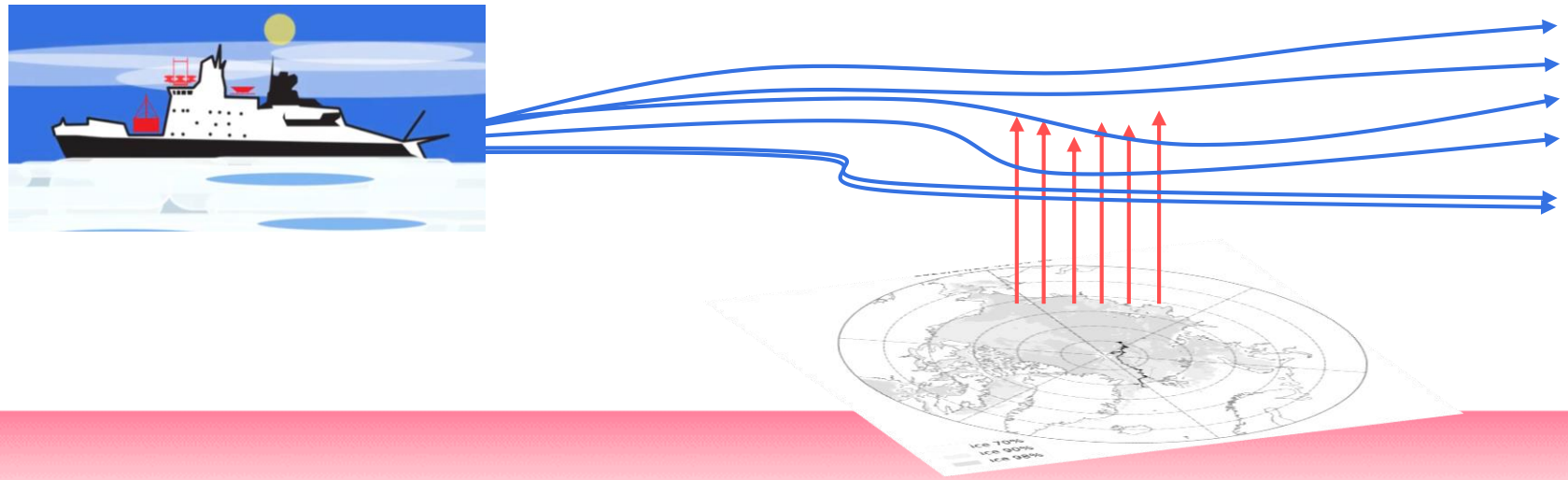
An atmospheric **source attribution** system based on Lagrangian simulations, emission inventories and satellite data:

an example of application to the MOSAiC campaign

Silvia Bucci, Marina Duetsch, Andreas Stohl



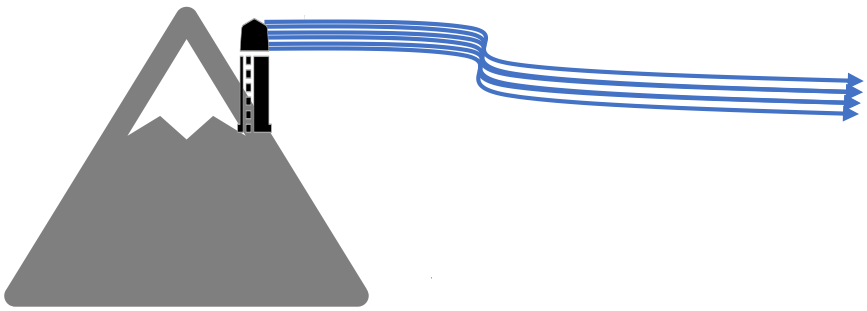
FLEXPART simulations for data interpretation...made easy!

System of backtrajectories management for **particle and gases** of different nature:

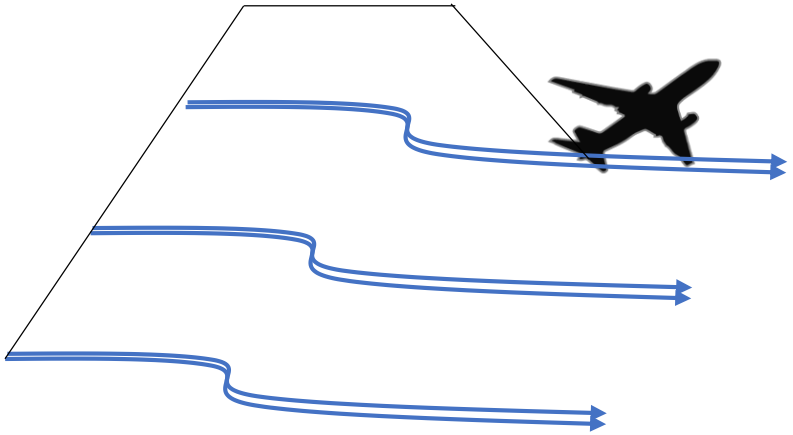
- Manage large backtrajectories releases at once
- Easily couple simulations with maps of sources (or proxies)

FLEXPART simulations for campaigns...made easy!

