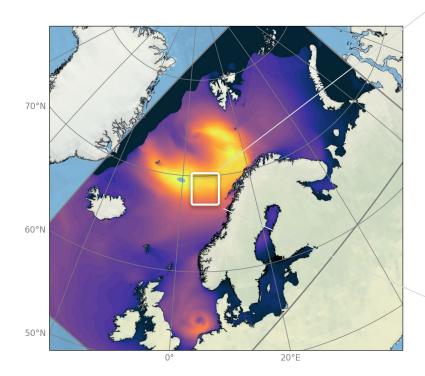




## Validate?











# What you could do ...

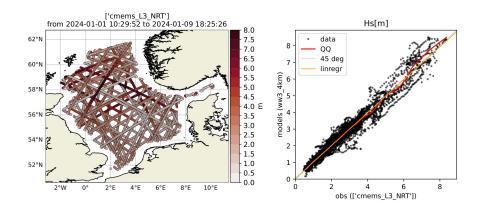


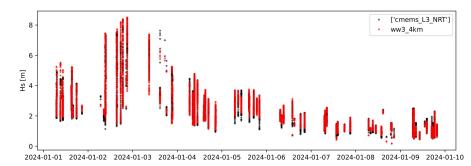
\$ mamba install wavyopen



# What you could do ...

```
from wavy import ms, cc, gc
from wavy.grid_stats import apply_metric
# --- retrieve satellite multisat -----
missions = ['s3a', 's3b', 'c2', 'j3', 's6a',
            'cfo', 'h2b', 'h2c', 'al', 'swon']
# retrieval
mso = ms(sd='2024-01-01', ed='2024-01-10',
        name=missions, region='NorthSea')
# filter
msof = mso.filter_landMask().filter_distance_to_coast(llim=50000)
# quicklook
msof.quicklook(m=True)
# --- collocate data with model ----- #
cco = cc(model='ww3_4km', oco=msof, leadtime='best').populate()
# std linear regression
cco.quicklook(ts=True, sc=True,
             std regression line=True,
             std regression col='orange')
```







## conda-forge / packages / wavyopen 0.4.1

## **Copernicus CMEMS Product Quality Documents QuID**

- Arctic Ocean Wave Hindcast system, ARCTIC\_MULTIYEAR\_WAV\_002\_013, https://doi.org/10.48670/moi-00008
- Arctic Ocean Wave Analysis and Forecast, ARCTIC\_ANALYSIS\_FORECAST\_WAV\_002\_014, https://doi.org/10.48670/moi-00002

## Internal usage at MET Norway

- · operational validation of wave models
- · project based validation of wave models
- · operational and project based tuning of wave models

## Public operational validation tasks using wavy

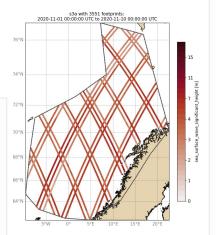
Operational model validation for the Copernicus CMEMS product ARCTIC\_ANALYSIS\_FORECAST\_WAV\_002\_014 (https://cmems.met.no/ARC-MFC/Wave3kmValidation/index.html)

## PhD thesis with wavy

Fabien Collas, since 2023: Working with triple collocation, calibration, and extremes.

## Master thesis using wavy

Judith Thu Ølberg, 2023: Wave Measurements Using Ship Mounted Sensors as part of the One Ocean Expedition, University of Bergen, https://hdl.handle.net/11250/3071001.



## Scientific papers that used wavy

- Hope, G., Seldal, T., Rabault, J., Bryhni, H., Bohlinger, P., Björkqvist, J.-V., and Coauthors, 2025: SFY—A Lightweight, High-Frequency, and Phase-Resolving Wave Buoy for Coastal Waters. J. Atmos. Oceanic Technol., 42, 133–154, https://doi.org/10.1175/JTECH-D-23-0170.1.
- Altiparmaki, O., Breivik, Ø., Aouf, L., Bohlinger, P., Johannessen, J. A., Collard, F., and Coauthors (2024). Influence of ocean currents on wave modeling and satellite observations: Insights from the one ocean expedition. Journal of Geophysical Research: Oceans, 129, e2024JC021581. https://doi.org/10.1029/2024JC021581
- Ølberg, J.T., Bohlinger, P., Breivik, Ø., and Coauthors (2024). Wave measurements using open source ship mounted ultrasonic altimeter and motion correction system during the one ocean circumnavigation. Ocean Engineering. 292. https://doi.org/10.1016/j.oceaneng.2023.116586.
- Rabault, J., and Coauthors (2022). Openmetbuoy-v2021: An easy-to-build, affordable, customizable, open-source instrument for oceanographic measurements of drift and waves in sea ice and the open ocean. Geosciences, 12 (3).
- Breivik, Ø., and Coauthors (2022). The impact of a reduced high-wind charnock parameter on wave growth with application to the north sea, the norwegian sea and the arctic ocean. Journal of Geophysical Research: Oceans, e2021JC018196.
- Halsne, T., Bohlinger, P., Christensen, K.H., Carrasco, A., Breivik, Ø. (2022). Resolving regions known for intense wave-current interaction using spectral wave models: A case study in the energetic flow fields of Northern Norway, Ocean Modelling, Volume 176.
- Thomas, E. E., Müller, M., Bohlinger, P., Batrak, Y., & Szapiro, N. (2021). A Kilometer-Scale

