

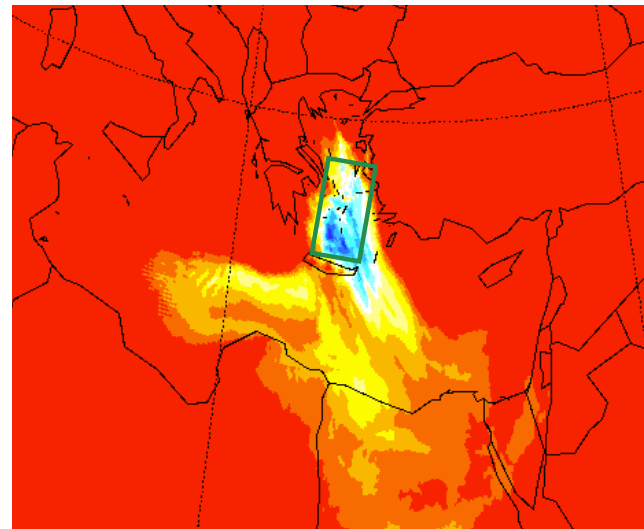
Water tracers in the COSMO model: technical issues related to mass conservation and tracer-tracer correlation

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Water tracers

- tracers in additional **diagnostic water cycle**
- flexible initialization
- most important **processes**:
 - **advection** and turbulent transport
 - cloud microphysics, moist convection
- **applications**:
 - source regions for precipitation events
 - simulation of stable water isotopes
 - ...

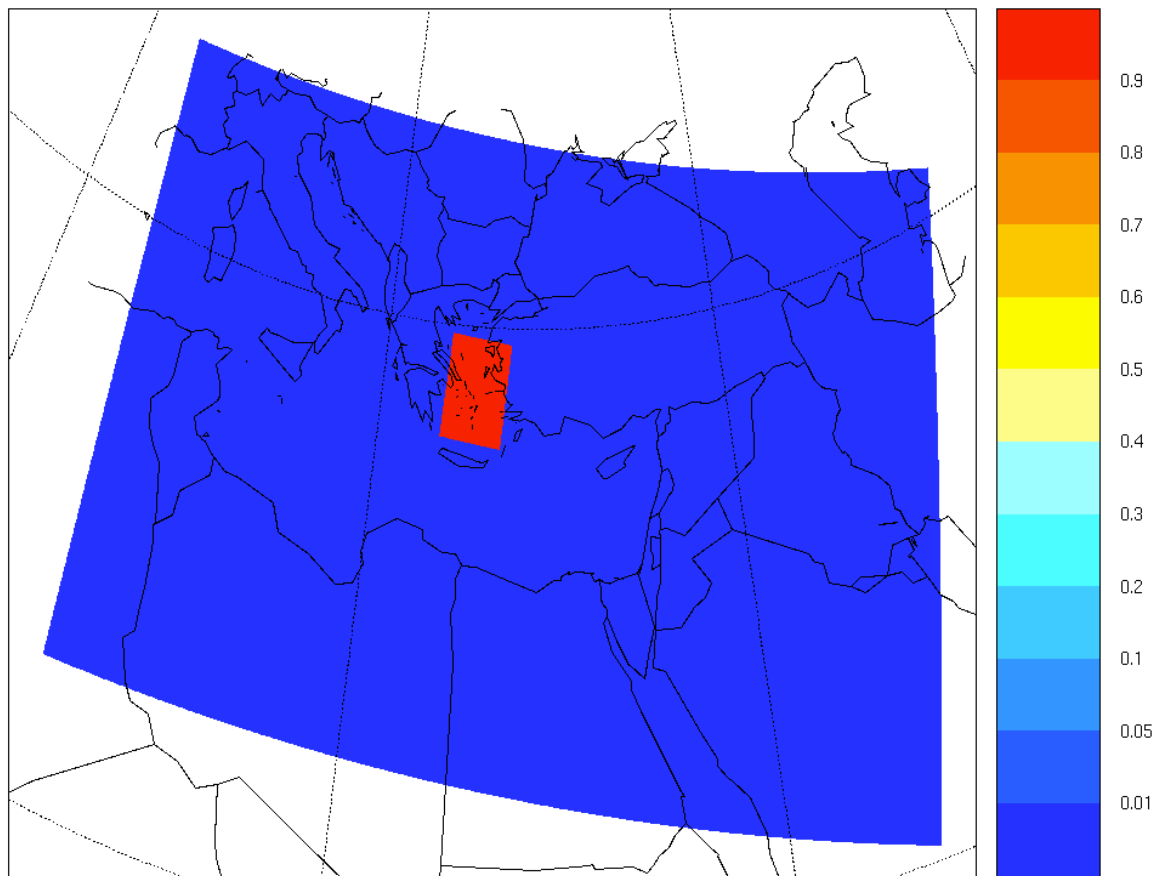


Mass conservation

Passive tracer
experiment:

