



# Ensemble Lake Modelling with *LakeEnsemblR*

brought to you by AEMON-J

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# Who's who?

 **#LakeEnsemblR**



Jorrit



Hannes



Robert



Tadhg

# Welcome!

- If you want to run the simulations during the workshop, you will need to install the following software on your computer. If you just want to watch, ask questions, and drive from the back seat, that's fine, too!
- **Questions?** Ask in the Zoom chat, raise your hand in Zoom, or join our Slack channel



## Two paths to the workshop examples:

- (1) Clone or download files from:

[https://github.com/gsgaleon/G21.5\\_GSA\\_workshop/tree/master/LakeEnsemblR](https://github.com/gsgaleon/G21.5_GSA_workshop/tree/master/LakeEnsemblR)

(a) you'll need R ( $\geq 3.5$ ) and certain packages (instructions are online in the README)

- (2) Get the container: <https://hub.docker.com/r/hydrobert/lakeensemblr-rocker> (requires docker)

(a) this includes Rocker, all packages, all scripts and all data:

```
docker run --rm -d -p 8000:8000 -e ROOT=TRUE -e PASSWORD=password hydrobert/lakeensemblr-rocker:latest
```

open any web browser and type 'localhost:8000' (user: rstudio, password: password)

# Time schedule today

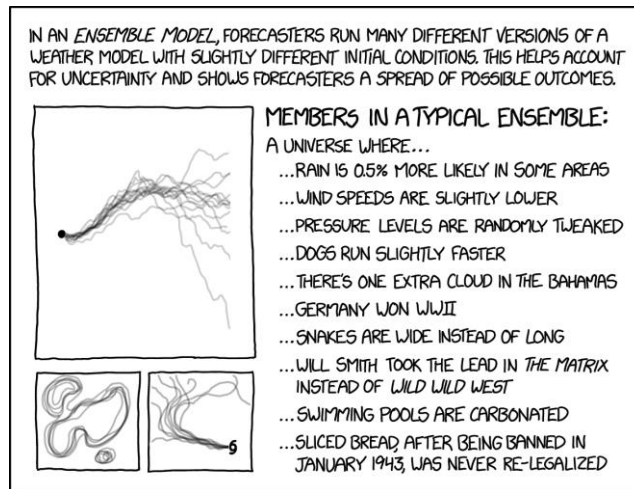
9:00-9:15	<b>Introduction to LakeEnsemblR</b>	<ul style="list-style-type: none"><li>• Why use ensembles?</li><li>• What is LakeEnsemblR?</li></ul>
9:15-9:50	<b>Using LakeEnsemblR</b>	<ul style="list-style-type: none"><li>• Standardisation of input data</li><li>• Functions</li><li>• Visualising output &amp; calibration</li><li>• Apply it to YOUR lake! (or on OUR examples)</li></ul>
9:50-10:00	<b>LakeEnsemblR Q&amp;A</b>	<ul style="list-style-type: none"><li>• Questions</li><li>• LakeEnsemblR &amp; FLARE</li></ul>

# The current state in lake modeling

- lots of different 1D hydrodynamic lake models



- (some) require compilation and additional instructions before running
- people chose the model that lab/supervisor is using
- ensemble modeling is state-of-the-art → quantifies uncertainty & identifies shortcomings



