User-friendly moisture tracking with WAM2layers

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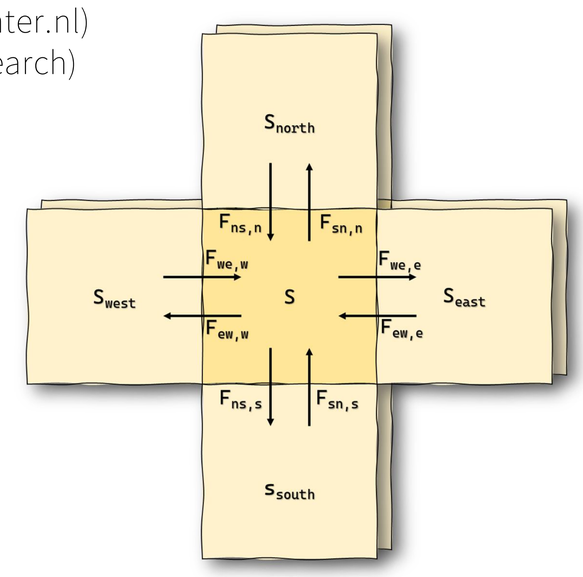


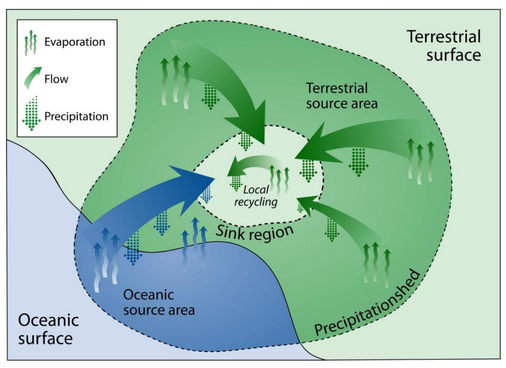
Introduction

WAM2layers is an atmospheric moisture tracking model that can be used to determine where precipitation originally evaporated (backtracking), or where evaporated moisture eventually ends up (forward tracking). In this project we develop an updated version, suitable for state-of-the-art datasets and easy to use.

Example applications

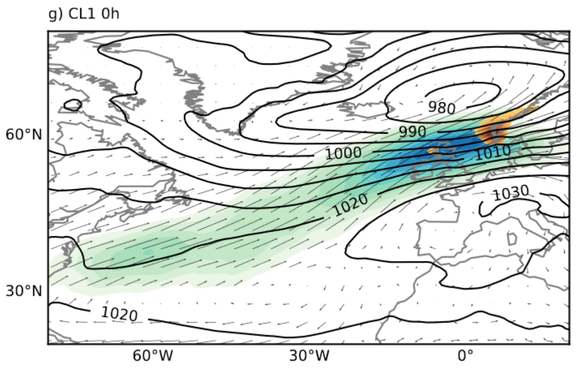
At the interface of earth and sky, WAM2Layers is truly **connecting communities**

Water resources



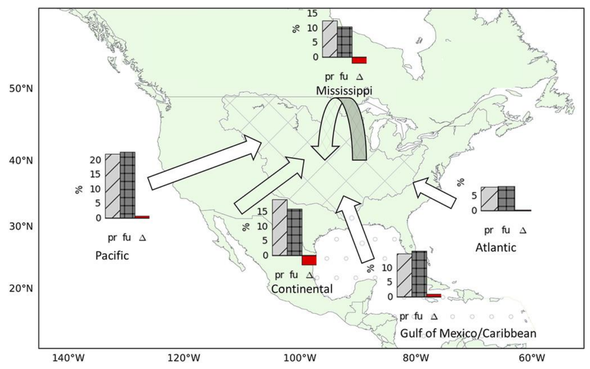
Introducing the concept of *atmospheric watersheds* (10.5194/bg-9-733-2012)

Meteorology



Atmospheric rivers leading up to a heavy precipitation event (10.1175/MWR-D-18-0362.1)

Climate



The fate of Mississippi river in a future climate (10.1175/JHM-D-19-0094.1)

