

2017 Joint DTC-EMC-JCSDA GSI-EnKF Tutorial  
July 11-14, 2017,  
NCWCP, College Park, MD

# Introduction to Practice Session

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Developmental Testbed Center



Developmental Testbed Center

# Practice sessions: List of content

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[http://www.dtcenter.org/com-GSI/users/tutorial/online\\_tutorial/Practical\\_2017](http://www.dtcenter.org/com-GSI/users/tutorial/online_tutorial/Practical_2017)

[http://www.dtcenter.org/EnKF/users/tutorial/online\\_tutorial/Practical\\_2017](http://www.dtcenter.org/EnKF/users/tutorial/online_tutorial/Practical_2017)

- Introduction
- Practical Sessions
  - *Tuesday 2:30-5:00 pm*
  - *Wednesday 2:15-5:00 pm*
  - *Thursday 3:30-5:00 pm*
  - *Friday (optional): 9:00 am -12:00 pm (at University of Maryland)*
- GSI Basic Exercises
  - Single observation tests
  - 3DVar with conventional data
  - 3DVar with conventional data + radiance + GPSRO + radar radial wind
  - 3DEnVar with conventional data
  - Basic BUFR/PrepBUFR tool

# Practice sessions: List of content - cont.

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- GSI Advanced Exercises:
  - Session A: Repeat of basic exercises with new data
    - Single observation tests
    - 3DVar with conventional data
    - 3DVar with conventional data plus other data
    - 3DEnVar with conventional data
    - Make your own BUFR tool
  - Session B: Cycling of GSI ARW
  - Session C: GSI Hybrid 4DEnVar
  - Session D: GSI NMMB Analysis
  - Session E: GSI Global Analysis
  - Session F: GSI Analysis with Chemical Observations
- Building GSI/EnKF from Scratch

# Practice sessions: List of content - cont.

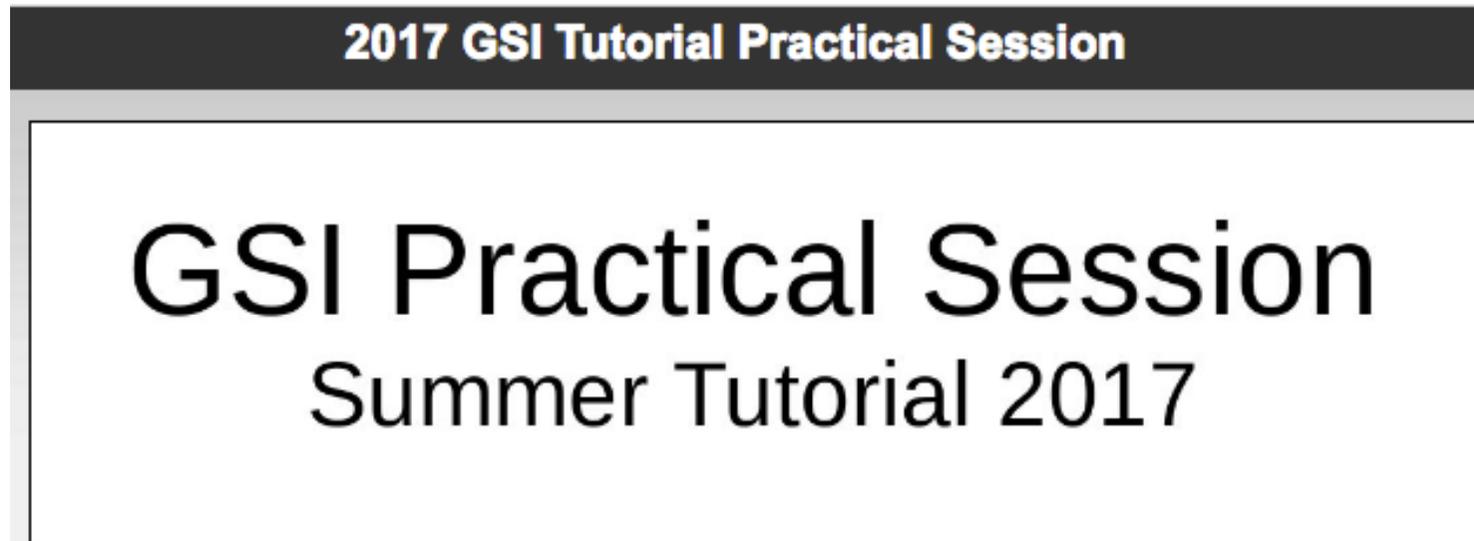
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- EnKF Basic Exercises:
  - Test with conventional data for ARW background
  - Test with conventional data and radiance data for ARW background
- EnKF Advanced Exercises:
  - Session A: Repeat basic exercises with new data
    - Test with conventional data for ARW background
    - Test with conventional, radiance and GPS RO data for ARW background
    - Test with conventional data, radiance data, but turn off GPS RO for ARW background
  - Session B: EnKF Global Analysis

