



# Overview of past year's Noah-MP community activities: achievements, lessons, and issues

**Cenlin He (NSF NCAR/RAL)**

June 3, 2024 @Noah-MP Annual Users' Workshop

# Noah-MP name trademark and logo

*United States of America*  
United States Patent and Trademark Office

Noah-MP

The name of **Noah-MP** (and its variants) has been officially trademarked, thanks to Tim Schneider's enormous efforts in working with the UCAR law office.



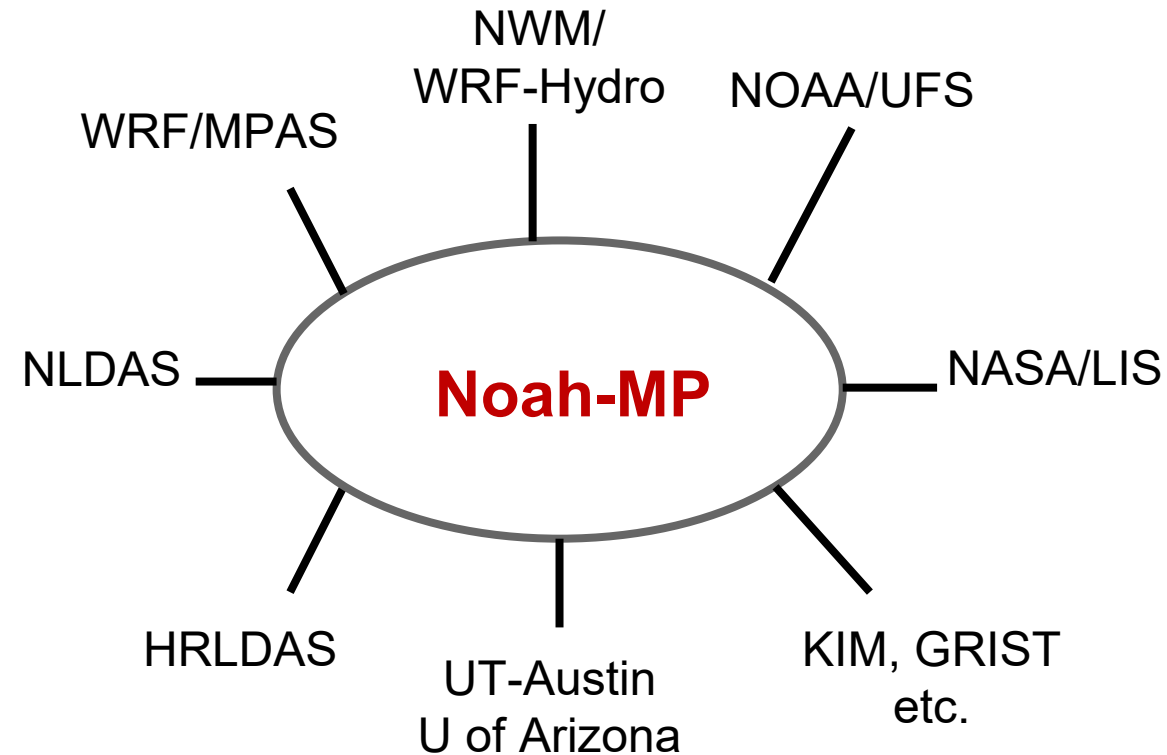
The Noah-MP logo was originally designed by Prasanth Valayamkunnath (IISERTVM, India).

The logo meaning:

Color Represents: **Soil**, **Water**, **Vegetation**, and **Energy**

Four big circles "**C**": **C**ommunity, **C**ollaborative, **C**omprehensive, **C**utting-edge

# Noah-MP widely-used in various research and operational modeling systems



**Noah-MP community GitHub:**

<https://github.com/NCAR/noahmp>

## Scientific Applications

Groundwater and terrestrial water storage

Plant hydraulics/root water uptake

Prognostic vegetation growth and canopy processes

Urban

Biogeochemical cycle (e.g., carbon-nitrogen coupling, air pollution, biogenic emissions)

Climate/weather extremes (e.g, fire, drought, heatwave, flood, etc.)

