

**Postdoctoral Fellow**  
**Data Assimilation and Machine Learning Scientist**  
**(20-118)**

The Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University seeks to fill a postdoctoral fellowship in November 2020 as part of a National Science Foundation (NSF) award to train a new scientist in data assimilation and machine learning techniques. Located at CIRA in Fort Collins, Colorado, this fellowship is intended for persons who have completed their Ph.D.'s within the last 3 years and may last up to 3 years contingent upon NSF funding availability.

Recent work at CIRA has focused on non-Gaussian-based data assimilation systems that are mixed Gaussian-lognormal based. As part of a previous award, a second non-Gaussian distribution has been detected in the Lorenz 63 model, as well as early indication of this reverse lognormal distribution in the output from the Weather Research and Forecasting (WRF) model. The individual in this position will develop the theory of the reverse lognormal in both variational and ensemble data assimilation systems.

Specifically, the individual in this position will serve as a member of the CIRA data assimilation group and will test the robustness of machine learning techniques to identify the links between non-Gaussian distributions and different atmospheric scale dynamics, convert the hybrid version of WRF-GSI to have a non-Gaussian component, and assess the robustness of new non-Gaussian based ensemble systems along with advancing the development of a new version of the Maximum Likelihood Ensemble Smoother.

**Decision Making:**

The individual in this fellowship will execute a plan of research that will resonate with the underpinning science objectives of the supporting project. The decisions they will make and the approaches they will take will be determined by the individual's own scientific acumen and in consultation with the Principal Investigator. Successful execution of the proposed research, i.e. supporting the deliverables mentioned in the project's statement of work, will hinge on the definition of a scientifically-sound plan and its execution. Ultimately this decision-making process will lay a foundation that will be critical for success in future proposals and will build an independent and self-sufficient research program. Similarly, the individual in this fellowship will conduct their research with an eye toward establishing strong partnerships with both CIRA research staff and sponsors.

**Essential Job Duties:**

Machine Learning to Identify Non-Gaussian Dynamics 40%

- assess the robustness of machine learning methods including Support Vector Machines (SVM) to detect changes in distribution with the series of more complex Lorenz models;
- assess and determine the reliability of machine learning methods including SVM in different dynamical situations with the WRF model;
- determine the impacts and reliability of using machine learning methods including SVM to direct the WRF-GSI to switch distributions.

Non-Gaussian Hybrid WRF-GSI 40%

- convert the Gridpoint Statistical Interpolation (GSI) system and the hybrid system to allow for a lognormal component (e.g., for the moisture variable) and a version with the logarithmic transform approach, as well as developing the new reverse lognormal theory;
- test and develop the new non-Gaussian versions of the Maximum Likelihood Ensemble Filter;
- help develop and test the robustness of the new Maximum Likelihood Ensemble Smoother as an alternative to the ensemble component of the hybrid GSI;
- test and compare the different versions of the WRF-GSI against different distributed error scenarios;
- conduct WRF-GSI experiments to assess the impacts on short and medium range forecasts from the different configurations of the hybrid WRF-GSI system.

Documentation & Reporting 20%

- prepare manuscripts for submission to peer-reviewed journals and edit through the review process;
- prepare and present conference abstracts, posters, and/or presentations;

- present research results during domestic and international conferences; travel may be required.

### **Required Qualifications:**

Please specifically address all required qualifications in your cover letter.

- PhD in Physics, Mathematics, Statistics, Meteorology, or related physical science field;
- proficiency in programming in Fortran90 or higher;
- working knowledge of machine learning techniques or data assimilation systems;
- higher education in fundamental mathematics and/or physics.

### **Preferred Qualifications:**

Please specifically address all applicable preferred qualifications in your cover letter.

- solid quantitative educational background in fundamental Mathematics, Physics, and/or Statistics;
- proficiency with scripting in a Linux environment;
- familiarity with high performance computing;
- working knowledge of variational data assimilation;
- knowledge of WRF-GSI or other numerical weather/ocean prediction systems;
- knowledge of Bayesian Theory;
- knowledge of the mathematical field of Numerical Analysis, i.e. preconditioning, numerical linear algebra, NSDE etc.;
- knowledge of mesoscale and/or synoptic meteorology;
- proficiency in MATLAB or equivalent analysis and display software.

**Annual Salary:** \$55,000

### **Background Check:**

Colorado State University (CSU) strives to provide a safe study, work, and living environment for its faculty, staff, volunteers and students. To support this environment and comply with applicable laws and regulations, CSU conducts background checks. The type of background check conducted varies by position and can include, but is not limited to, criminal (felony and misdemeanor) history, sex offender registry, motor vehicle history, financial history, and/or education verification. Background checks will be conducted when required by law or contract and when, in the discretion of the university, it is reasonable and prudent to do so.

### **Commitment to Diversity and Inclusion:**

Reflecting departmental and institutional values, candidates are expected to have the ability to advance the Department's commitment to diversity and inclusion.

### **Application Deadline and How to Apply:**

Applications will be accepted until the fellowship is filled; however, to ensure full consideration applications should be submitted by 11:59 PM MT on October 25, 2020. References will not be contacted without prior notification of candidates. Apply electronically by clicking "Apply to this Job" at the following website: <http://jobs.colostate.edu/postings/80087>. **NOTE:** In your cover letter, **please specifically address the required and preferred qualifications of this position.** A cover letter that fails to address the required and preferred qualifications of this position may not be further considered after review by the search committee.

Colorado State University is committed to providing an environment that is free from discrimination and harassment based on race, age, creed, color, religion, national origin or ancestry, sex, gender, disability, veteran status, genetic information, sexual orientation, gender identity or expression, or pregnancy and will not discharge or in any other manner discriminate against employees or applicants because they have inquired about, discussed, or disclosed their own pay or the pay of another employee or applicant. Colorado State University is an equal opportunity/equal access/affirmative action employer fully committed to achieving a diverse workforce and complies with all Federal and Colorado State laws, regulations, and executive orders regarding non-discrimination and affirmative action. The Office of Equal Opportunity is located in 101 Student Services. The Title IX Coordinator is the Executive Director of the Office of Support and Safety Assessment, 123 Student Services Building, Fort Collins, CO 80523 -2026, (970) 491-7407. The Section 504 and ADA Coordinator is the Executive Director of Human Resources and Equal Opportunity, Office of Equal Opportunity, 101 Student Services Building, Fort Collins, CO 80523-0160, (970) 491-5836.