# GSI Practical Session

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[http://www.dtcenter.org/com-GSI/users/tutorial/online\\_tutorial/Practical\\_2017](http://www.dtcenter.org/com-GSI/users/tutorial/online_tutorial/Practical_2017)



# Introduction

- Basic application skills on Yellowstone
- Setup GSI and WRF system on your own account space
  - Pre-compiled GSI
  - Pre-compiled WRF-ARW
- Get data for practice
  - Where is the data
  - What kind of data available

## 2017 GSI Tutorial Practical Session

# GSI Practical Session

## Summer Tutorial 2017

### Exercises for the 2017 GSI/EnKF Tutorial ONLY!

#### Welcome to 2017 GSI/EnKF Tutorial Practical Session Guide!

Both the DTC community GSI analysis system V3.6 and the WRFV3.9 have been pre-compiled on the NCAR supercomputer Yellowstone for the tutorial exercises. Before starting the exercises, read the section on [Setting up the GSI system](#) and follow the instruction found there. Since building the community GSI system from scratch takes a significant amount of time, we strongly recommended that users use the pre-compiled executables to make the best use of their laboratory time.

If upon completion of the exercise you want to experiment with building GSI, please check [here](#) for instructions.

[Using Yellowstone](#)

[Setting up the GSI system](#)

[Case data summary and download](#)



# Build your run script for the classroom

- Important to go through these steps!

## Talk: GSI Fundamentals (2): Run & Namelist

### Build basic GSI run script for the classroom

Before proceeding to the practical cases, please do spend some time to work through the GSI basic run script!

- Start with the basic run script `run_gsi_regional.ksh`, found in the `comGSIv3.6_EnKFv1.2/run` directory
- Copy `run_gsi_regional.ksh` as `run_gsi_regional.ksh_basic`
- Following instructions to modify and test `run_gsi_regional.ksh_basic`.

Note: The `run_gsi_regional.ksh_basic` will be used as the template for all the later scripts used in the tutorial Practical Session exercises. It is modified specific to the practical environment for this tutorial. If you are running these exercises elsewhere, additional modifications will be necessary.

- Make a copy of the basic run script `comGSIv3.6_EnKFv1.2/run/run_gsi_regional.ksh` → `run_gsi_regional.ksh_basic`
- Make modifications to `run_gsi_regional.ksh_basic`
  - Job header
  - Case set up
  - Submit the job & check results

# Basic Practical Cases

- Introduction
- Background and data
- Setting up the run script
  - Instructions
  - Sample script
- Running the script
- Results
  - Standard out (stdout)
  - Fit files (fort.\*)
  - Convergence (fort.220)
- Visualizing the Analysis

## Basic Practical Cases

### 1). Single Observation Tests:

- [a]. [ARW background with global BE](#)
- [b]. [ARW background with NAM BE](#)

### 2). Test with conventional data (prepbufr):

- [ARW background](#)

### 3). Test with conventional, satellite radiance, gpsro and radar data:

- [ARW background](#)

### 4). 3DEnVar test with conventional data:

- [ARW background](#)

Talk: GSI Hybrid  
Thursday (Kleist)

### 5). BUFR/PrepBUFR

- [Basic BUFR/PrepBUFR tools](#)