Subseasonal-to-seasonal (S2S) predictions

Agriculture

Land data assimilation

Soil moisture

Snowpack and water resources

Land-atmosphere interaction and coupling

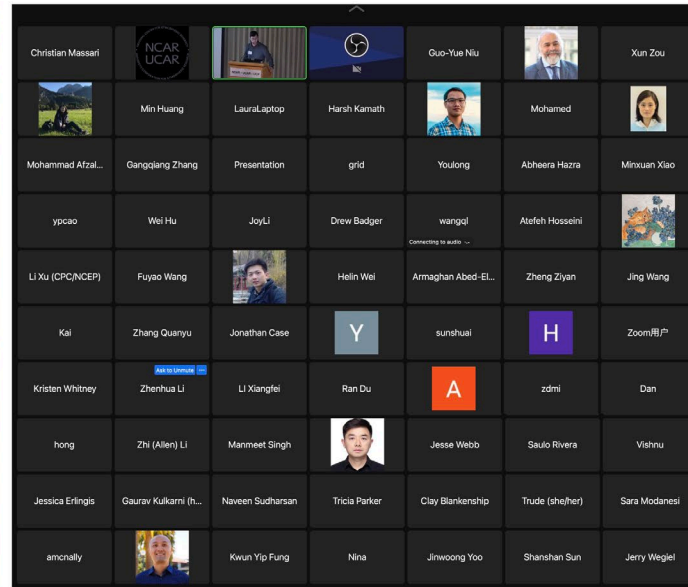
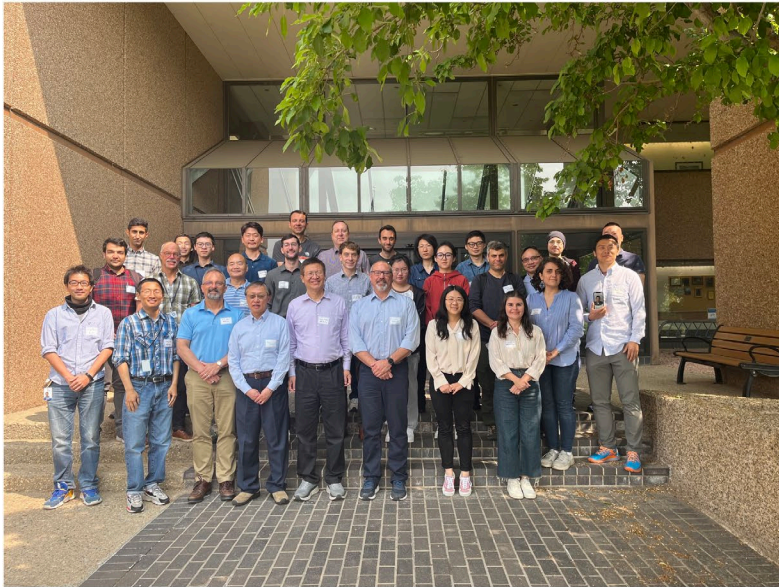
Model diagnostics and new capabilities

Land use land cover change

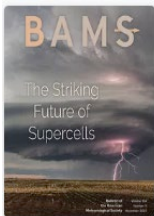


# Recap from 2023 Noah-MP Annual Users' Workshop

Workshop materials are available at: <https://ral.ucar.edu/events/2023/noah-mp-annual-users-workshop>



**Workshop Summary BAMS paper:** <https://doi.org/10.1175/BAMS-D-23-0249.1>



Enhancing the Community Noah-MP Land Model Capabilities for Earth Sciences and Applications

Cenlin He, Fei Chen, Michael Barlage, Zong-Liang Yang, Jerry W. Wegiel, Guo-Yue Niu, David Gochis, David M. Mocko, Ronnie Abolafia-Rosenzweig, Zhe Zhang, Tzu-Shun Lin, Prasanth Valayamkunnath, Michael Ek, and Dev Niyogi

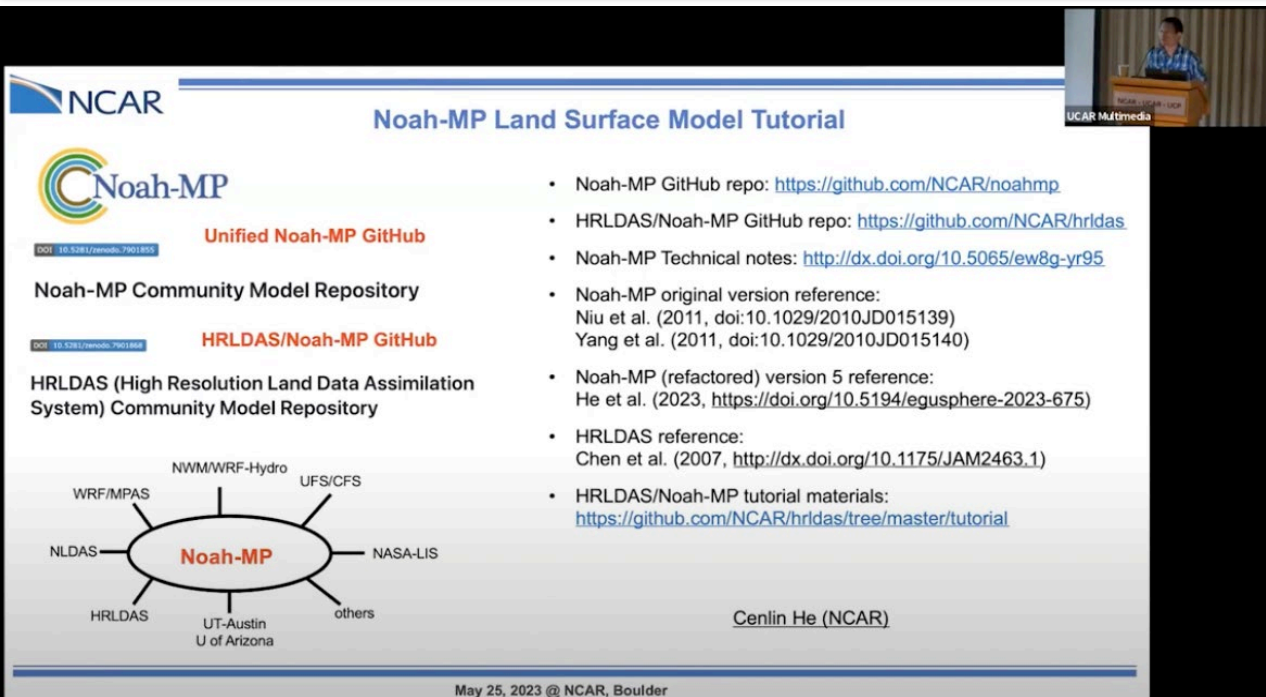
## Future Priorities:

- 1) Advance land DA modeling framework
- 2) Improve physics in S2S predictions particularly for hydroclimate extremes
- 3) Enhance anthropogenic processes (agriculture & LULCC) in model
- 4) Establish Noah-MP Academia Collaboratory

