**README**

**Overview:**

This repository contains all necessary data, scripts, simulation and solver files for the study presented in Marquart et al. (2025). The study focuses on coupled (and decoupled) sea ice dynamics and thermodynamics simulations using OpenFOAM and Python.

**Folder structure:**

**ERA5\_datasets**

This folder contains input variables for the thermodynamic model, sourced from ERA5:

* specific\_humidity\_air.grib
* specific\_humidity\_surface.grib
* remaining\_variables.grib

These variables are also freely available online at the Copernicus Climate Data Store: <https://cds.climate.copernicus.eu/datasets/reanalysis-era5-single-levels?tab=download>

**Job\_submission\_scripts**

This folder contains scripts to submit jobs to a high-performance computing (HPC) cluster for the **Full-field case** for three different wavelengths (120m, 240m, 360m):

* The **Dynamics**-only model: north, east, south, west direction
* The **Thermodynamics**-only model: west direction
* The fully coupled **Dynamics & Thermodynamics** model: west direction

And the **Test case** for three different wavelengths (120m, 240m, 360m):

* The **Dynamics**-only model: horizontal, vertical, diagonal and zigzag direction

Note: Update the file paths to match your own directory structure before submitting.

**Simulation\_files**

This folder is structured by simulation type and region:

* **Fullfield case** for three different wavelengths (120m, 240m, 360m):
  + **Dynamics**
    - **East**
      * **T120, T240, T360**: OpenFOAM simulation folders
    - **North, South, West**: same folder/file structure as **East**
  + **Dynamics & Thermodynamics**
    - **West**
      * **Python\_real**
        + **Previous index values:** folder where the previous index files for ice floes and grease ice are generated at each time step
        + **Saved variables:** contains all .pkl files required as initial input for the thermodynamics model for both ice floes and grease ice
        + **Storage alpha/csv/eta/h:** folders to store alpha/csv/eta/h files
        + **T120, T240, T360**: contain all folders required for the OpenFOAM model
        + **T120\_cont, T240\_cont, T360\_cont**: contain all files required for the thermodynamics model
      * **Python\_storage\_real**
        + **T120, T240, T360**: folders where thickness files are created and updated
        + **T120\_storage\_real, T240\_storage\_real, T360\_storage\_real**: folders to store the output from the **Dynamics & Thermodynamics** model
  + **Thermodynamics:** Same folder/file structure as **Dynamics & Thermodynamics**. Note: the wave amplitude in the constant/transportProperties file is set to zero, and the application specified in system/controlDict - in both the OpenFOAM and Python-related files - is set to **my\_seaIce\_06112024\_v2**

Note: Update the file paths to match your own directory structure before submitting.

* **Test case** for three different wavelengths (120m, 240m, 360m):
  + **Dynamics**
    - **Diagonal**
      * **T120, T240, T360**: OpenFOAM simulation folders
    - **Horizontal, Vertical, Zigzag**: same folder/file structure as **Diagonal**

**Solver\_files**

Contains the OpenFOAM solvers used for the simulations:

* **my\_seaIce\_06112024**: solver for the dynamics-only and fully coupled models
* **my\_seaIce\_06112024\_v2**: solver for thermodynamics-only model