Talk:  
Wednesday

# Basic Practical Cases

- Introduction
- Background and Data
- Setting up the Run Script
  - Instructions
  - Sample script
- Running the Script
- Results
  - Standard out (stdout)
  - Fit files
  - convergence
- Visualizing the Analysis

## Basic Practical Cases

1. Single Observation Tests
2. 3DVar test with conventional data (prepbufr)
3. 3DVar test with conventional data, satellite radiances, gpsro and radar data
4. 3DEnVar test with conventional data
5. BUFR/PrepBUFR tools

## GSI fundamentals

- (1): Setup and Compilation
- (2): Run and Namelist

- (3): Diagnostics

## GSI fundamentals

- (5): Applications

## GSI tools

Observation processing

# Advanced Practical Session A:

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- Introduction
- Setting up the Run Script
  - **No instructions!**
  - Sample script
- Running the Script
- Results
  - stdout
  - Fit files
  - fort.220
- Visualizing the Analysis

## Advanced Practical Session A: Repeat basic practice with new data

Please repeat the basic case 1 to 4 using the new data at 18Z May 13th, 2017. Those data files are located in the directory `/glade/p/ral/jnt/GSI_DTC/data/tutorial/2017051318` on Yellowstone.

### A1). Single Observation Tests:

- [a]. [ARW background with global BE](#)
- [b]. [ARW background with NAM BE](#)

### A2). Test with conventional data (prepbuf):

- [ARW background](#)

### A3). Test with conventional, satellite radiance, gpsro and radar data:

- [ARW background](#)

### A4). 3DEnVar test with conventional data:

- [ARW background](#)

### A5). BUFR/PrepBUFR

- [Make your Own BUFR/PrepBUFR tools](#)

# Advanced Practical Session A and Basic Practical Cases

## Repeat basic practice with **new data**

A1). Single Observation Tests:  
[a]. ARW background with global BE  
[b]. ARW background with NAM BE

A2). 3DVar Test with conventional data:  
. ARW background

A3). 3DVar test with conv. plus other data:  
. ARW background

A4). 3DEnVar test with conventional data:  
. ARW background

A5). BUFR/PrepBUFR tools  
. Make your own BUFR/PrepBUFR

## Basic Practical Cases

A1). Single Observation Tests:  
[a]. ARW background with global BE  
[b]. ARW background with NAM BE