# Noah-MP tutorial and training



# First Noah-MP Tutorial (May 25, 2023 @NSF NCAR)



**NCAR**

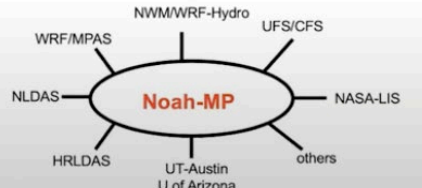
## Noah-MP Land Surface Model Tutorial

**Noah-MP**  
Unified Noah-MP GitHub  
DOI: 10.5281/zenodo.7901855

Noah-MP Community Model Repository

**HRLDAS/Noah-MP GitHub**  
DOI: 10.5281/zenodo.7901864

HRLDAS (High Resolution Land Data Assimilation System) Community Model Repository

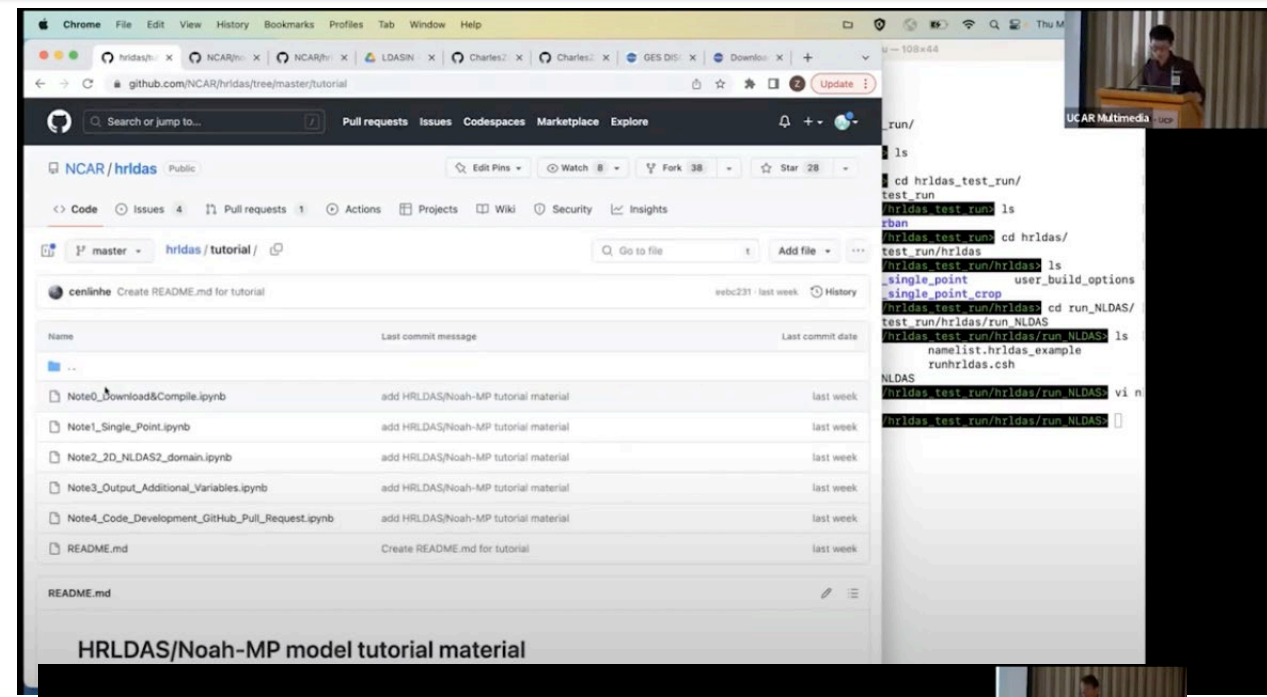


**Noah-MP**

- Noah-MP GitHub repo: <https://github.com/NCAR/noahmp>
- HRLDAS/Noah-MP GitHub repo: <https://github.com/NCAR/hrlidas>
- Noah-MP Technical notes: <http://dx.doi.org/10.5065/ew8g-yr95>
- Noah-MP original version reference:  
Niu et al. (2011, doi:10.1029/2010JD015139)  
Yang et al. (2011, doi:10.1029/2010JD015140)
- Noah-MP (refactored) version 5 reference:  
He et al. (2023, <https://doi.org/10.5194/egusphere-2023-675>)
- HRLDAS reference:  
Chen et al. (2007, <http://dx.doi.org/10.1175/JAM2463.1>)
- HRLDAS/Noah-MP tutorial materials:  
<https://github.com/NCAR/hrlidas/tree/master/tutorial>

Cenlin He (NCAR)

May 25, 2023 @ NCAR, Boulder



Chrome File Edit View History Bookmarks Profiles Tab Window Help

hrlidas: x NCAR: x NCAR: x LDASIN x Charles? x Charles? x GES DIS: x Download x +

github.com/NCAR/hrlidas/tree/master/tutorial

Search or jump to... Pull requests Issues Codespaces Marketplace Explore

NCAR/hrlidas Public

Edit Pins Watch 8 Fork 38 Star 28

Code Issues 4 Pull requests 1 Actions Projects Wiki Security Insights

cenlinhe Create README.md for tutorial svbc231 · last week History

Name	Last commit message	Last commit date
..		
Note0_Download&Compile.ipynb	add HRLDAS/Noah-MP tutorial material	last week
Note1_Single_Point.ipynb	add HRLDAS/Noah-MP tutorial material	last week
Note2_2D_NLDAS2_domain.ipynb	add HRLDAS/Noah-MP tutorial material	last week
Note3_Output_Additional_Variables.ipynb	add HRLDAS/Noah-MP tutorial material	last week
Note4_Code_Development_GitHub_Pull_Request.ipynb	add HRLDAS/Noah-MP tutorial material	last week
README.md	Create README.md for tutorial	last week