initialize tracer in
rectangular box,
5 lowest model
levels

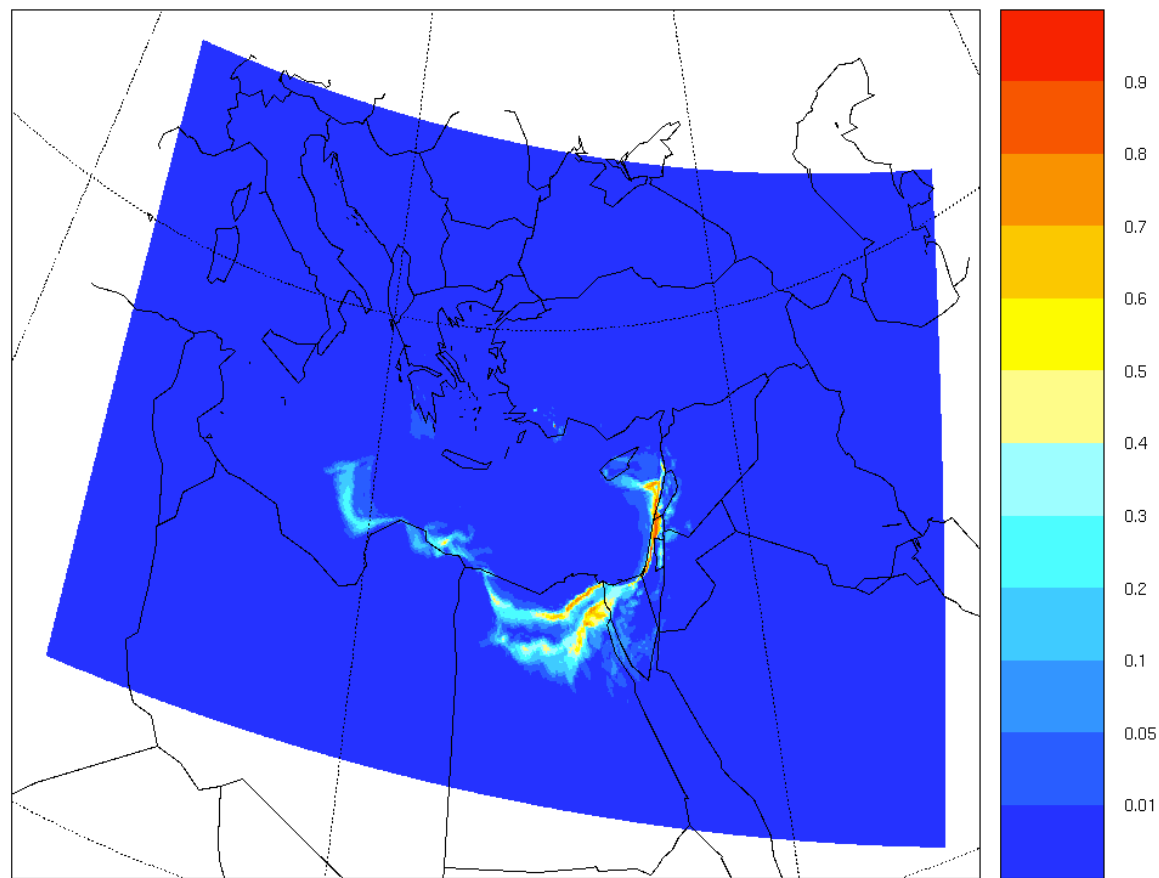
only advection
(Bott scheme)