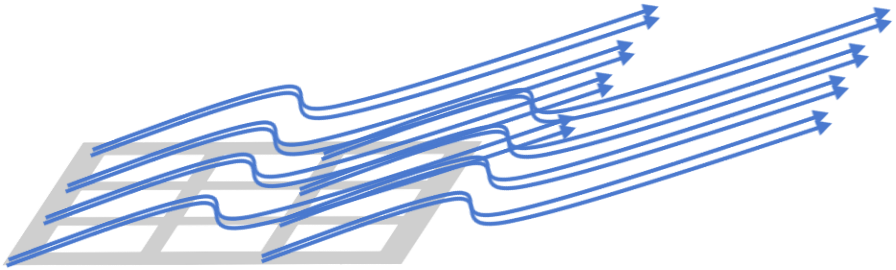
Continuous observations from fixed points



Observations from mobile platforms
(e.g. aircraft, ships, mobile stations)



Observations from gridded areas
(e.g. satellite observations)



Python chain to:

- Automatically manage simulations from several points
- Automatically couple with emission inventories and/or proxy maps from satellites.

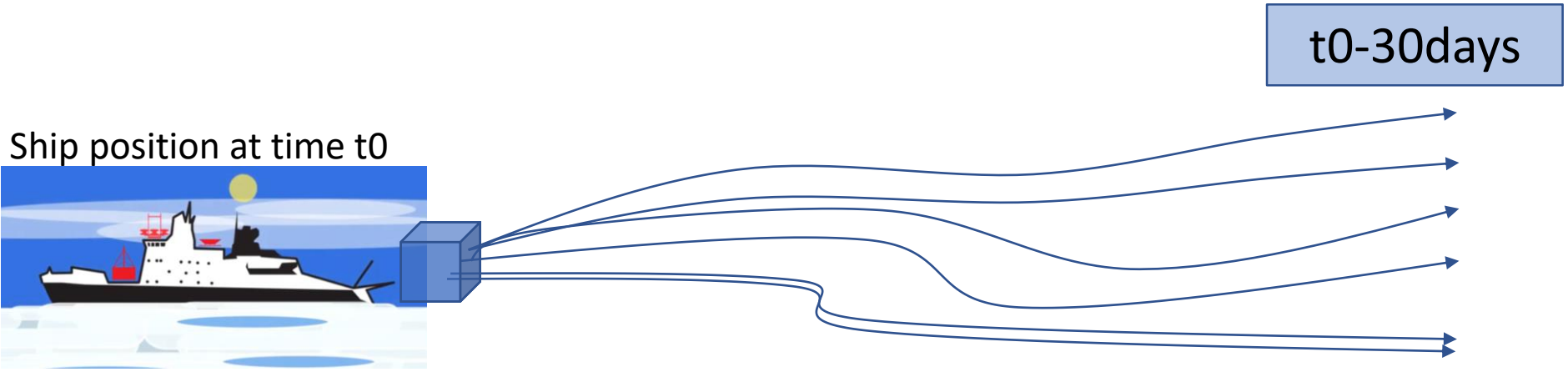
Coupling FLEXPART with emission maps and proxies