A2). 3DVar Test with conventional data:  
. ARW background

A3). 3DVar test with conv. plus other data:  
. ARW background

A4). 3DEnVar test with conventional data:  
. ARW background

A5). BUFR/PrepBUFR tools  
. Basic BUFR/PrepBUFR Tools

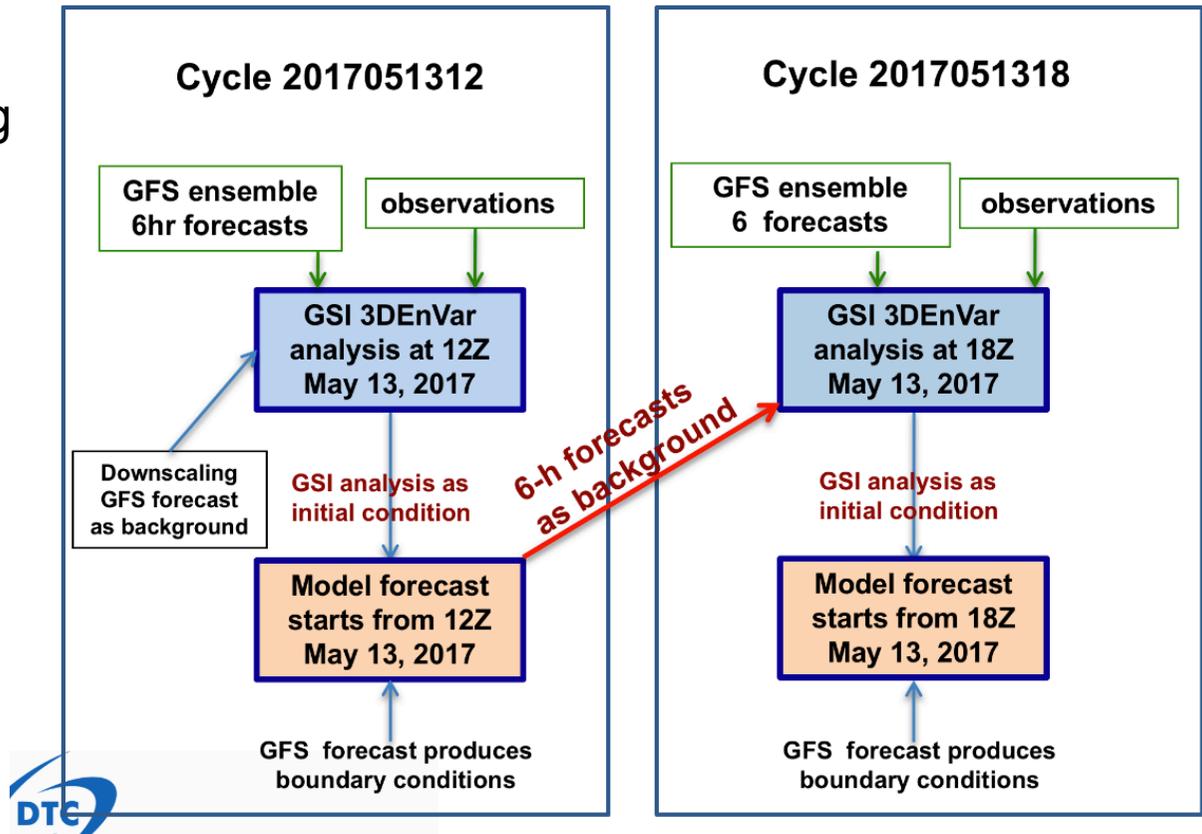
# Advanced Practical Session B - Cycling

- Introduction
- GSI Run (Similar to Advanced Session A)
  - **No instructions**
  - Sample script
  - Running GSI and checking the results
- ARW Run
  - Setting up ARW run environment
    - **Detailed instructions**
  - Running the ARW and checking the forecast results

## Advanced Practical Session B: cycling

This section is to illustrate the basic structure and flow of a cycling data assimilation system. The flow chart of this practical cycling data assimilation system can be found at [here](#).

B1). GSI and ARW Cycling exercise:



# Advanced Practical Session C – 4DEnVar

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- Introduction
- Background and Data (Background and GFS ensemble forecast: **three time levels**)
- Setting up the Run Script and Namelist
  - Line to line instruction
  - Sample scripts
- Running the Script
- Results
  - Standard out (stdout)
  - Fit files
  - convergence
- Visualizing the Analysis

## Advanced Practical Session C: 4DEnVar using global ensemble forecasts

After running the previous GSI exercises (basic and advanced A, B) successfully, interested users can practice the GSI hybrid 4DEnVar function based on A4 and GSI in cycle 2017051318. Different from the GSI hybrid 3DEnVar cases, we need three background files of difference time levels and three time levels of the GFS ensemble forecasts. For this practice, only 5 out of 80 GDAS EnKF ensemble members are used to save space and computer resources.

C1). GSI Hybrid 4DEnVar with global ensemble forecast

- [Setup GSI 4DEnVar Hybrid Run](#)

# Advanced Practical Session D and E

- Session D
  - Regional NMMB
  - Sample run script
- Session E
  - GSI global analysis
  - GFS background
  - New run script for GFS
    - New namelist script

## Advanced Practical Session D: GSI Analysis with NMMB

After finish the basic practical cases, interested users can practice running GSI for the NOAA Environmental Modeling System (NEMS) Nonhydrostatic Multiscale Model on the B-grid (NMMB). This exercise will show users how to run a regional NMMB analysis with conventional data.

D1). GSI Analysis with NMMB

- [Setup GSI Run for NMMB](#)

## Advanced Practical Session E: GSI global Analysis

This exercise will show users how to run a GFS GSI analysis with conventional data, GPSRO, and radiance data.