specific tracer concentration on lowest model level

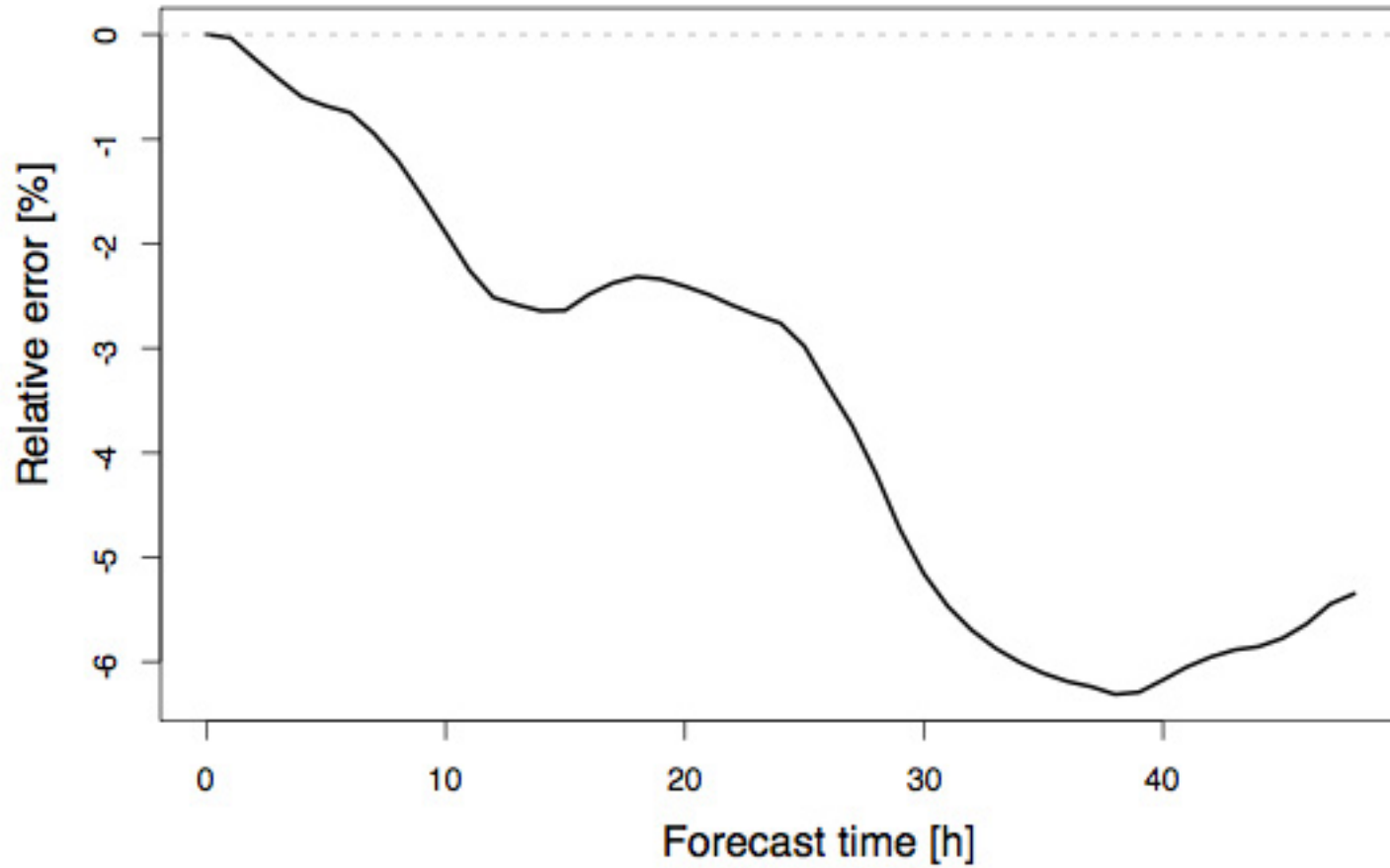
Mass conservation

Tracer distribution
after 2 days



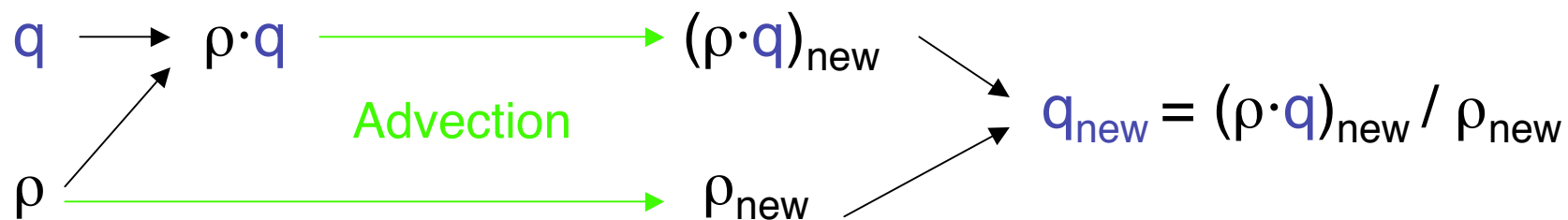
specific tracer concentration on lowest model level

Mass conservation



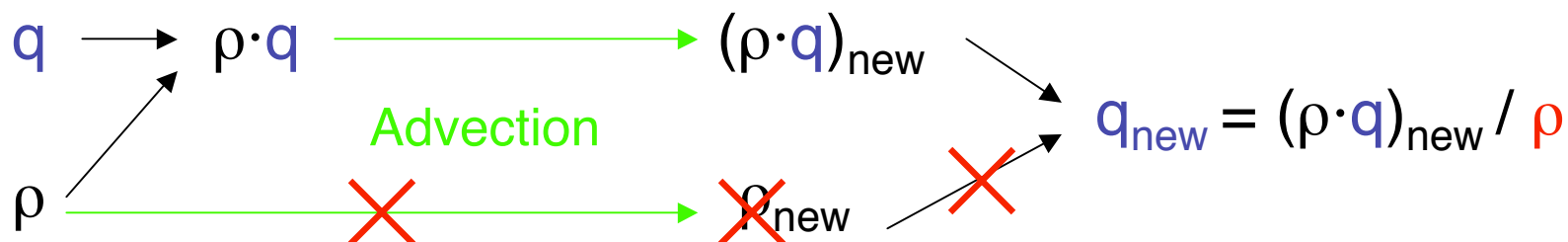
Mass conservation

- standard settings for Bott scheme:



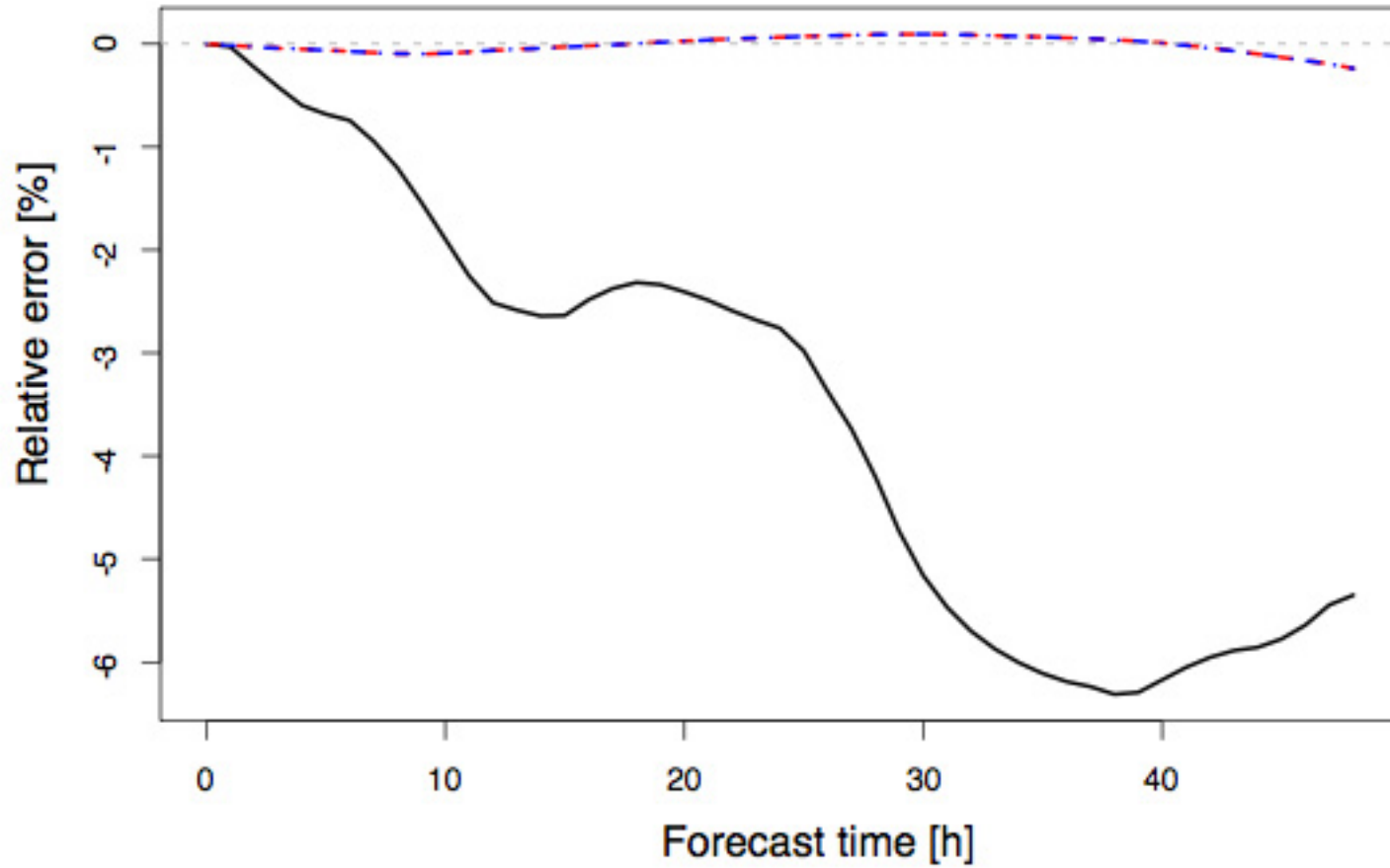
Mass conservation

- standard settings for Bott scheme:

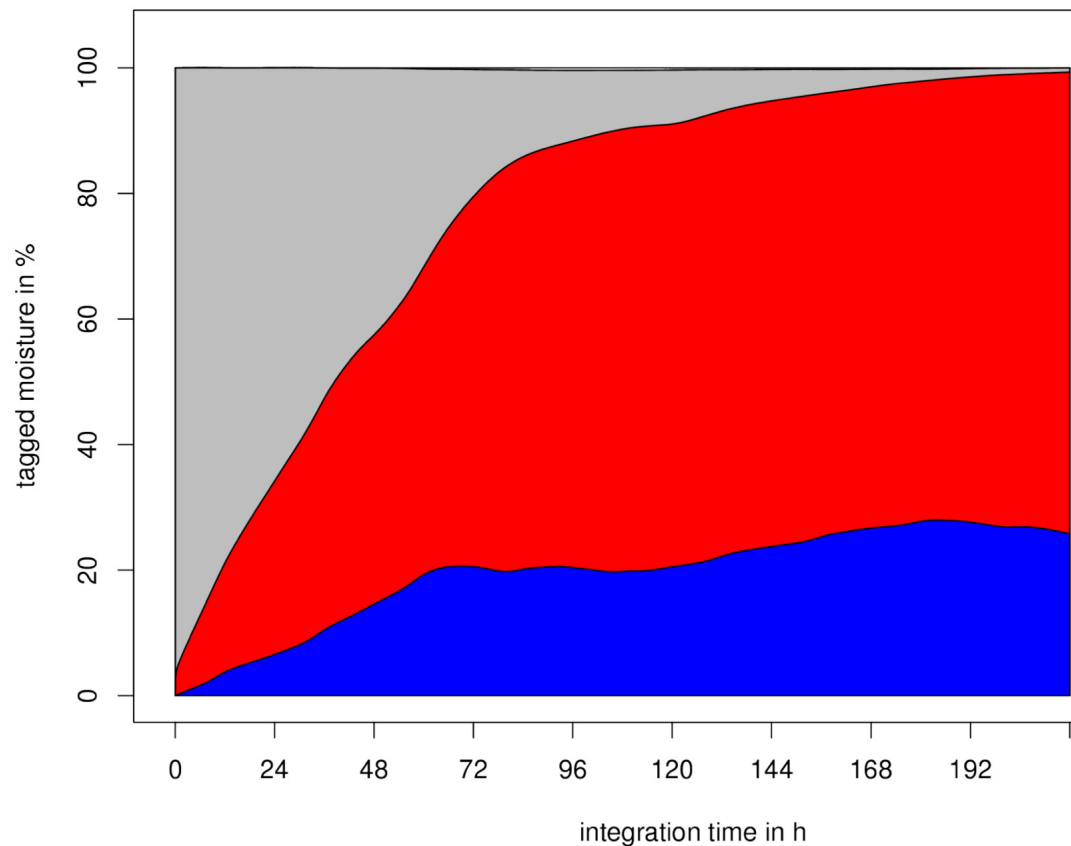


- alternative:** omit transport of ρ (and add small explicit horizontal diffusion)

Mass conservation



Mass conservation



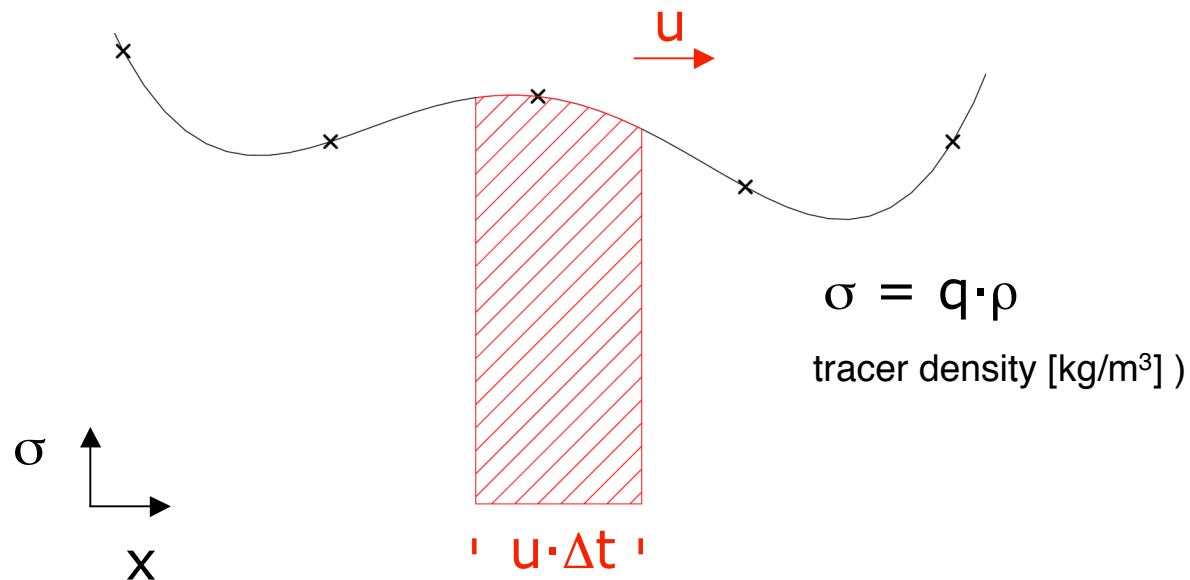
Experiment with 3
moisture tracers:

initial atmospheric
moisture,
transport through
boundaries,
surface evaporation

maximum deviation:
-0.4 %

Tracer-tracer correlation

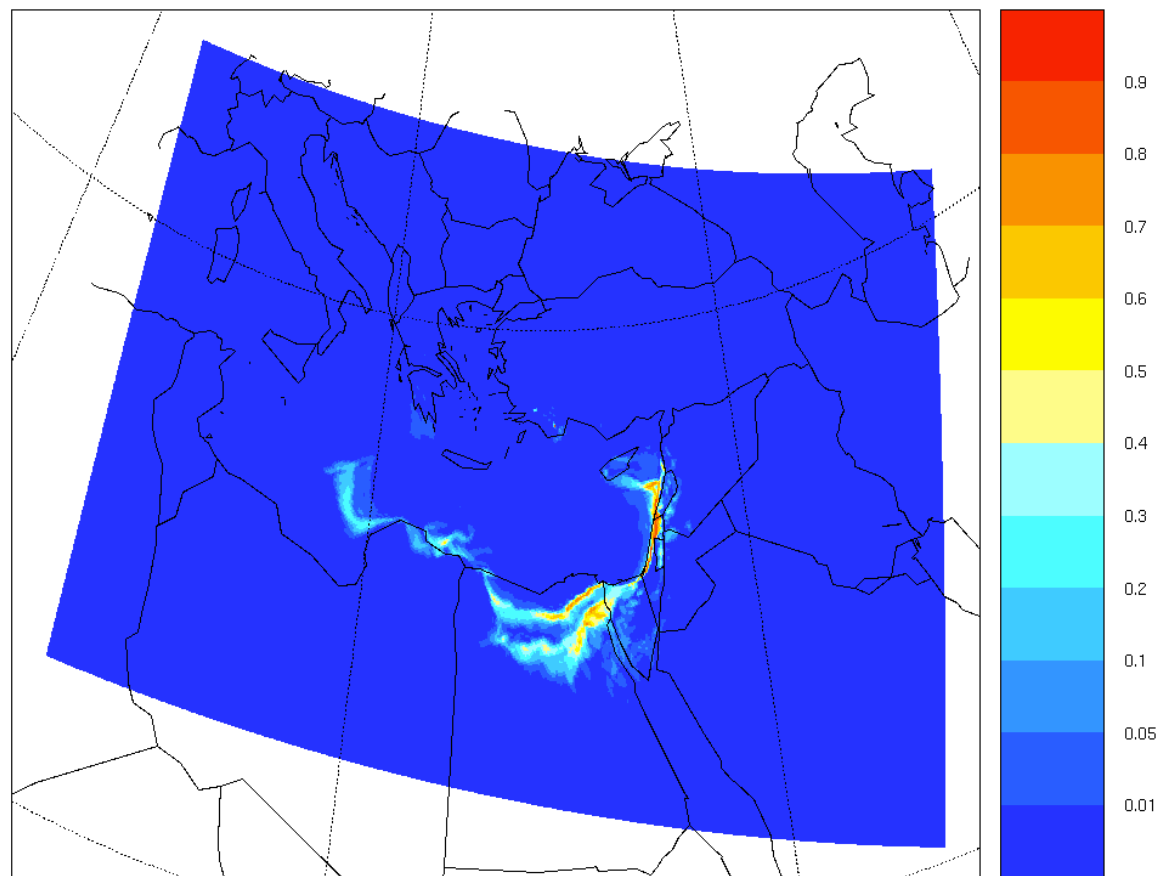
Bott advection scheme:



- standard approach: separate fits for tracers σ_a and σ_b
- new approach: separate fits for σ_a and σ_b/σ_a ; get advective flux of σ_b from $(\sigma_a)^{\text{fit}} \cdot (\sigma_b/\sigma_a)^{\text{fit}}$

Tracer-tracer correlation

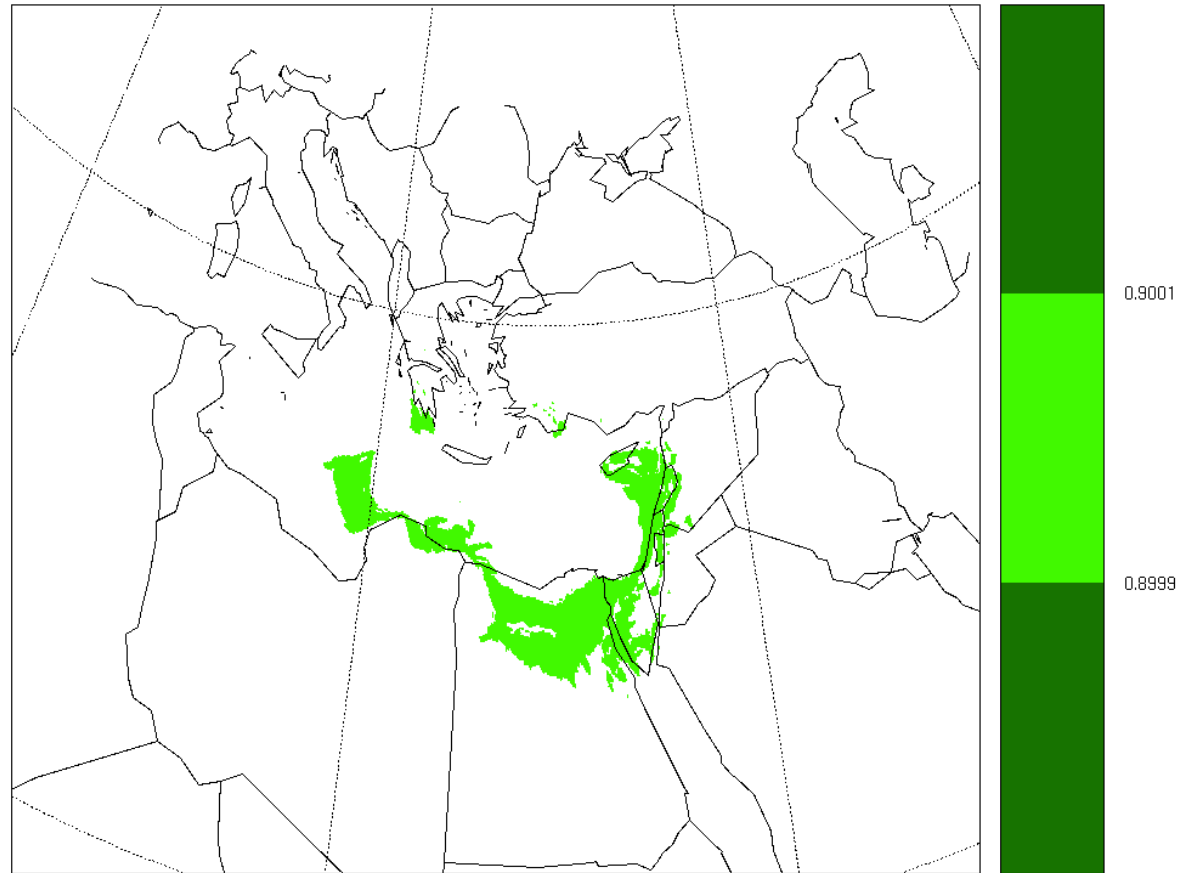
Passive tracer
distribution after
2 days