- Release points

Ship position at time t0

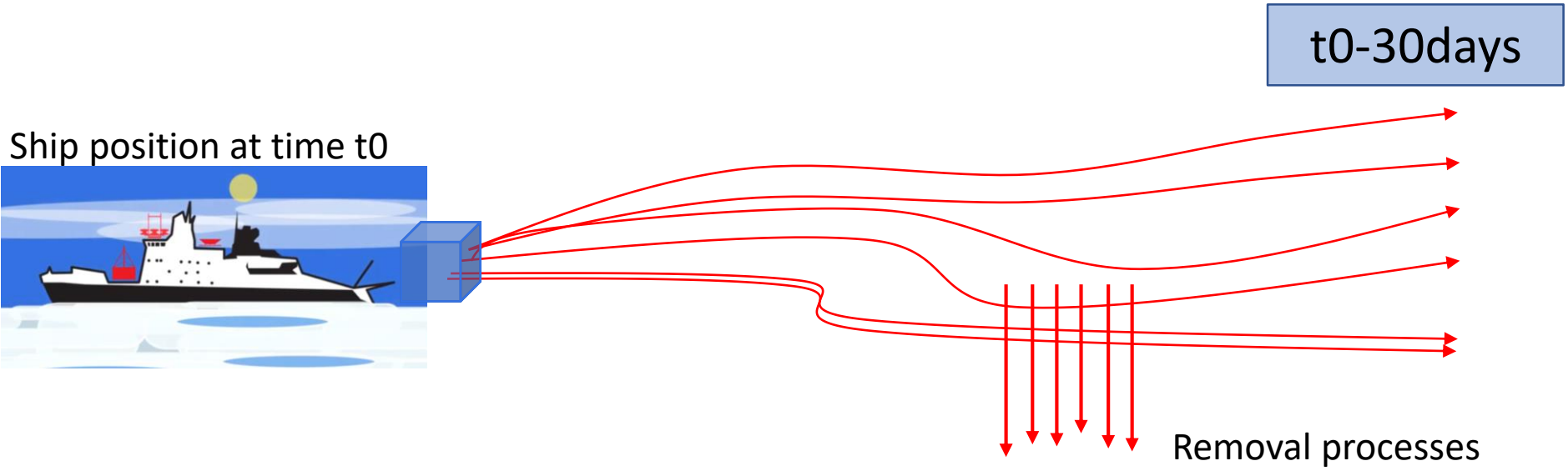
Coupling FLEXPART with emission maps and proxies

- Release points
- Length of simulations and number of trajectories



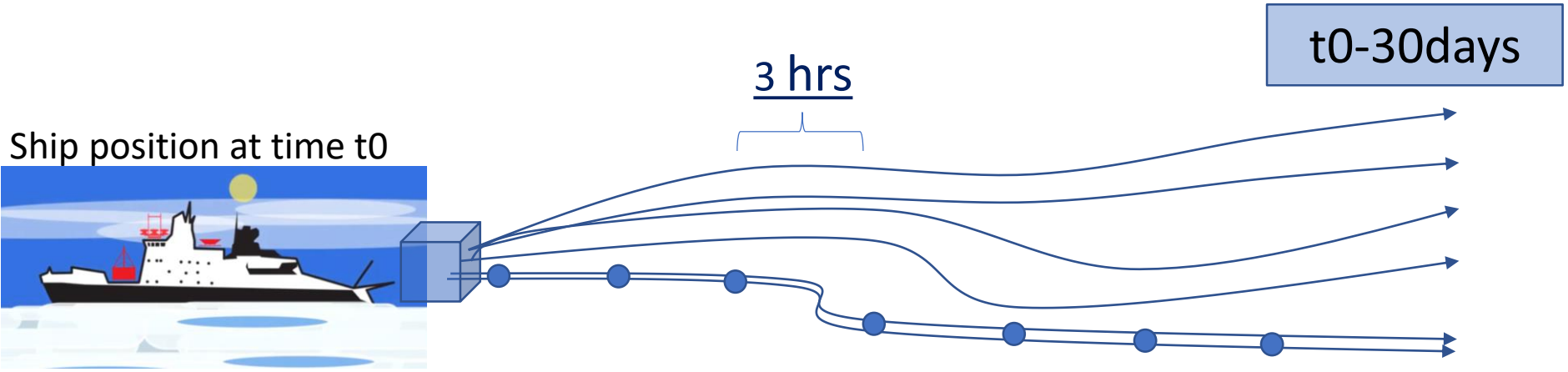
Coupling FLEXPART with emission maps and proxies

- Release points
- Length of simulations and number of trajectories
- Species



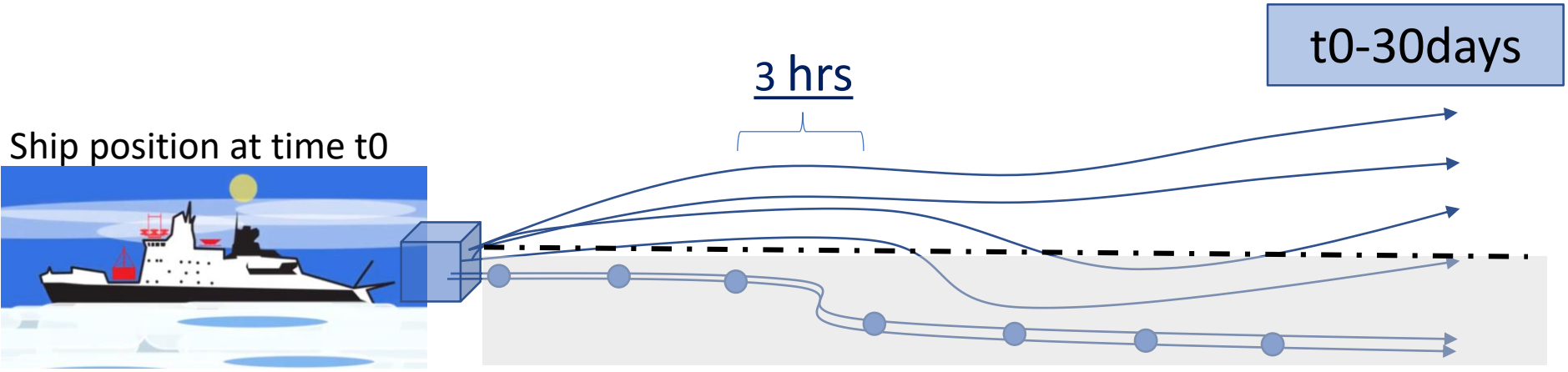
Coupling FLEXPART with emission maps and proxies