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## OVERVIEW

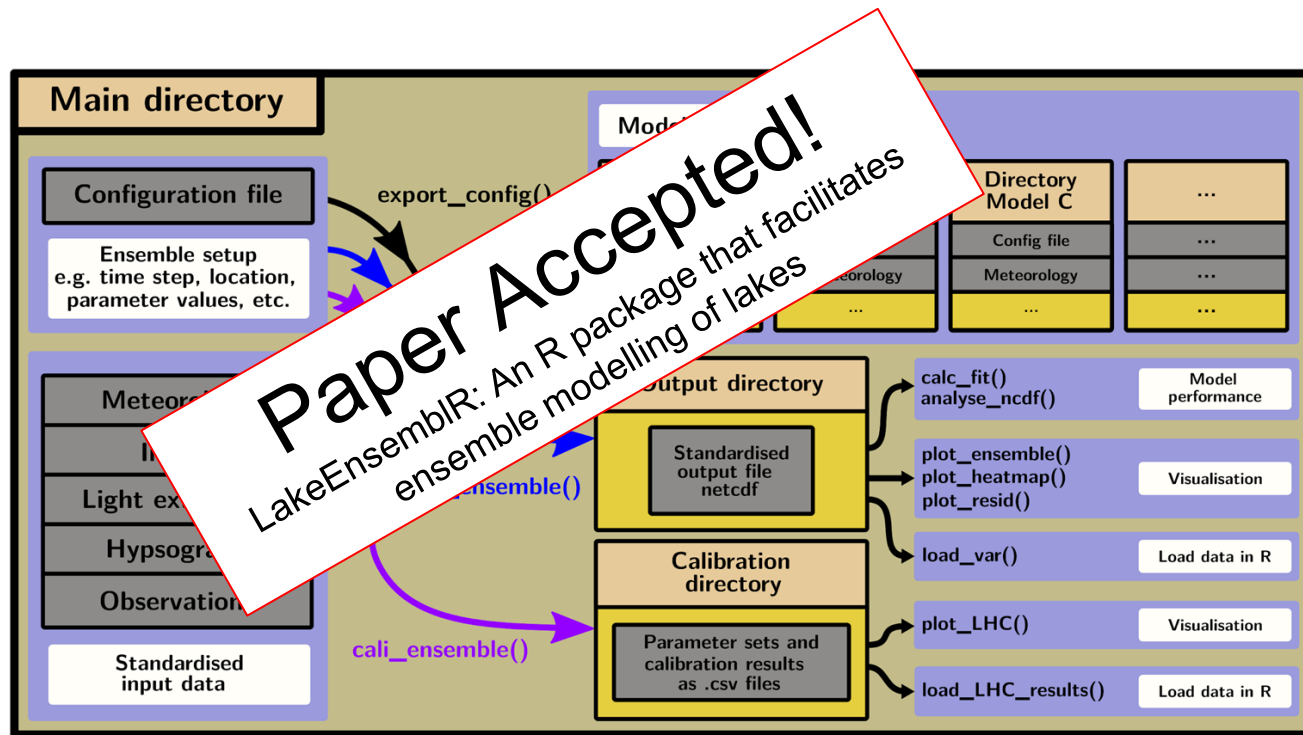


## Ensemble flood forecasting: Current status and future opportunities

Wenyan Wu<sup>1</sup> | Rebecca Emerton<sup>2</sup> | Qingyun Duan<sup>3</sup> | Andrew W. Wood<sup>4</sup> |  
Fredrik Wetterhall<sup>5</sup> | David E. Robertson<sup>6</sup>

# LakeEnsemblR

- open-source and open access R package (GNU 2.0 license)
- models: R-packages that contain executables for macOS, Windows & Linux
- standardized workflow



# LakeEnsemblR

- Models:



Two-layer  
representation

Numerical  
weather  
predictions



1D energy  
balance  
approach

Ecosystem  
modeling



1D k- $\epsilon$   
turbulence  
model

Lake  
turbulence  
studies

**SIMSTRAT**

1D k- $\epsilon$   
turbulence  
model

Lake  
turbulence  
studies

**MyLake**

1D heat  
equation

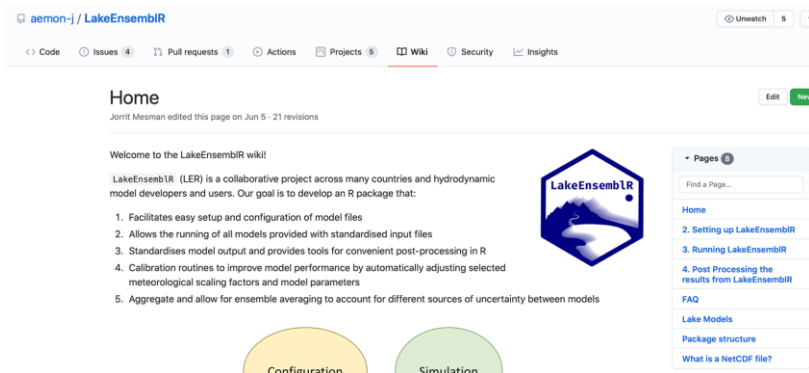
Ecosystem  
modeling

- Calibration:

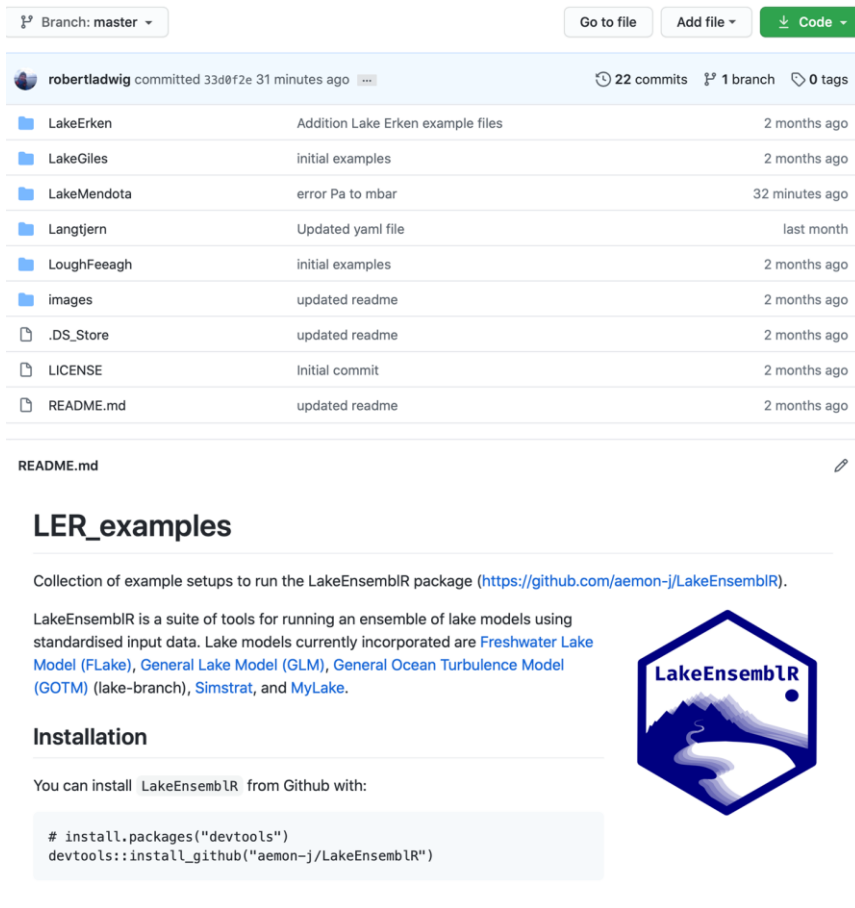
- Latin Hypercube Sampling
- Markov-Chain Monte Carlo
- Different algorithms for constrained optimization using the FME package

# LakeEnsemblR: support

- walk-through: vignette in R and wiki  
<https://github.com/aemon-j/LakeEnsemblR/wiki>
- example configuration files:  
[https://github.com/aemon-j/LER\\_examples](https://github.com/aemon-j/LER_examples)



The screenshot shows the GitHub repository page for 'aemon-j / LakeEnsemblR'. The 'Home' tab is selected, displaying a welcome message and a list of five bullet points describing the project's goals. A 'LakeEnsemblR' logo is visible on the right. Below the list, there are two circular icons labeled 'Configuration' and 'Simulation'. A sidebar on the right contains a 'Pages' section with links to 'Home', '2. Setting up LakeEnsemblR', '3. Running LakeEnsemblR', '4. Post Processing the results from LakeEnsemblR', 'FAQ', 'Lake Models', 'Package structure', and 'What is a NetCDF file?'.



The screenshot shows the file browser view of the 'LakeEnsemblR' repository. At the top, there's a 'Branch: master' dropdown and buttons for 'Go to file', 'Add file', and 'Code'. Below this, a commit by 'robertladwig' is shown. A table lists the repository's files and their last update times:

File	Last Update
LakeErken	Addition Lake Erken example files (2 months ago)
LakeGiles	initial examples (2 months ago)
LakeMendota	error Pa to mbar (32 minutes ago)
Langtjern	Updated yaml file (last month)
LoughFeeagh	initial examples (2 months ago)
images	updated readme (2 months ago)
.DS_Store	updated readme (2 months ago)
LICENSE	Initial commit (2 months ago)
README.md	updated readme (2 months ago)

Below the file list, the 'README.md' content is displayed. It includes the title 'LER\_examples', a description of the collection, and the LakeEnsemblR logo. The 'Installation' section provides the following R code snippet:

```
# install.packages("devtools")
devtools::install_github("aemon-j/LakeEnsemblR")
```



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# Time for the workshop



- **Workshop materials:**

- Clone or download files from: [https://github.com/tadhg-moore/LER\\_workshop](https://github.com/tadhg-moore/LER_workshop)
  - you'll need R ( $\geq 3.5$ ) and certain packages (instructions are online in the README)
- Get the docker here: <https://hub.docker.com/r/hydrobert/lakeensemblr-rocker> (requires docker)
  - this includes Rocker, all packages, all scripts and all data, just do

`docker run --rm -d -p 8000:8000 -e ROOT=TRUE -e PASSWORD=password hydrobert/lakeensemblr-rocker:latest`

open any web browser and type 'localhost:8000' (user: rstudio, password: password)

- **Four files (pdf, html, Rmd, R)**

- You only need one of them; pick what you prefer

# Try it out!



```
remotes::install_github("GLEON/rLakeAnalyzer")
remotes::install_github("USGS-R/glmtools", ref = "ggplot_overhaul")
remotes::install_github("aemon-j/gotmtools", ref = "yaml")
remotes::install_github("FLARE-forecast/GLM3r")
remotes::install_github("aemon-j/GOTMr")
remotes::install_github("aemon-j/SimstratR")
remotes::install_github("aemon-j/FLakeR", ref = "inflow")
remotes::install_github("aemon-j/MyLakeR")
remotes::install_github("tadhg-moore/LakeEnsemblR", ref = "flare")

remotes::install_github("aemon-j/LakeEnsemblR")
```

Questions, issues, problems & feedback?

Join the official AEMON-J slack

Thanks for joining!