README.md

HRLDAS/Noah-MP model tutorial material

```
ls
cd hrlidas_test_run/
test_run
hrlidas_test_run ls
rban
hrlidas_test_run cd hrlidas/
test_run/hrlidas
hrlidas_test_run/hrlidas ls
single_point user_build_options
single_point_crop
hrlidas_test_run/hrlidas cd run_NLDAS/
test_run/hrlidas/run_NLDAS
hrlidas_test_run/hrlidas/run_NLDAS ls
namelist.hrlidas_example
runhrlidas.csh
NLDAS
hrlidas_test_run/hrlidas/run_NLDAS vi n
hrlidas_test_run/hrlidas/run_NLDAS |
```

**Tutorial delivered by  
Cenlin He, Zhe Zhang, and Ufuk Turuncoglu**

## Introduction to Noah-MP component model in NOAA's UFS

Ufuk Turuncoglu and Michael Barlage

25 May 2023, Noah-MP Workshop & Tutorial

This work is supported by the NOAA Joint Technology Transfer Initiative (JTTI)  
NA21OAR4590167: Advancing Land Modeling Infrastructure in the UFS for Hierarchical Model Development



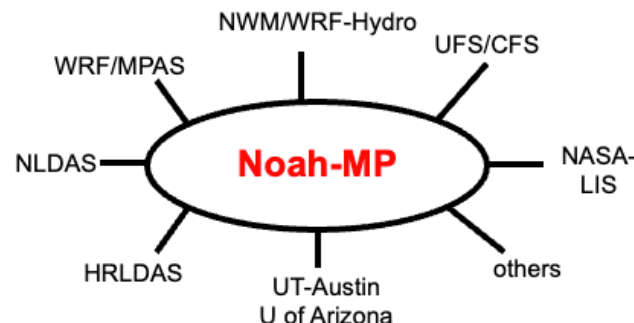
# USGS Training: Noah-MP Tutorial (Sept 27, 2023)

Training delivered by Cenlin He and Fei Chen  
via the USGS-NCAR collaborative CONUS404 project



DOI 10.5281/zenodo.7901855

Noah-MP® Community



Technical documentation,  
released in 2023

The Community Noah-MP  
Land Surface Modeling  
System Technical Description  
Version 5.0

Cenlin He  
Prasanth Valayamkunnath  
Michael Barlage  
Fei Chen  
David Gochis  
Ryan Cabell  
Tim Schneider  
Roy Rasmussen  
Guo-Yue Niu  
Zong-Liang Yang  
Dev Niyogi  
Michael Ek

Refactored Noah-MP (version 5.0), released in March 2023

Geosci. Model Dev., 16, 5131–5151, 2023  
<https://doi.org/10.5194/gmd-16-5131-2023>  
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the Creative Commons Attribution 4.0 License.



Modernizing the open-source community Noah with  
multi-parameterization options (Noah-MP) land surface  
model (version 5.0) with enhanced modularity,  
interoperability, and applicability

Cenlin He<sup>1</sup>, Prasanth Valayamkunnath<sup>1,5</sup>, Michael Barlage<sup>2</sup>, Fei Chen<sup>1</sup>, David Gochis<sup>1</sup>, Ryan Cabell<sup>1</sup>,  
Tim Schneider<sup>1</sup>, Roy Rasmussen<sup>1</sup>, Guo-Yue Niu<sup>3</sup>, Zong-Liang Yang<sup>4</sup>, Dev Niyogi<sup>4</sup>, and Michael Ek<sup>1</sup>

NCAR Technical Notes  
NCAR/TN-575+STR

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Atmospheric Research  
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Boulder, Colorado  
80307-3000  
[www.ucar.edu](http://www.ucar.edu)

National Science Foundation  
NSF





# 2024 AMS Noah-MP short-course (hybrid) (Jan 27, 2024)



AMERICAN METEOROLOGICAL SOCIETY  
104TH ANNUAL MEETING  
28 JANUARY-1 FEBRUARY 2024  
BALTIMORE, MD & ONLINE

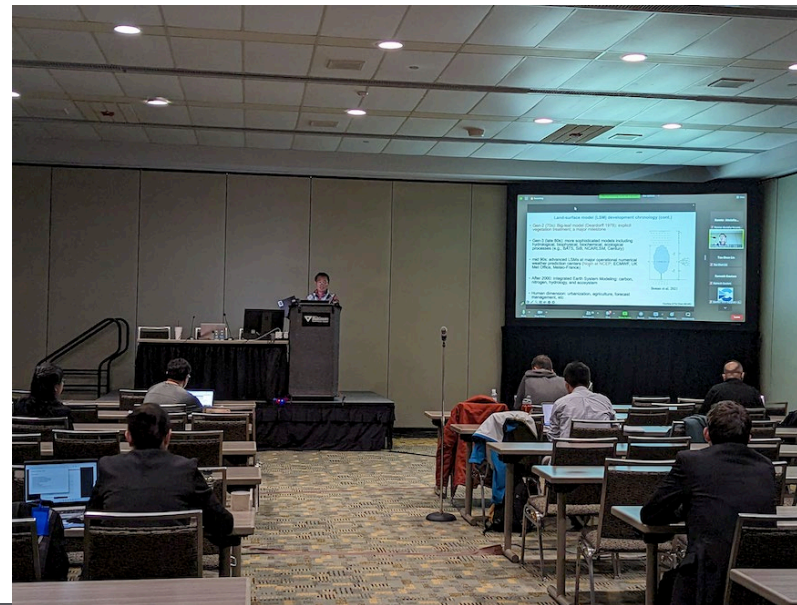
## Session - Noah-MP Land Surface Model Tutorial: Model Physics, Code Structures, and Simulation Exercises (Hybrid)