- Release points
- Length of simulations and number of trajectories
- Species
- Resolution



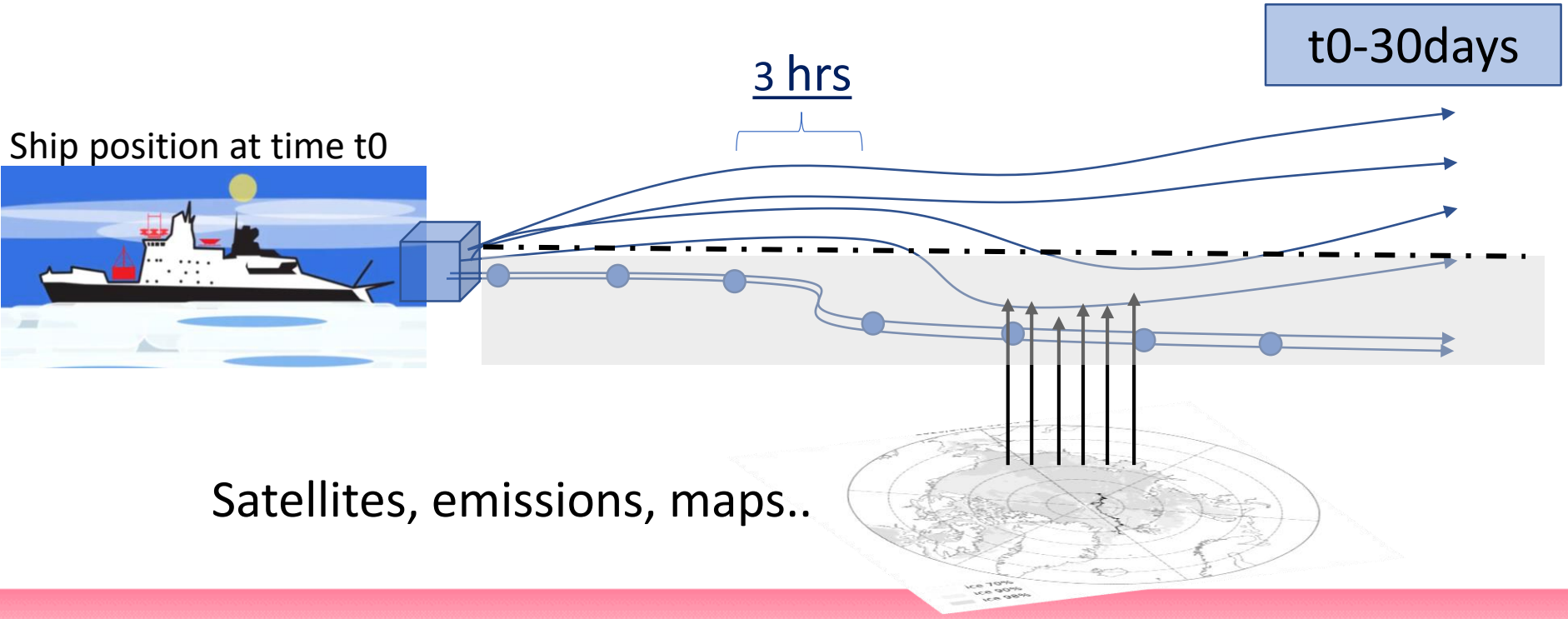
Coupling FLEXPART with emission maps and proxies

- Release points
- Length of simulations and number of trajectories
- Species
- Resolution
- Layer of interaction



Coupling FLEXPART with emission maps and proxies

- Release points
- Length of simulations and number of trajectories
- Species
- Resolution
- Layer of interaction
- Maps of sources to couple with



