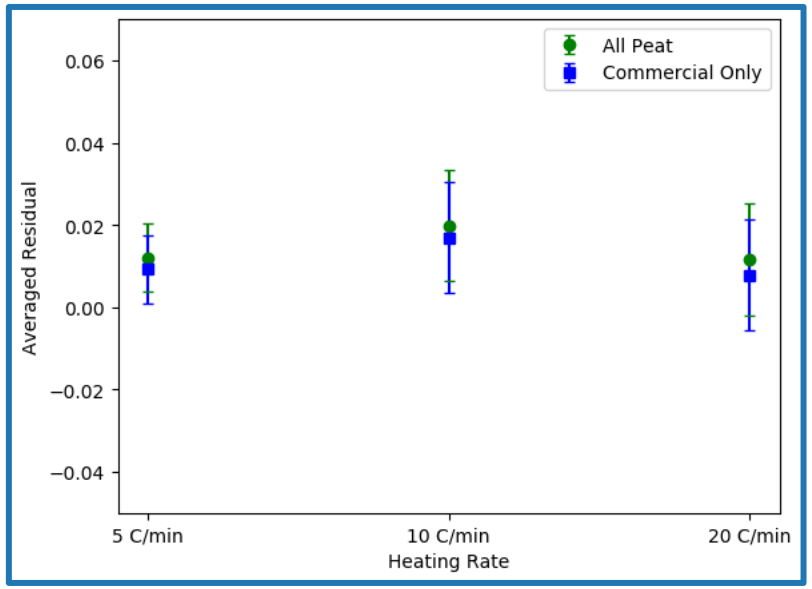
Mid



Deep







Conclusions and future work

- Optimizing across peat types increases error, but not significantly
- Suggest using common pyrolysis kinetics across peat types maybe appropriate
- Future work:
  - Simulate a pyrolyzing column of peat (with heat transfer) using the different mechanisms to understand consequences of a common peat pyrolysis model
  - Conduct the same tests and analysis in air

Acknowledgements

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