Calendar icon: Saturday, January 27, 2024

Clock icon: 1:30 PM - 5:30 PM

Location pin icon: 316 (The Baltimore Convention Center)



Short course delivered by  
**Cenlin He**  
**Zhe Zhang**  
**Ufuk Turuncoglu**





# Future plans for Noah-MP training/tutorial/course

1. **Make it an annual event (at least once a year)**
2. **Design tutorials for various difficulty levels (e.g., focused topics, specialized tools, etc.)**
3. **Invite more Noah-MP experts to teach at tutorials based on their specialty (volunteers are very welcome! Please email me if you are interested).**
4. **Different groups are welcome to organize their own training/tutorial events to expand the Noah-MP user community.**

**Any suggestions to improve Noah-MP tutorial are welcome!**



# Noah-MP model resources

# New look for Noah-MP model website

<https://ral.ucar.edu/model/noah-multiparameterization-land-surface-model-noah-mp-lsm>

The screenshot shows the homepage of the Noah-MP model website. At the top left are the NSF and NCAR logos. To the right is a 'Contact Us' link and a search box labeled 'Search RAL'. Below this is a navigation menu with links for 'About', 'What We Do', 'Products + Tools', 'Technologies', 'Our Impacts', 'Work With Us', 'Events', 'News', and 'Staff Login'. The main heading reads 'Noah-Multiparameterization Land Surface Model (Noah-MP® LSM)'. Below the heading is a large image of a forest with a lake. To the right of the image is a 'RESOURCE LINK' section with links to 'Noah-MP® version 5.0 code GitHub link', 'Noah-MP® technical documentation', 'Noah-MP® community discussion forum', and 'HRLDAS community discussion forum'. Below that is a 'RELATED R&D' section with a link to 'Land Atmosphere Interactions'. At the bottom left is a 'DOWNLOADS' section with links to 'Noah-MP® version 5.0 code GitHub link' and 'Noah-MP® technical documentation'. At the bottom right is a 'RELATED TECHNOLOGY' section with a link to 'Decision Support Systems'. A 'Screenshot' button is located at the bottom center of the page.

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[Home](#)

## Noah-Multiparameterization Land Surface Model (Noah-MP® LSM)



**RESOURCE LINK**

- [Noah-MP® version 5.0 code GitHub link](#)
- [Noah-MP® technical documentation](#)
- [Noah-MP® community discussion forum](#)
- [HRLDAS community discussion forum](#)

**RELATED R&D**

- [Land Atmosphere Interactions](#)

**DOWNLOADS**

- [Noah-MP® version 5.0 code GitHub link](#)
- [Noah-MP® technical documentation](#)

**RELATED TECHNOLOGY**

- [Decision Support Systems](#)

Screenshot





# Noah-MP Technote

<http://dx.doi.org/10.5065/ew8g-yr95>

The Community Noah-MP  
Land Surface Modeling  
System Technical Description  
Version 5.0

Cenlin He  
Prasanth Valayamkunnath  
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Zong-Liang Yang  
Dev Niyogi  
Michael Ek

NCAR Technical Notes  
NCAR/TN-575+STR

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Atmospheric Research  
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Boulder, Colorado  
80307-3000  
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UCAR | Atmospheric Research

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NSF IS SPONSORED BY THE NSF



## The Community Noah-MP Land Surface Modeling System Technical Description Version 5.0

Originated: March 7, 2023

Cenlin He<sup>1</sup>, Prasanth Valayamkunnath<sup>1,5</sup>, Michael Barlage<sup>2</sup>, Fei Chen<sup>1</sup>,  
David Gochis<sup>1</sup>, Ryan Cabell<sup>1</sup>, Tim Schneider<sup>1</sup>, Roy Rasmussen<sup>1</sup>, Guo-Yue Niu<sup>3</sup>,  
Zong-Liang Yang<sup>4</sup>, Dev Niyogi<sup>4</sup>, Michael Ek<sup>1</sup>

1. Research Applications Laboratory, National Center for Atmospheric Research, USA
2. NOAA Environmental Modeling Center, USA
3. University of Arizona, USA
4. University of Texas Austin, USA
5. Indian Institute of Science Education and Research, Thiruvananthapuram, India



# Noah-MP GitHub Materials

<https://github.com/NCAR/hirdas/tree/master/tutorial>

NCAR / hirdas

<> Code Issues 3 Pull requests Discussions

master hirdas / tutorial

CharlesZheZhang Adding NLDAS2 Initial conditions

Name
..
Note0_Download_Compile.ipynb
Note1_Single_Point.ipynb
Note2_2D_NLDAS2_domain.ipynb
Note3_Output_Additional_Variables.ipynb
Note4_Code_Development_GitHub_Pull_Request.ipynb
Note5_Regional_modeling_ERA5-Land_forcing.ipynb
Note6_AMS2024_NoahMP_short_course.ipynb
Note7_AMS24_Tutorial_UFS_NoahMP_component.ipynb
README.md

# Noah-MP GitHub Discussion Forum

NCAR / hrlDas

Issues 3 Pull requests Discussions Actions Projects Wiki Security Insights Settings