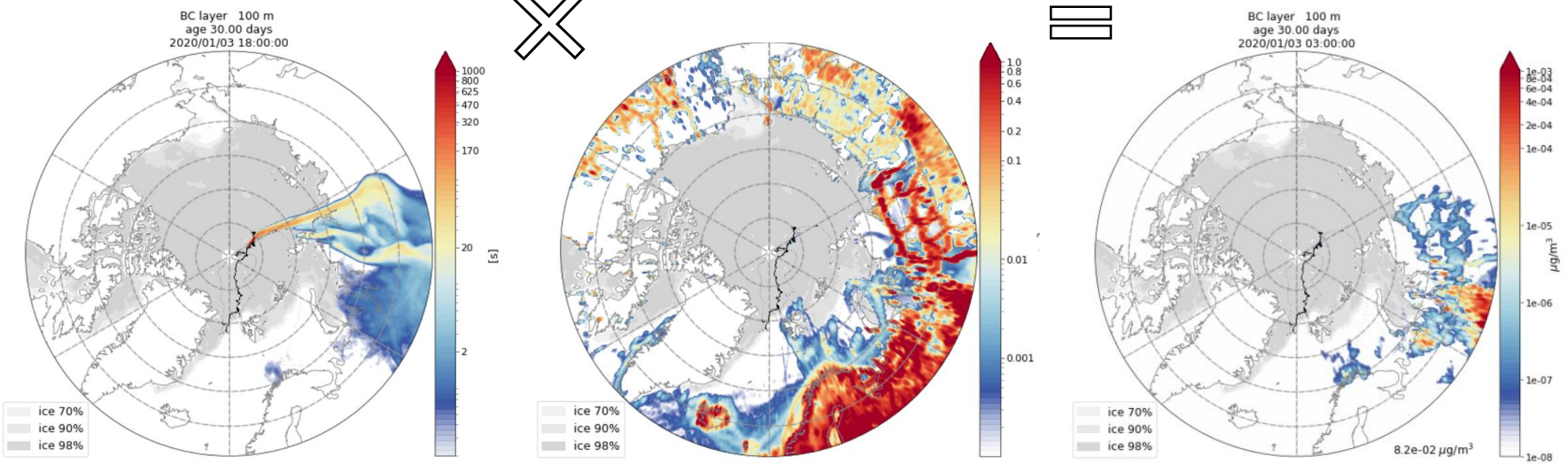
Satellites, emissions, maps..

Coupling of trajectories with emissions / maps

Emission Sensitivity **FLEXPART**
(proportional to residence time of the particles, loss processes included)

Emission fluxes
from **INVENTORIES**

Source Contribution
in [ug/m3]



It indicates regions contributing to the air masses composition at the point of release

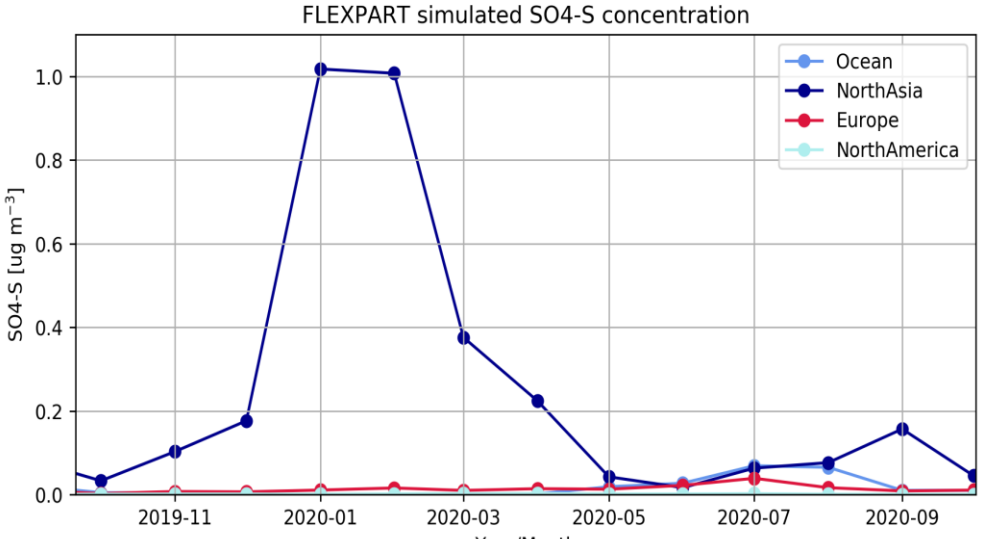
[s]

[ug/m2/s]