E1). GSI Global Analysis

- [Setup GSI Run for GFS analysis](#)

# Advanced Practical Session F

- Session F
  - 2 GSI analysis for Chemical Obs
  - Two kinds of backgrounds:
    - WRF-Chem GOCART
    - CMAQ
  - Observation: PM2.5
  - New run script for Chem
    - New namelist script
  - Results

## Advanced Practical Session F: GSI Analysis with Chemical Observations

The GSI has been developed to analyze chemical observations, such as MODIS AOD or PM2.5, to improve the pollution forecast with chemical models.

In this exercise, we will practice GSI Run with CMAQ and WRF-Chem GOCART, both use PM2.5 observations.

F1). GSI Analysis with WRF-Chem

- [Exercise 01](#): Setup GSI Run for WRF-Chem GOCART

F2). GSI Analysis with CMAQ

- [Exercise 02](#): Setup GSI Run for CMAQ

# Suggestions and notes

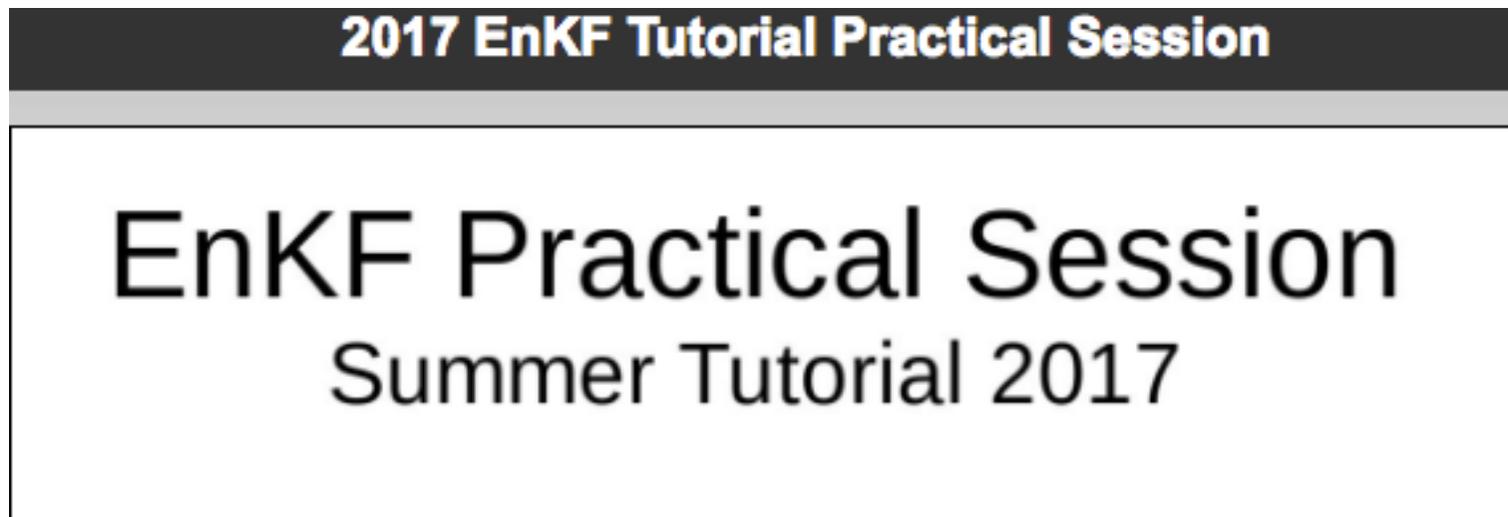
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- Basic cases:
  - Try to go through all
- Advanced cases:
  - Pick up cases based on needs

# EnKF Practical Session

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[http://www.dtcenter.org/EnKF/users/tutorial/online\\_tutorial/Practical\\_2017](http://www.dtcenter.org/EnKF/users/tutorial/online_tutorial/Practical_2017)



**EnKF Talks: Thursday**

# Introduction

- Basic application skills on Yellowstone
- Setup EnKF system on your own account space
  - Precompiled GSI and EnKF
- Get data for practice
  - Where is the data
  - What kind of data available

## EnKF Practical Session Summer Tutorial 2017

**Exercises for Community EnKF release version 1.2 ONLY!**

**Welcome to 2017 EnKF Tutorial Practical Session Guide!**

Both the DTC community EnKF analysis system v1.2, GSI v3.6, and the WRFv3.9 have been pre-compiled on the NCAR supercomputer Yellowstone for the tutorial exercises. Before starting the exercises, read the section on *Setting up the EnKF system* and follow the instructions found there. Since building the community EnKF system from scratch takes a significant amount of time, we strongly recommended that users use the pre-compiled binaries to make the best use of their laboratory time.