How to ask a question or open a Discussion in HRLDAS Forum  
Announcements · cenlinhe

Welcome to HRLDAS Community Discussion Forum!  
Announcements · cenlinhe

is:open Sort by: Latest activity Label Filter: Open New discussion

Categories

- View all discussions
- Announcements
- General
- Ideas
- Polls
- Q&A
- Show and tell

Most helpful Last 30 days

- tslin2 2

Discussions

- Running with non-global forcing data  
leiapauline asked last week in Q&A · Answered 4
- Noah-MP Docker Container Setup (Windows): Regression Test Failed  
leiapauline asked 3 weeks ago in Q&A · Answered 3
- hrlDas.exe error: unrealistic LWDN and TV, TG at first timestep  
neha12-3 asked on Apr 18 in Q&A · Answered 19
- Boundary Run-Time Check Failure for variable 'module\_grib\_mp\_findgrib\_\$ITELL'  
avinp07 asked 3 weeks ago in Q&A · Answered 2
- Solar radiation budget problem in NoahMP LSM  
OBJ780 asked 3 weeks ago in Q&A · Unanswered

**HRLDAS: 186 discussion threads as of June 1, 2024**

<https://github.com/NCAR/hrlDas/discussions>

NCAR / noahmp

Issues 3 Pull requests Discussions Actions Projects Wiki Security Insights Settings

How to ask a question or open a Discussion in Noah-MP Forum  
Announcements · cenlinhe

Welcome to Noah-MP Community Discussion Forum!  
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is:open Sort by: Latest activity Label Filter: Open New discussion

Categories

- View all discussions
- Announcements
- General
- Ideas
- Polls
- Q&A
- Show and tell

Most helpful

- Be sure to mark someone's comment as an answer if

Discussions

- Spin up for running Dynamic vegetation in Noah-MP 4.0.1  
Arijit22ITDelhi asked 4 days ago in Q&A · Unanswered help wanted question 1
- Albedo and SoilColor in Noah-MP  
manel-bravo asked on Apr 29 in Q&A · Unanswered 5
- NUOPC interface for coupling  
uturuncoglu started on Mar 21 in General 28
- An error always occurs when running the model.  
shenjuyue asked on Apr 9 in Q&A · Unanswered 1

**Noah-MP: 132 discussion threads as of June 1, 2024**

<https://github.com/NCAR/noahmp/discussions>





# Other Noah-MP community updates

# Noah-MP community AGU get-together

Dec 2023, San Francisco, CA



# Noah-MP committee formed

- **Noah-MP code review committee:**

- Role: review, approve, and answer model code issues and updates
- Current members: Cenlin He, Tzu-Shun Lin, Prasanth Valayamkunnath, Michael Barlage, David Mocko, Ronnie Abolafia-Rosenzweig, Guo-Yue Niu, Zhe Zhang, Yanjun Gan, Lingcheng Li, Zhao Yang, Ming Chang, Myung-Seo Koo, Carolina Bieri, Weizhong Zheng, Ehud Strbach, Min Huang, Huilin Huang, Van Doan, Lingbo Xue

- **Noah-MP strategic planning committee:**

- Role: guide future directions, coordinate community efforts, seek for resources, interacting with external communities
- Current members: Cenlin He, Fei Chen, Michael Barlage, Jerry Wiegel, Zong-Liang Yang, Dev Niyogi, Guo-Yue Niu, David Mocko, Myung-Seo Koo, Prasanth Valayamkunnath, Xuemei Wang, Gonzalo Miguez-Macho

**We had one committee meeting in the past few months for each committee.**



# Noah-MP model updates

# Current community Noah-MP physics capabilities

- **Canopy process:** rain/snow interception, radiative transfer, stomatal resistance, turbulence, evapo./sublime./melt/freeze, heat storage change, etc.
- **Snow process:** rain-snow partition, canopy interception, compaction, layer combination/division, melt/freeze/sublim/frost, sensible & latent heat, ground heat, radiation, temperature change, etc.
- **Soil process:** evapo/sublim/dew/frost/melt/freeze, supercooled water, infiltration, soil hydraulics, surface/subsurface runoff, radiation, sensible & latent heat, ground heat, temperature change, etc.
- Different main Noah-MP process and **soil process timesteps**
- **Groundwater process:** recharge/discharge, lateral flow, baseflow, aquifer storage change
- **Dynamic vegetation and crop growth:** key carbon processes
- **Tile drainage** schemes
- **Dynamic irrigation** processes
- Bulk urban treatment and coupling with external **urban canopy model**

**Highlights: modeling anthropogenic processes (urban and agriculture)!**

# Other Noah-MP physics that are currently not in the community version

- (1) nitrogen dynamics (Cai et al., 2016);
- (2) new plant hydraulics (Li et al., 2021);
- (3) dynamic root optimization (Wang et al. 2018) with an explicit representation of plant water storage (Niu et al., 2020);
- (4) dynamic root growth scheme (Bieri et al., 2024);
- (5) coupling with a wind erosion model (Jiang et al., 2021);
- (6) a wetland representation and dynamics (Z. Zhang et al., 2022);
- (7) a unified turbulence parameterization throughout the canopy and roughness sublayer (Abolafia-Rosenzweig et al., 2021);
- (8) coupling with a snow radiative transfer (SNICAR) model (Tzu-Shun Lin et al., 2024);
- (9) an organic soil layer representation at forest floors (Chen et al., 2016) and a microbial-explicit soil organic carbon decomposition model (MESDM; X. Zhang et al., 2022b);
- (10) coupling with atmospheric dry deposition of air pollutant (Chang et al., 2022);
- (11) enhanced permafrost soil representations (X. Li et al., 2020);
- (12) spring wheat crop dynamics (Zhang et al., 2023);
- (13) the Gecros crop model (Ingwersen et al., 2018; Warrach-Sagi et al., 2022);
- (14) a 1-D dual-permeability flow model (based on the mixed-form Richards' equation) representing preferential flow through variably-saturated soil with surface ponding (University of Arizona);
- (15) Mosaic subgrid treatment with urban hydrology (Alexander et al., 2024).