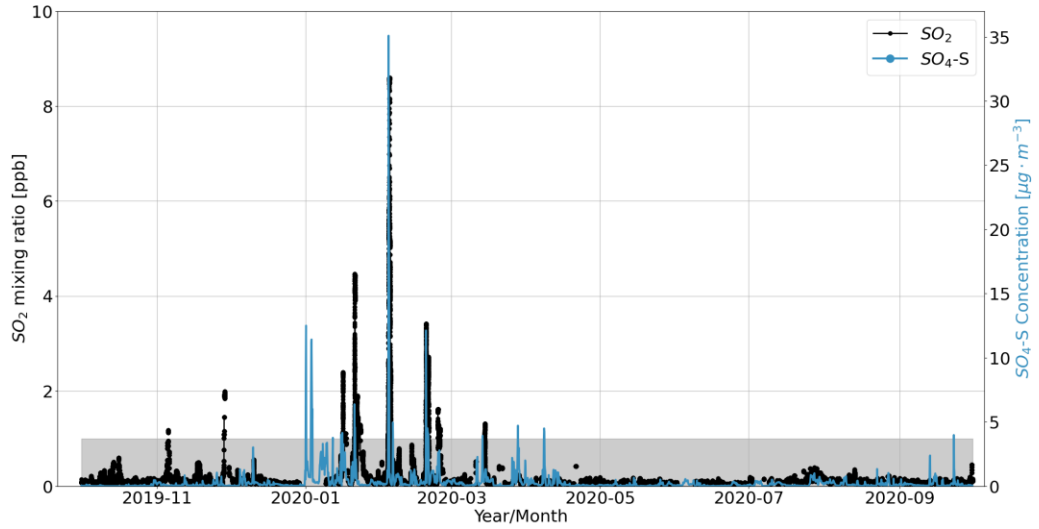
$\int$ (s) X (ug/m2/s)/m
= ug/m3

Repeating it for each timestep of the whole campaign...

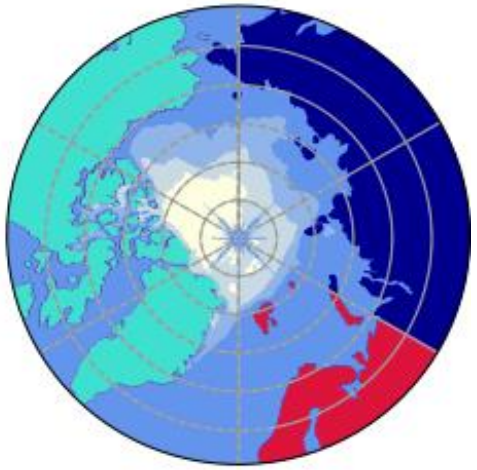
Coupling of trajectories with emissions / maps



SO2 observations



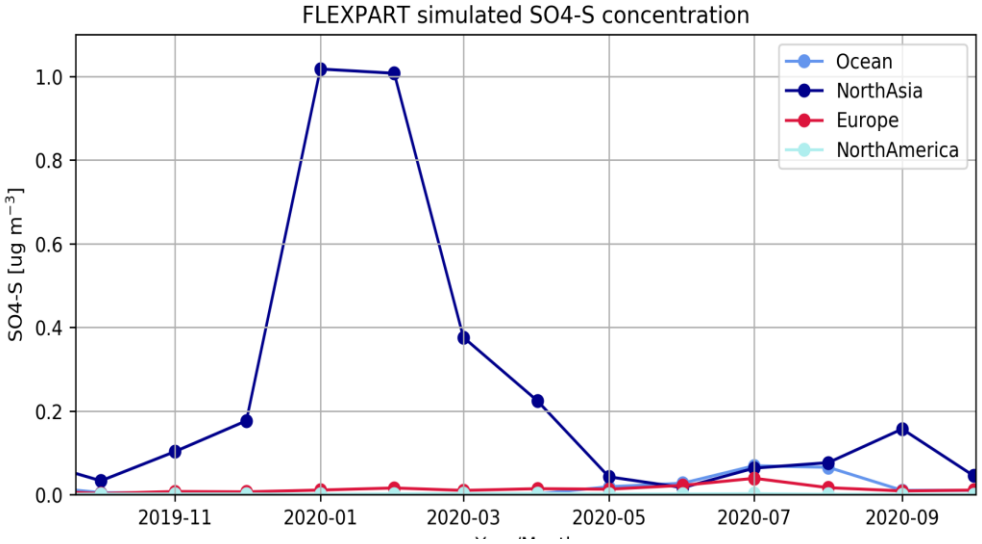
Complete overview on transport and sources, supporting data interpretation



$\int$ (s) X (ug/m2/s)/m
= ug/m3

(Boyer et al., in prep)

