

Lawrence Jing Yueh Liu

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RESEARCH INTERESTS

Mesoscale Dynamic Meteorology, Data Assimilation, Numerical Weather Prediction, Atmospheric Predictability, Radar Meteorology, and Machine Learning Weather Prediction

EDUCATION

M.S., September 2022, Atmospheric Sciences, National Central University (NCU), TAIWAN

Advisor: Professor Shu-Chih Yang

Thesis: "Analyzing the convection development over northern Taiwan using a multi-scale radar data assimilation system with rapid update cycles"

GPA: 4.18/4.3

B.S., June 2021, Atmospheric Sciences, National Central University (NCU), TAIWAN

Honors: College Dean's Award (Rank #2 in class)

GPA: 4.18/4.3

EXPERIENCE

Research Assistant, Department of Atmospheric Sciences, National Central University, TAIWAN

- Research on multi-scale radar data assimilation, October 2022 – present
- Research on Taiwan-Area Heavy rain Observation and Prediction Experiment / Prediction of Rainfall Campaign in the Pacific (TAHOPE/PRECIP) IOP3 events (with a multi-scale radar data assimilation framework), April 2023 – present
- Research on scale-dependent inflation methods within WRF-LETKF (WRF model with Localized Ensemble Transform Kalman Filter), April 2023 – present

Teaching Assistant, Department of Atmospheric Sciences, National Central University, TAIWAN

- Numerical Analysis I, August 2021 – January 2022
- Special Topics on Data Assimilation, February 2022 – July 2022

Summer Internship, Central Weather Bureau, TAIWAN

- Special topic on simulating typhoon using an idealized barotropic vorticity equation, July 2020 – August 2020

Member of Field Campaign, Department of Atmospheric Sciences, National Central University, TAIWAN

- Collecting sounding data in the Yilan Experiment for Severe Rainfall (YESRain), November 2021

SELECTED PROJECTS

- Designed and implemented an idealized barotropic vorticity equation model:
 - Investigated the path and strength of typhoons approaching Taiwan.
 - Simulated the interaction of multiple typhoons.
- Used WRF-LETKF radar data assimilation system to reconstruct 4D analysis fields and improve forecast skills of multi-scale extreme weather events:
 - Investigated the predictability of the position and strength of extreme precipitation events in Taiwan.
 - Analyzed the cross-scale interactions in dynamic and thermodynamic aspects in extreme rainfall events.
- Used MATLAB to construct an Ensemble Transform Kalman Filter to perform an OSSE of Burger equation:
 - Evaluated the error reduction with inflation method or tuning assimilation frequency.
 - Designed methods to enhance the efficiency and accuracy for capturing nonlinearity behavior.
- Used WRF model to perform an idealized simulation of a supercell thunderstorm with different microphysics schemes:
 - Evaluated dynamic differences in cold pools produced by different schemes.

SKILLS

Languages: Python, FORTRAN, MATLAB, and GrADS

OS: MS-WINDOW, UNIX, and LINUX

Others: Weather Forecasting and Research Model (WRF), Localized Ensemble Transform Kalman Filter (LETKF), National Central University Radar Kit (RAKIT, a radar quality control system), The Model for Prediction Across Scales (MPAS)

COURSES

- Atmospheric Dynamics
- Numerical Simulation
- Mesoscale Meteorology
- Radar Meteorology
- Data Assimilation
- Numerical Analysis
- Atmospheric Physics
- Atmospheric Thermodynamics
- Synoptic Meteorology and Weather Analysis
- Programming Languages
- Atmospheric Measurements

PUBLICATIONS

1. Lawrence Jing-Yueh Liu, Shu-Chih Yang, Kuan-Jen Lin, Guo-Yuan Lien and Chih-Chien Tsai. Analyzing the convection development over northern Taiwan using a multi-scale radar data assimilation system with long-hour rapid update cycles. *In preparation* for journal QJR.
2. Shu-Chih Yang, Lawrence Jing-Yueh Liu, and Hao-Lun Yeh. Investigating TAHOPE/PRECIP IOP3 event with a multi-scale radar data assimilation framework. *In preparation* for journal publication.

PRESENTATIONS

1. Shu-Chih Yang, Lawrence Jing-Yueh Liu, Pao-Liang Chang. Investigating the Development of Heavy Rainfall Over Northern Taiwan on 8 September 2018 with the WLRAS Rapid-update Analyses. *Asia Oceania Geoscience Society 18th Annual Meeting*, August 2021
2. Lawrence Jing-Yueh Liu, Shu-Chih Yang, Pao-Liang Chang, Wei-Yu Chang, Chih-Chien Tsai. Rapid-update Analysis with Multi-scale Correction and Its Impact on the Heavy Rainfall Development Over the Taipei Basin. *Asia Oceania Geoscience Society 19th Annual Meeting*, August 2022
3. Lawrence Jing-Yueh Liu, Shu-Chih Yang, Hao-Lun Yeh, Kuan-Jen Lin, Pao-Liang Chang. Leveraging Multi-Scale Radar Data Assimilation to Investigate Multi-Scale Convection Events in Taiwan. *The 104th American Meteorology Society Annual Meeting*, January 2024. (*Submitted*)

HONORS & ACHIEVEMENTS

Awards:

- Atmospheric Science Section Best Student Poster Award, Asia Oceania Geoscience Society, **2022**
- Graduation with College Dean's Award (Rank #2 in class), June **2021**
- The Zhu Shun Yi He Qin Scholarship (Rank #1 of the college in the semester; \$3000 Award), National Central University, **2020**
- Rank #3 in National Earth Science System Special Research Competition (\$300 Award), Chinese Geoscience Union, Taiwan, **2020**
- The Liu Ren Jie Alumni Scholarship (\$600 Award), National Central University, **2020**
- Academic Excellence Award (top 2% of class in semester; \$150), National Central University, **Fall 2018, Spring 2018, Fall 2020**

Research Grants:

- "How to Improve the Rainfall Forecast of Multiscale Weather System in Northern Taiwan using Radar Data Assimilation." College Student Research Scholarship with grant **\$1500**, Ministry of Science and Technology, Taiwan, 2019

REFERENCE

Available upon request