Russell "Russ" Limber
Curriculum Vitae

CURRENT POSITION

Graduate Research Assistant, Aug 2021 - Present
Oak Ridge National Laboratory
Environmental Science Division,
Bethel Valley Road, Building 4500 North,
Oak Ridge, TN 37830
Office: F129-F

EDUCATION

Ph.D. **Data Science and Engineering** Aug 2021 - Anticipated Spring 2025
The University of Tennessee; Bredesen Center
Knoxville, TN
Dissertation: Modeling River Ice Breakup Throughout Alaska
Advisor: Jitendra Kumar
Dissertation Committee: Jitendra Kumar, Forrest M. Hoffman, Monica Papes, Qiusheng Wu

M.S. **Data Analytics** May 2018 - June 2020
Western Governors University, College of Information Science
Salt Lake City, UT
Thesis: Modeling the Price of AirBnB Accommodations in NYC
Advisor: Michele Cole

B.S. **Environmental Science** Aug 2014 - Dec 2017
State University of NY College of Environmental Science and Forestry (SUNY ESF),
Department of Environmental Science
Minors (3): Mathematics, Physics and Applied Statistics
Honors: Graduated Magna Cum Laude
Advisor: Russell Briggs

WORK & RESEARCH EXPERIENCE

Graduate Research Assistant Aug 2021 - Present
Oak Ridge National Laboratory
Environmental Science Division
Bethel Valley Road, Building 4500 North Oak Ridge,
TN 37830
Office: F129-F

Estimating Aboveground Biomass in Costa Rica using Sentinel-1 and Sentinel-2 Images
Project: NGEE-Tropics (Next Generation Ecosystem Experiments in the Tropics)

- Train time series based deep learning models such as LSTM and transformers to predict aboveground biomass using spaceborne lidar (GEDI) as ground truth and multispectral images (Sentinel-2) with synthetic aperture radar (Sentinel-1) as inputs. Current regions of interest are Costa Rica, Panama and Manuas.
- Devise approaches to temporal image gap filling such as polynomial regression with outlier detection through leverage and spatial autoencoders.
- Create methods for parallel data import using mpi4py with Python request utilities and Google Earth Engine.

Forecasting River Ice Breakup in Alaska USA Using a Long Short Term Memory Model
Project: Interface (Interdisciplinary Research for Arctic Coastal Environments)

- Structure LSTM for time series classification to predict the breakup day of arctic river ice across select locations of Alaska. Made novel adjustments to LSTM based on highly unbalanced data and variability over space and time.
- Apply above techniques to Daymet, ECMWF and select CMIP6 outputs. Model the breakup dates of river ice using Daymet meteorological data, assess forecasting capability by embedding ECMWF meteorological data, create simulations of future scenarios using CMIP6 experiments.
- Create high speed, efficient, data import pipelines for Daymet and ECMWF meteorological inputs as well as for CMIP6 Earth system model outputs. Optimized parameter selection using Bayesian statistical methods.
- Derived a novel physics based methodology for correlating the presence of atmospheric rivers and Arctic river ice breakup timing.

Forecasting Wildfires in California
Project: ForWarn II Satellite-Based Change Recognition and Tracking;

- Use remote sensing to fuse Daymet, MODIS and USGS fuel cover products to predict US Forest Service fire danger scores throughout California.
- Develop and apply transformers and Conv-LSTMs to determine the ideal deep learning framework for fire danger forecasting as an emulator.

Graduate Research Assistant Aug 2018 - June 2020
Western Governors University
Department of Information Technology
4001 S 700 East, Salt Lake City, UT
(Remote)

- Modeled the price of AirBnB listings in the NYC metropolitan area based on intrinsic and extrinsic factors. Fused a spline regression with multiple correspondence analysis.

Research Assistant Oct 2015 - Dec 2017
Syracuse University
High Energy Physics Department
Crouse Dr, Syracuse, NY 13210

Project: Deep Underground Neutrino Experiment

- Designed and built equipment to collect and analyze data on the durability of circuitry prior to its use in the liquid argon cloud chamber. Designed a cryostat based on a mechanistic analysis requiring the application of partial differential equations such as Fourier's Law and Duhamel's Principle.

TRAINING

Strategies and Tactics for Recruiting to Improve Diversity and Excellence Nov 2022
University of Tennessee Knoxville
1403 Circle Dr, Knoxville, TN 37916

Community Earth Systems Model (CESM) Training Aug 2022
National Center for Atmospheric Research
1850 Table Mesa Dr. Boulder, CO 80305

Certified in SAS for Business Analytics June 2020
(Virtual Testing)

Certified in Base SAS Feb 2020
(Virtual Testing)

Certified in SQL Advanced Database Management through Oracle Aug 2019
10 Upper College Dr, Alfred, NY 14802

PROFICIENCIES

Python (primary language)

- *Geospatial*
  - gdal
  - xarray
  - geopandas
  - rasterio
  - Google Earth Engine (ee)
  - geemap
  - pyproj
  - pyesgf (to import ESM outputs)
- *ML/Statistics*
  - tensorflow
  - pytorch
  - keras
  - keras-tuner
  - some Raytune experience
  - some optuna experience
  - scikit-learn
  - scipy
- *Data Management*
  - *pandas*
  - *pickle*
  - *numpy*
  - *numba*
  - *h5py*
- *Parallel Computing*
  - mpi4py
  - some dask experience
- *Visualization*
  - matplotlib
  - seaborn
  - some folium experience
- *Web-Scraping*
  - mechanical soup
  - beautiful soup