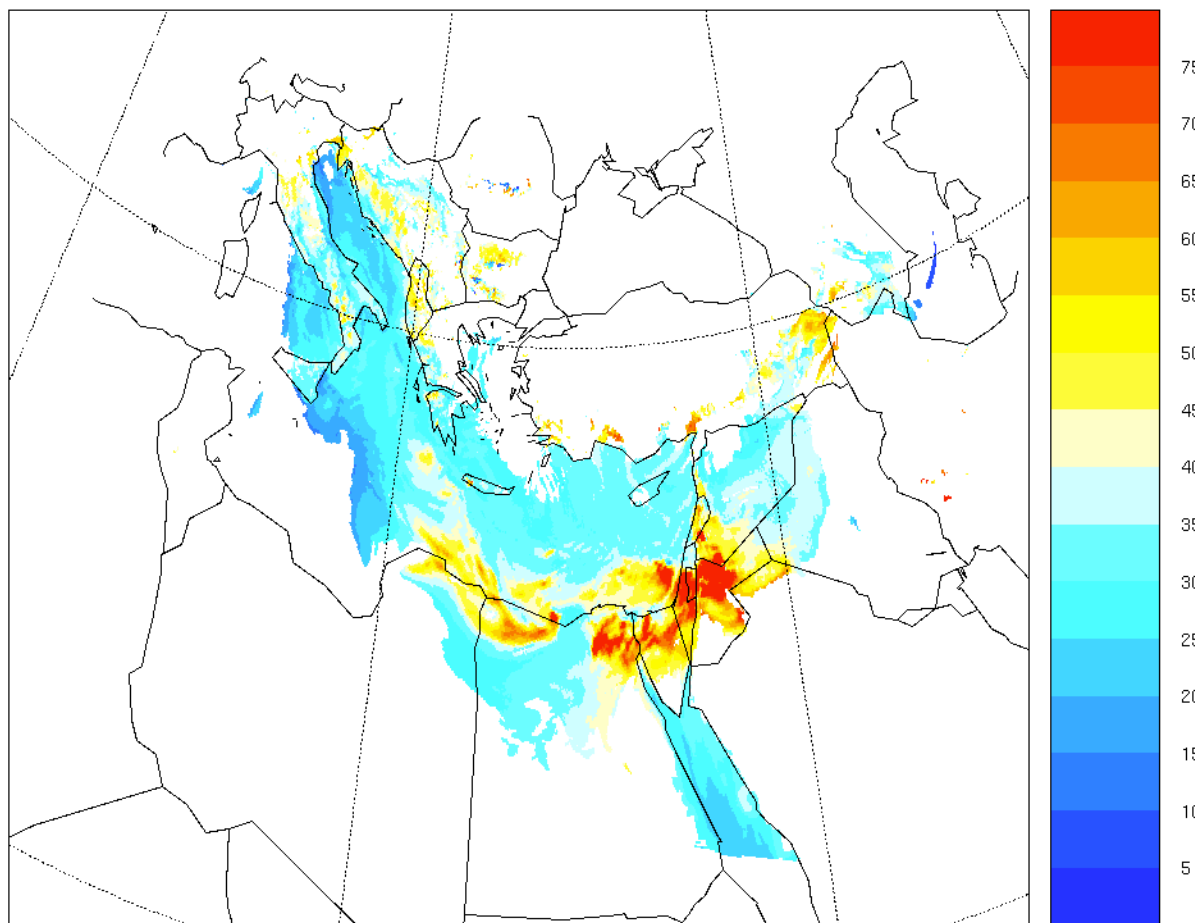
specific tracer concentration on lowest model level