Coupling of trajectories with emissions / maps



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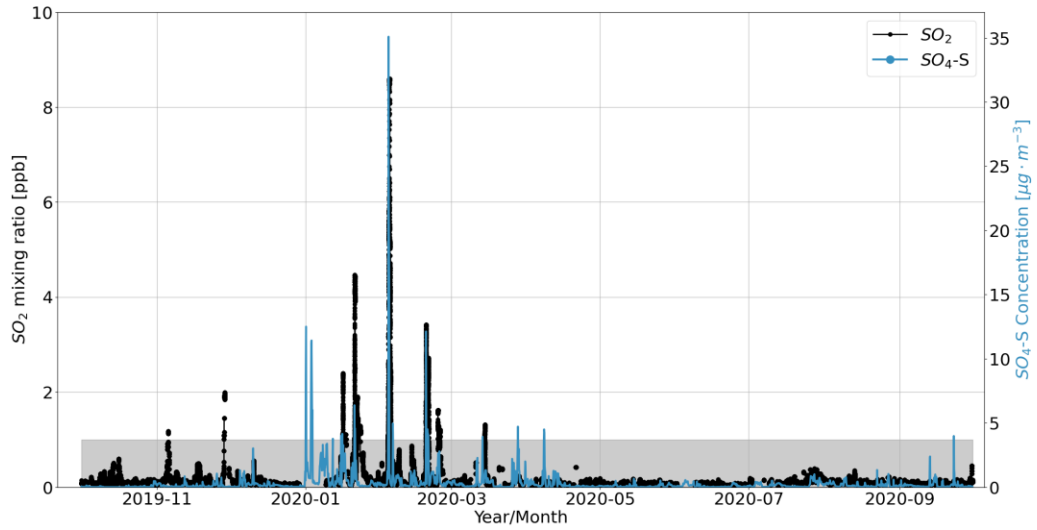

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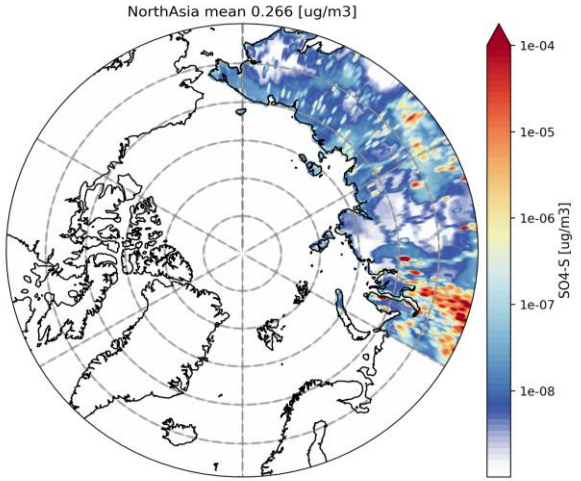

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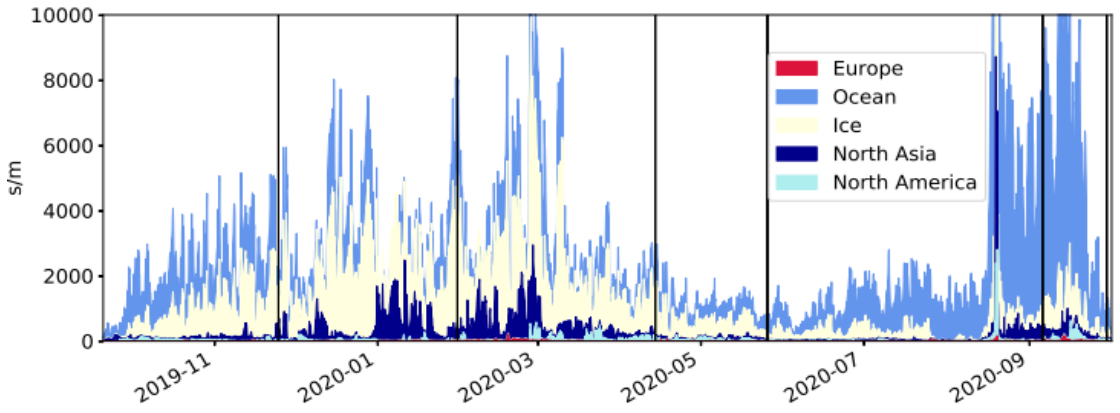
(Boyer et al., in prep)

Conclusions

- System of backtrajectories for **campaigns** and/or **data interpretation**.
- **Python package** for easy managing and setup of FLEXPART simulations (to be released in a publication)
- **Easy coupling** with proxies, emissions and statellite data.

Relative regional contribution (FLEXPART)