Distributed programming
Experience writing Slurm scripts and allocating resources on Frontier & Andes multi-cluster (ORNL OLCF) and Perlmutter (NERSC)

Git & Github
Housing repos for academic software development

Vim
Text editor

R
Specific use cases for statistical analysis

Linux
I use Linux machines on all ORNL servers as well as my personal laptop (bash)

LaTeX
For all of my manuscripts

QGIS
For basic mapping and small data analysis (prefer python libraries)

CONFERENCES & PRESENTATIONS BY PROJECT

NGEE-Tropics (https://ngee-tropics.lbl.gov/)

"*Estimating Above Ground Biomass in Costa Rica using Sentinel-1 and Sentinel-2 Images*" by Russ Limber, Jitendra Kumar and Forrest M. Hoffman

- Poster: *Environmental System Science, Principal Investigators Meeting* — May 2023
  - 1 Bethesda Metro Center, 7400 Wisconsin Ave, Bethesda, MD 20814
- Talk: *University of Tennessee Knoxville, Geosymposium, 2023* — Feb 2023
  - 1502 Cumberland Ave, Knoxville, TN 37916
- Poster: *American Geophysical Union, Annual Meeting 2022* — Dec 2022
  - McCormick Convention Center 2301 S Martin Luther King Dr, Chicago, IL 60616
- Poster: *Lawrence Berkeley, NGEE-Tropics All-hands Meeting* — Sept 2022
  - 1 Cyclotron Rd, Berkeley, CA 94720

Mosquito Lagoon Seagrass Conservation

"*Monitoring an ecosystem in crisis: measuring seagrass meadow loss utilizing Deep Learning in Mosquito Lagoon, Florida*" by Stephanie A. Insalaco, Hannah V. Herrero, Russ Limber, Clancy Oliver, and William B. Wolfson

- Poster: *Association of American Geographers, 2023* — March 2023
  - 1550 Court Pl, Denver, CO 80202
- Poster: *University of Tennessee Knoxville, Geosymposium, 2023* — Feb 2023
  - 1502 Cumberland Ave, Knoxville, TN 37916
- Poster: *Southeastern Division of the American Association of Geographers, 2022* — Nov 2022
  - 800 Spring St NW, Atlanta, GA 30308

Interface (https://arcticinterface.org/)

"*Influence of Atmospheric Rivers on Alaskan River Ice*" by Russ Limber, Elias Massoud, Bin Guan, Forrest M. Hoffman and Jitendra Kumar

- Poster: International Atmospheric Rivers Conference (IARC) June 2024
    - Scripps Seaside Forum, 8610 Kennel Way, San Diego, CA 92037

Manuscript has been submitted to Geophysical Research Letters special issue "Integrating In Situ, Remote Sensing, and Physically Based Modeling Approaches to Understand Global Freshwater Ice Dynamics" and is under a second round of revision.

"*Forecasting River Ice Breakup in Alaska USA Using Long Short Term Memory Models*" by Russ Limber, Jitendra Kumar and Forrest M. Hoffman

- Talk: *ORNL Environmental Division; All-hands Meeting* March 2024
    - 4500 North Bethel Valley Rd. (ORNL Campus)
- Poster: *American Geophysical Union, Annual Meeting 2023* Dec 2023
    - Moscone Center 747 Howard St, San Francisco, CA 94103
- Poster: *Interface Annual All-Hands Meeting* Aug 2023
    - Virtual Attendance

Manuscript is currently in prep and will be submitted to Water Resources Research special issue "Advancing Interpretable AI/ML Methods for Deeper Insights and Mechanistic Understanding in Earth Sciences: Beyond Predictive Capabilities"

"*Forecasting Future River Ice Breakup Timing using Deep Learning and CMIP6*" by Russ Limber, Jitendra Kumar and Forrest M. Hoffman

Manuscript is currently in prep and will be submitted to Nature Climate Change special issue "Freshwater ecosystems under global change"

ForWarn II Satellite-Based Change Recognition and Tracking (https://forwarn.forestthreats.org/)

- Talk: Institute of Electrical and Electronics Engineers (IEEE) Big Data 2024 Dec 2024
    - 400 New Jersey Avenue, NW Washington, D.C., 20001 United States

Manuscript was accepted as a conference paper in the "IEEE Big Data 2024 Conference; Workshop: 2nd International Workshop on Big Data Analytics with Artificial Intelligence for Climate Change"

"*Forecast of Wildfire Potential Across California USA Using a Transformer*" by Russ Limber, William W. Hargrove, Forrest M. Hoffman, Jitendra Kumar

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REFERENCES

Jitendra Kumar	kumarj@ornl.gov	(865) 574-9467	Building 4500N, Room F107-T, Mail Stop 6290
Forrest M. Hoffman	forrestertw@ornl.gov	(865) 229-6424	Building 4500N, Room F106, Mail Stop 6301