# Latest Noah-MP version5 coupling in weather and climate models


- Coupling with **NASA/LIS** (completed, to be released soon; led by Cenlin He and LIS team)
- Coupling with **MPAS** (completed, to be released soon; led by Laura Fowler w/ help from Cenlin He)
- Coupling with **UFS** (on-going as a component model; led by Ufuk Turuncoglu w/ help from Cenlin He)
- Coupling with **WRF-Hydro** (on-going; led by Soren Rasmussen and WRF-Hydro team)
- Coupling with **WRF** (planned; led by Cenlin He and WRF team)
- Coupling with **Korean Integrated Model (KIM)** (completed; led by Myung-Seo Koo)
- Coupling with **FastEddy®** (GPU-based LES) (started; led by FastEddy® team w/ help from Cenlin He)




# HRLDAS/Noah-MP preprocessor update for ERA5-Land data

- HRLDAS/Noah-MP ERA5-Land Pre-processor (HRLDAS\_forcing) updated with tutorial: [https://github.com/NCAR/hrldas/blob/master/tutorial/Note5\\_Regional\\_modeling\\_ERA5-Land\\_forcing.ipynb](https://github.com/NCAR/hrldas/blob/master/tutorial/Note5_Regional_modeling_ERA5-Land_forcing.ipynb)
- The new preprocessor is much more computational efficient.
- A great example of community collaboration and contribution:

📄 master [hrldas](#) / [hrldas](#) / [docs](#) / [README.ERA5](#) 🔖

 **CharlesZheZhang** Update documentation regarding soil thickness 51f34fa · 8 months ago

**Code** Blame 241 lines (159 loc) · 12.1 KB Raw 

```
1
2 Steps for running a HRLDAS simulation using ERA5-Land for forcing.
3
4 UPDATES in 2023-10-23, with contribution from Dr. Stefano Serafin (University of Vienna);
5 Dr. Allesandro Anav (alessandro.anav@enea.it) from Italian National Agency for New Technologies, Energy and Sustainable Economic Development;
6 Dr. Ehsan Jalilvand (ehsanj@msu.edu) from Michigan State University;
7 Dr. Tzu-Shun Lin (tslin2@ucar.edu) and Dr. Zhe Zhang (zhezhang@ucar.edu) from NCAR.
```

# HRLDAS/Noah-MP Docker Container

- **Allow running Noah-MP in local machine with all environments setup included in the docker container**

[https://hub.docker.com/r/cenlinhe/noahmp\\_container/tags](https://hub.docker.com/r/cenlinhe/noahmp_container/tags)

- **How to set up Noah-MP docker container:**

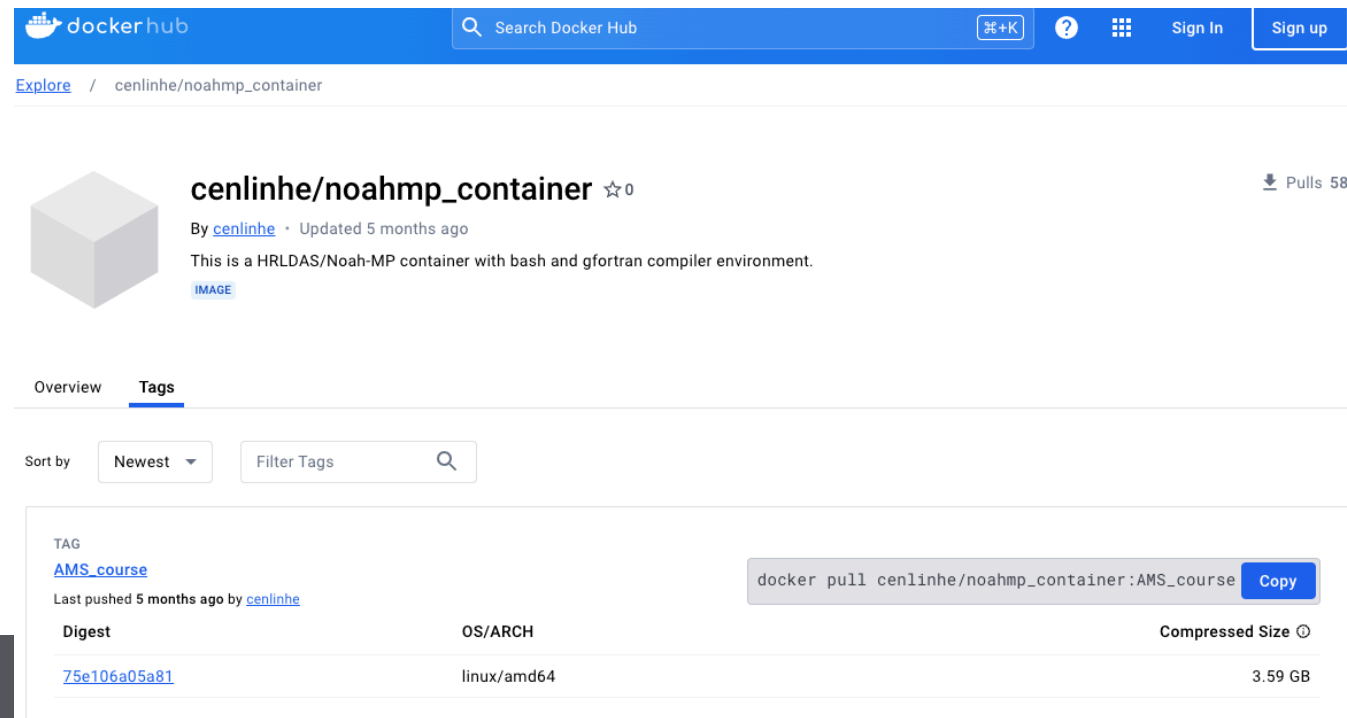
[https://github.com/NCAR/hrlDas/blob/develop/tutorial/NoahMP\\_docker\\_container\\_setup.pdf](https://github.com/NCAR/hrlDas/blob/develop/tutorial/NoahMP_docker_container_setup.pdf)