Activities and future plans

Datasets / test cases

- ❑ ERA5 test cases
  - ✓ Pressure levels / Model levels
  - ✓ Heavy precipitation events (2013, 2021)
  - ❑ Global, ERA5, 10-30 years
- ❑ CMIP5 EC-Earth test case
- ❑ CMIP6
- ❑ NextGEMS
- ❑ …

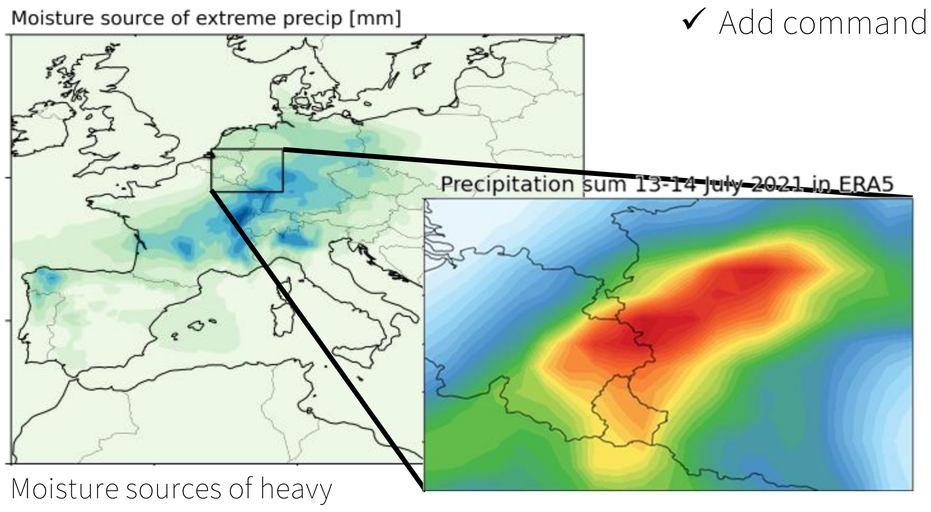
User friendliness / other best practices

- ✓ Add documentation
- ✓ Upload example data for quickstart
- ✓ Enable pip-install
- ✓ Consistent terminology
- ✓ Separate pre-processing from tracking
- ✓ Separate configuration from functionality
- ✓ Use xarray in most user-facing code
- ✓ Add citation information to code
- ✓ Restructure code base
- ✓ Auto-format code base using black
- ✓ Add command line interface

Optimization

- ✓ Switch to Python 3
- ✓ Eliminate Python loops and other inefficient operations
- ✓ Smaller memory footprint
- ✓ Reduced I/O
- ❑ Use numba for performance critical parts
- ❑ Out-of-core computation with dask

→ A simple case now runs in ~1 s per day
→ Memory now the biggest constraint



Moisture sources of heavy precipitation over the Eiffel and Ardennes in July2021

Do you want to…

- ➢ Find out where evaporated water ends up
- ➢ Understand moisture transport resulting in an extreme precipitation
- ➢ Study the impact of land-use change on downstream regions
- ➢ Investigate local moisture recycling ratio's
- ➢ Perform sensitivity studies e.g. to the number of levels in input data

… get started in 5 minutes!

```
pip install wam2layers                                  wam2layers.readthedocs.io

# Download data and update paths in .yaml file
# https://rebrand.ly/wam2layers-example-data

# Run example case
wam2layers backtrack floodcase_202107.yaml
wam2layers visualize output floodcase_202107.yaml

# Congrats! For more, see the documentation
```

Leave your feedback

```
Add your +1 to the options you like

Writing/running (Python) code:
•  Editor + command line
•  Jupyter lab
•  Spider
•  Other: …

Installing
•  pip package
•  conda package
•  Scripts + conda environment file

Dataset support
•  ERA5
•  CMIP6 (which model?)
•  …
•  …

Features
•  Forward tracking
•  Backward tracking
•  Calculating recycling ratio's
•  Calculating residence time
•  Support for dask clusters
•  Basic model interface (BMI)
•  ESMValTool pre-processing

Are you comfortable with GitHub? (yes:     no:     )
```