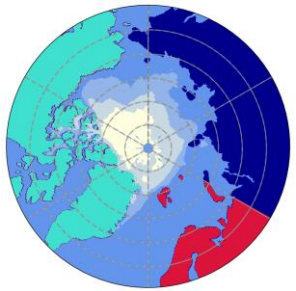


Months

REGIONAL INFLUENCE

POLLUTANTS concentrations

MAPS of proxies



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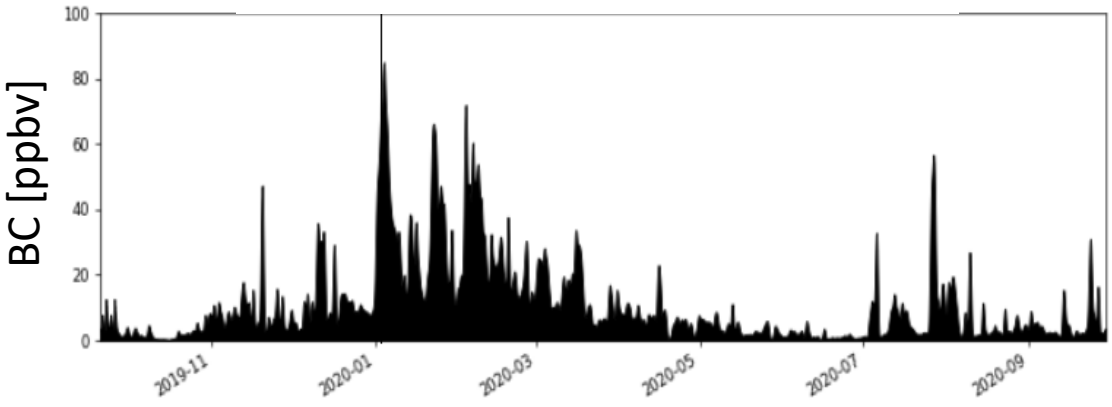
Simulated concentration FLEXPART



REGIONAL INFLUENCE

POLLUTANTS concentrations

MAPS of proxies

(here, for ex., BC)

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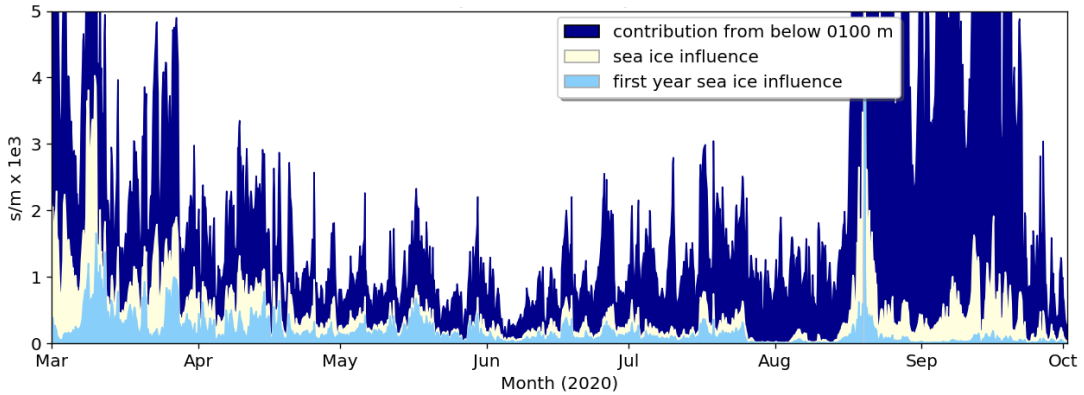
Relative contribution ICE vs. SEA (FLEXPART)



Months

REGIONAL INFLUENCE

POLLUTANTS concentrations

MAPS of proxies

OCEAN vs. ICE COVER
ADDED info on ICE AGE

Conclusions

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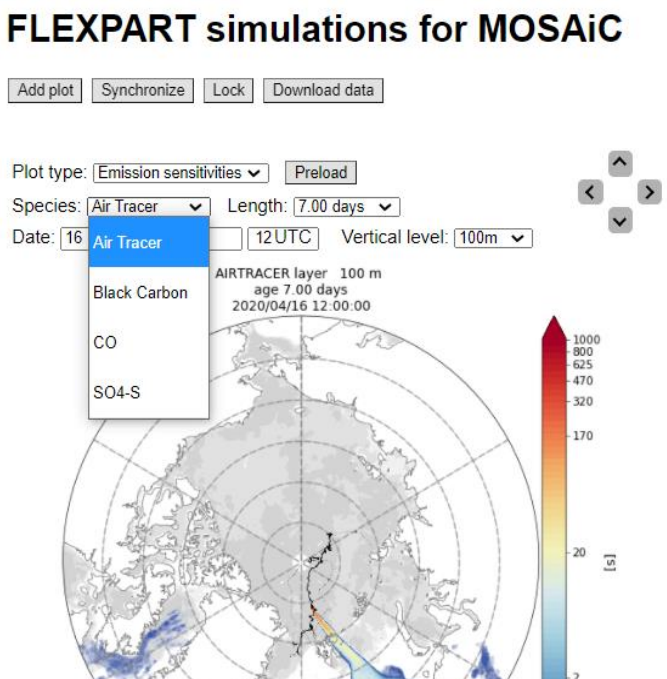
https://srvx1.img.univie.ac.at/webdata/mosaic/mosaic.html



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THANK YOU!