# wavy-based operational validation and education via capacity building project SAREPTA

- · Vietnam Meteorological and Hydrological Administration (VNMHA)
- VNU University of Science (a part of Vietnam National University). The Department of Meteorology, Hydrology and Oceanography uses the wavy to validate and calibrate wave models.
- The Marine Dynamics and Environment Center (MDEC)
- Mozambique (workshops)

## Projects wavy is/was contributing to

- · Copernicus CMEMS/ARC MFC (Arctic Monitoring Forecasting Centre) [EU]
- FORESEE Young Research Talents Grant [NFR Norwegian Research Council]
- · COSY Project on coastal altimetry from the [NOSA Norwegian Space Agency]
- B-WAVES National Project [NFR]
- SAREPTA Large capacity building project (https://bistand.met.no/) [NORAD The Norwegian Agency for Development Cooperation]
- · One Ocean Expedition UN Decade of Ocean Science for Sustainable Development

tem for the European Arctic. Weather and

er, M. (2019). A novel approach to computing super lidation, Ocean Modelling, 139, 404.



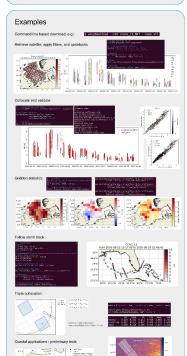
- ☐ model validation (metocean)
- triple collocation
- coastal satellite products

Drop by!





wavyopen



## wavy - a package for effortless wave model validation

Patrik Bohlinger<sup>1</sup>, Fabien Collas<sup>1</sup>, Gaute Hope<sup>1</sup>, Lars R. Hole<sup>1</sup>; Dung M. Nguyen<sup>1</sup>, Øyrind Beevik<sup>1,2</sup>

<sup>1</sup> Norwegian Meteordrogical Institute, Norwey<sup>2</sup> University of Bargen, Norwey

Contact: Patrik Bohlinger, patrikk@met.no., +4740171(829)



#### Motivation

O Meteorologisk

Opernicus

Takes related to Copernicus CLERGA RPC-ARTC and support for capacity building projects involvable to streaming relation and owners are streaming to action of review proteins of proteins proteins and contract and contract streaming to distinct or lever more object and providing strey-forces enterationed basis to appropriately process enteraturement the series, we personate the good of processing report data allows to both on the protein and providing process enterative the series, we personate the good of processing report data allows to both on the important table of indication, model development, and discretions which they have review processing and everyone that is directed.

## Primary Purpose - simple and easy to use softwere package

simple and easy to use software package
 collocation of observations with model data
 basic and advanced data retrieval and validation tasks
 comparison between validation methods

#### Key-features

manually choosing regions of interest utilizing polygones
 collocation of observations with model data
 dump data to netodf following of-convention for further use
 quicklook options

# Strategy - In this or existing sendeds - In this order of the sended s

#### ToDo - WishList - Collaboration?

- include more and different satellite products
   incorporate more collection strategies.
- incorporate more collocation strategies
   more focus on spectral observations and validation
   include more variables (depends on products)

#### wavy involvement

Copernicus - CMEMS/ARC MFC (Arctic Monitoring Forecasting Centre) [EU]

FORESEE - Young Research Talents Grant [NFR - Norwegian Research Council]

COSY - Project on coastal altimetry from the [NOSA - Norwegian Space Agency]

B-WAVES - National Project [NFR - Norwegian Research Council]

SAREPTA - Large capacity building project (https://bistand.met.no/) [NORAD - The Norwegian Agency for Development Cooperation]

One Ocean Expedition - UN Decade of Ocean Science for Sustainable Development

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