Tracer-tracer correlation

Ratio between
tracers



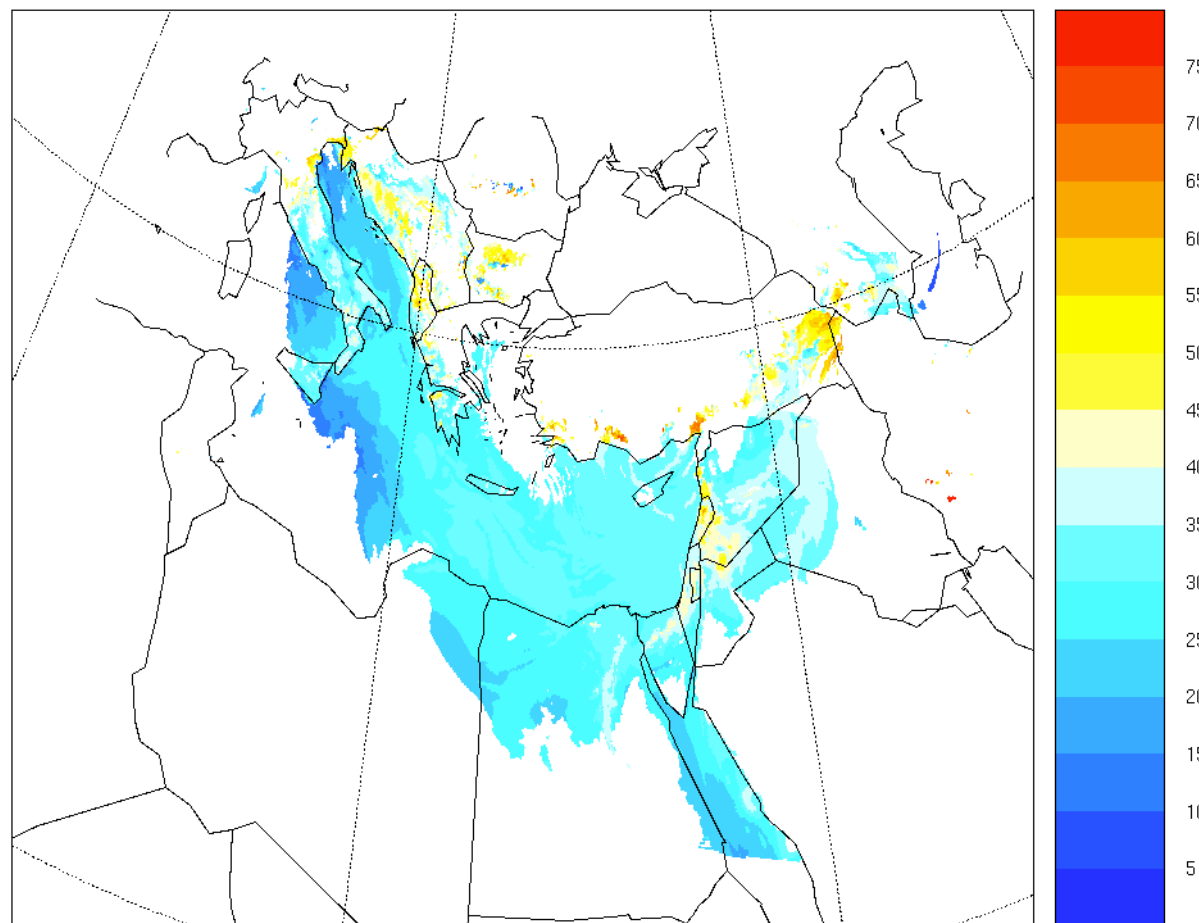
Tracer-tracer correlation



Deuterium
excess on
lowest model
level

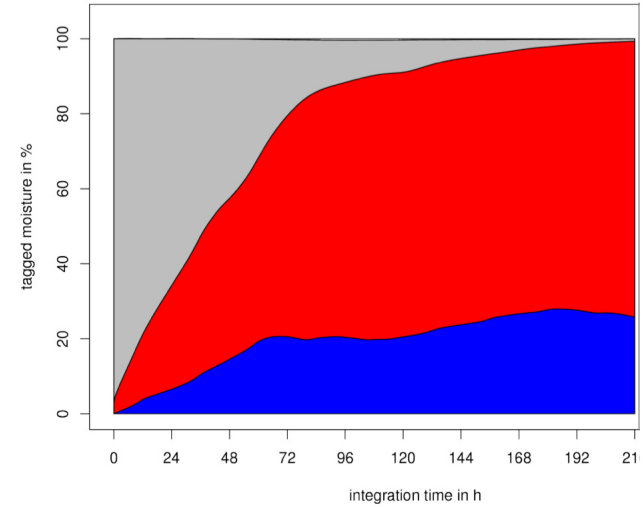
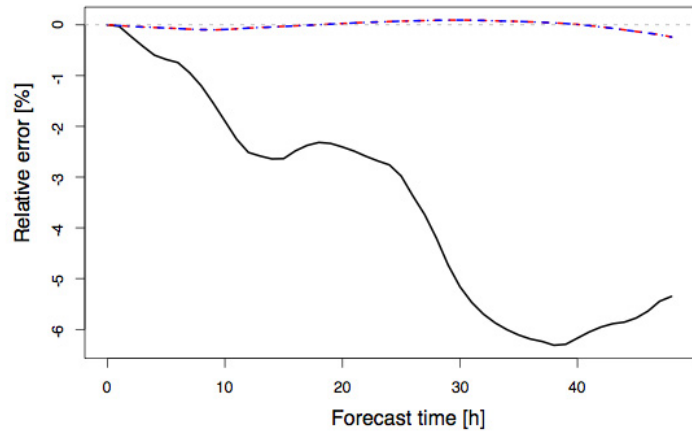
old advection
setup

Tracer-tracer correlation



Deuterium
excess on
lowest model
level

new advection
setup



Thank you!