- **How to run HRLDAS/Noah-MP and UFS/Noah-MP component model in docker container:**

[https://github.com/NCAR/hrlDas/blob/develop/tutorial/Note6\\_AMS2024\\_NoahMP\\_short\\_course.ipynb](https://github.com/NCAR/hrlDas/blob/develop/tutorial/Note6_AMS2024_NoahMP_short_course.ipynb)

- **How to run UFS/Noah-MP component model in docker container:**

[https://github.com/NCAR/hrlDas/blob/develop/tutorial/Note7\\_AMS24\\_Tutorial\\_UFS\\_NoahMP\\_component.ipynb](https://github.com/NCAR/hrlDas/blob/develop/tutorial/Note7_AMS24_Tutorial_UFS_NoahMP_component.ipynb)



The screenshot shows the Docker Hub page for the repository 'cenlinhe/noahmp\_container'. The page includes a search bar, navigation links, and a list of tags. The 'AMS\_course' tag is highlighted, showing it was last pushed 5 months ago and has a size of 3.59 GB. The page also features a 'Pulls 58' indicator and a 'Copy' button for the tag name.

dockerhub Search Docker Hub

Explore / cenlinhe/noahmp\_container

**cenlinhe/noahmp\_container** ☆0 Pulls 58

By [cenlinhe](#) · Updated 5 months ago

This is a HRLDAS/Noah-MP container with bash and gfortran compiler environment.

IMAGE

Overview **Tags**

Sort by Newest Filter Tags

TAG	Digest	OS/ARCH	Compressed Size
<a href="#">AMS_course</a>	<a href="#">75e106a05a81</a>	linux/amd64	3.59 GB

Last pushed 5 months ago by [cenlinhe](#)

docker pull cenlinhe/noahmp\_container:AMS\_course Copy



# Noah-MP key bug fixes since the release of version 5.0

- **bug fix for LECH SURFACE FUNCTIONS in Chen97 scheme:** <https://github.com/NCAR/noahmp/commit/ca2219246cebdcd9157f327c4527c9294ad6852c>
- **bug fix for leaf mass initialization for urban pixel:** <https://github.com/NCAR/noahmp/commit/843a742c6019a613450f0002e7ec65f44e49b523>
- **bug fix for FVEG scaling in canopy interception and stomatal resistance:**  
<https://github.com/NCAR/noahmp/commit/a7dd399972fca4d477c43654d384287ad62114a2>
- **bug fix for snow layer combine:** <https://github.com/NCAR/noahmp/commit/e0d20644c4532064669359f931ef0a621d503314>
- **bug fix for initialization to work with BEP,BEM urban physics:** <https://github.com/NCAR/noahmp/commit/45f65210cebe1bb4f821bfbde42723c6215acfd>
- **bug fix for FVEG scaling of canopy heat storage:** <https://github.com/NCAR/noahmp/commit/dfb99b670d2c0dc998c03644dbd21db9670688e0>
- **bug fix for LW calculation in SLUCM:** <https://github.com/NCAR/hrlDas/commit/b4f73d664094927be585a17acf2b53516ab41687>
- **bug fix for restart frequency setup for gfortran compiler:** <https://github.com/NCAR/hrlDas/commit/c9aa8ce0f7b26f6e9ba2efb759fb2b56f1c81630>
- **bug fix for SLUCM saturated humidity calculation:** <https://github.com/NCAR/hrlDas/commit/922a66f1c89963b5841952ca75e92bcbaf7f0193>
- **bug fix for ground heat flux sign in urban model:** <https://github.com/NCAR/hrlDas/commit/a3ce25e36733fddb277691db80225eabb33aa29e>
- **bug fix for ERA5 longitude and soil vert interpolation:** <https://github.com/NCAR/hrlDas/commit/ba09bf052c22f1e0fcbb93065998f3903ce2c033>
- **bug fix for detecting LCZ and update URBPARAM\_LCZ.TBL:** <https://github.com/NCAR/hrlDas/commit/9b3002238fe9bcf68a3ad41a31e2ce066175d91e>
- **bug fix for GLDAS forcing preprocessor:** <https://github.com/NCAR/hrlDas/commit/fe3f2adf23fc84809e7f3ea0deecd383ebe41574>

## Noah-MP Emergent Model Issues/Deficiencies

- Cold bias in daily max 2-m air temperature over snow-covered regions
- Warm bias in daily min 2-m air temperature throughout the year
- Too large soil temperature diurnal cycle (e.g., soil heat diffusion; coupled canopy-ground flux solver)
- **More to discuss during our discussion session (Tuesday afternoon, June 4)**