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| **PROFESSIONAL AND ACADEMIC EXPERIENCES**  **Quant Innovation Lead in Weather and Energy**, Morgan Stanley, NY, USA  **Mar 2022 – present**  Cross-desk expert integrating weather/climate to commodity analysis with statistics and econometrics via data and modeling capabilities   * Built a coupled automated system, including weather/climate datasets, a reduced climate model, a commodity market equilibrium model, and various self-developed algorithms and functions, used to:   **Grow advanced applications of weather/climate data, build the data system required, and explore potential edges**:   * + - Lead onboarding of weather/climate datasets (NOAA, ECMWF, NASA, etc.). Design the data system and the required infrastructure for storage and flexible application of spatial data.     - Derive regression models on how weather impacts energy and crop yield:   1) Estimated the relationship between daily temperature extremes and crop yield using two weather datasets, significantly improving the average temperature model. Predicted corn and soybean yields.  2) Built a global-scale non-linear regression model of electricity consumption as a function of daily temperature and income at 30x30km grid-cell level. Results allow high precision power demand forecast for any location any day.   * + - Understand how long-term climate trends and teleconnections can help predict prices:   1) Tested what variations within weather data, climate projections, and ENSO events have been “priced-in” for weather futures through regressions between historical prices and weather/climate data.  2) Investigate the relationship between polar vortex weakening, February cooling, and prices of commodities.  **Build new models and analytics to understand supply and demand of commodities integrating fundamental views:**   * + - Conduct simulations for the US power sector integrating fundamental views and questions on costs, capacity, and technologies. For example, modeling scenarios to power AI data centers with different power mix and technology options.     - Developed an internal tool that overlays real-time and forward-looking physical weather/climate hazards with assets of utility companies and key energy infrastructure, helping investment teams to use these exposure metrics in quant research.   **Developing quantitative methods for emerging commodities and evaluate opportunities:**   * + - Derived region-specific marginal abatement cost curve for 17 CCS technologies to support the voluntary carbon offset desk.     - Modeled EU’s Carbon Border Adjustment Mechanism to examine impacts on prices of the EU Allowances. * Built AIML-based company-level models to quantify the sensitivity of company’s fundamentals to physical climate hazards. Conducted feature reduction and model selection. Predict future exposures and identify mispricing of stocks. * Productionized the modeling system with three patents (1 awarded, 2 pending). Build digital tools and conducted 70+ demos and 2 webcasts with clients and teams. Prepare beta-user trials of for external clients such as asset managers and hedge funds.   **Postdoctoral Research Fellow**,The Earth Institute, Columbia University, NY, USA **Oct 2020 – Mar 2022**   * Examined the oil and gas stock price responses to the policy lift on methane emissions. Studied emitting behaviors of 600 oil and gas facilities before and after the policy using TROPOMI satellite retrievals. * Quantified the amplification of Pacific Northwest wildfires between 2002 to 2018 using satellite retrievals for carbon monoxide.   **Independent Consultant**, International Institute for Applied Systems Analysis, Austria **June 2019 – June 2022**   * Conducted climate model ensemble simulations for various scenarios. Analyzed climate model data across space and time. Attributed model uncertainty from natural variability. Results published in PNAS.   **EDUCATION**  **Duke University**, Durham, NC, USA |
| **PHD IN ATMOSPHERIC SCIENCE**, September 2020  **MASTER IN ENERGY SYSTEM**, May 2016 |
| **Peking University**, Beijing, China  **BACHELOR OF SCIENCE IN ATMOSPHERIC SCIENCE,** June 2013  **BACHELOR OF ART IN ECONOMICS,** June 2013 |
| **SKILLS**  **Programming**: Python, R, Linux. **Statistics and Econometrics:** regression, time-series analysis, causal inference, Machine Learning, uncertainty quantification. **Commodity and Climate:** global earth system models (CESM), energy system model (DOE), emission/carbon market modeling. **Datasets:** 3-dimensional weather/climate data, satellite data, ensembles, survey data. |

**SELECTED PUBLICATIONS**

Du, X., **Ru, M.**, Almond, D., 2024. Rapid Increases in Methane Emissions from the Oil and Gas Industry. *AEA Conference Paper.*

* Derived O&G activities using satellite data. Compared O&G stock prices before and after a policy lift. Conducted causal inference.

Tao, S., **Ru, M**.,, et al., 2018. Quantifying the residential energy transition in China through a national survey. *Nature Energy*, 3(7), 567.

* Reconstructed spatial-temporal patterns over 30 years from 30,000 samples. Derived residential energy demand model for China.