If upon completion of the exercises you want to experiment with building EnKF, please check [here](#) for instructions.

[Using Yellowstone](#)

[Setting up the EnKF system](#)

[Case data summary and download](#)



# Build your run script for the classroom

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- Important to go through these steps!

## EnKF Fundamentals (1): Configuration and Run

### Set up basic scripts:

To run any of the following practical cases, start with:

- [Building a basic run script for the GSI observer](#)
- [Building a basic run script for EnKF](#)

These run scripts are used by all the basic exercises, and are specific to this tutorial. If you are running these exercises elsewhere, modifications will be necessary.

- Make a copy of the basic GSI run script `comGSIv3.6_EnKFv1.2/run/run_gsi_regional.ksh` → `run_gsi_regional.ksh_basic`, and make modifications to run GSI observer
- Make a copy of the basic EnKF run script `comGSIv3.6_EnKFv1.2/run/run_enkf_wrf.ksh` → `run_enkf_wrf.ksh_basic`, and make modifications to run EnKF analysis

# Basic Practical Cases

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- Introduction
- Background and data
- GSI Observer
  - Setting up the GSI observer run script
    - Instructions
    - Sample script
  - Running the script & check results
- EnKF Analysis
  - Setting up the EnKF run script
    - Instructions
    - Sample script
  - Running the script & check results

## Basic Practical Cases

1). Test with conventional data (prepbufr):

- [ARW background](#)

2). Test with conventional and satellite radiance data:

- [ARW background](#)

**Optional Self Guided Practice:** Adding or deleting certain observations:

# Advanced Practical

## Session A: Repeating basic exercise with new data

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- Introduction
- GSI Observer
  - Setting up the GSI observer run script
    - No instructions
    - Sample script
  - Running the script & check results
- EnKF Analysis
  - Setting up the EnKF run script
    - No instructions
    - Sample script
  - Running the script & check results

### Advanced Practical Session A: Repeat previous exercise with new data

Please repeat basic cases 1a and 2a using the new data at 00Z February 13, 2014. Users can get the data following the instructions here: [Case data summary and download](#). For the practical session, these files are located in `/glade/p/ral/jnt/EnKF_DTC/data/arw_2014021300` on Yellowstone.

A1). Test with conventional data (prepbufr):

- [a1]. [ARW background](#)

A2). Test with conventional, satellite radiance, and GPS RO data:

- [a2]. [ARW background](#)

A3). Test with conventional and satellite radiance data, but turn off GPSRO data:

- [a3]. [ARW background](#)



# Advanced Practical Case B: EnKF Global Analysis

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- Introduction
- Background and data
- GSI Observer
  - Setting up the GSI observer run script
    - `run_gsi_global.ksh`
  - Running the script & check results
- EnKF Analysis
  - Setting up the EnKF run script
    - `run_enkf_global.ksh`
  - Running the script & check results

## Advanced Practical Session B: EnKF Global Analysis

### B). EnKF Global Analysis

- [b1]. [Exercise 01](#): Setup a global run

# Suggestions and notes

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- Basic cases: try to go through
- Advanced cases:
  - Pick up cases based on needs
- Optional Self Guided Practices
- Instructors in classroom to help

# Additional notes

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- Please return the yubikeys to us by the end of Thursday Practical session, unless you have a project with NCAR
- Friday optional practical session will be held in the University of Maryland (room 3426 in “Atlantic Building”).
  - Guest wifi will be provided
  - Additional information will be sent out by Thursday

# Questions?

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[gsi-help@ucar.edu](mailto:gsi-help@ucar.edu)

[enkf-help@ucar.edu](mailto:enkf-help@ucar.edu)