GLOBAL OCEAN FRESHWATER FLUX COMPONENTS FROM THE HOAPS-3 SATELLITE CLIMATOLOGY

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- Outline
  - Introduction of HOAPS-3
  - Comparison with GECCO / NCEP
  - Freshwater Flux Variability and NAO
  - Future Development / Summary

HOAPS-3

Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite Data

- climatology of freshwater flux over the ice free global ocean derived from satellite data

- 15 parameters: precipitation, evaporation and related surface and atmospheric state parameters

- radiometers on board polar orbiting satellites:
    - SSM/I (passive microwave)
    - AVHRR (infrared; Pathfinder V5 SST)

- data availability: 1987-2005 (18 complete years)

- homogeneous time series: Multi satellite averages containing all SSM/I operating at the same time including inter-sensor calibration

- scan-based dataset (HOAPS-S)

- gridded (HOAPS-G, HOAPS-C) datasets , resolution 0.5°, pentad and monthly means, twice daily composites

- data accessible via: *www.hoaps.org*

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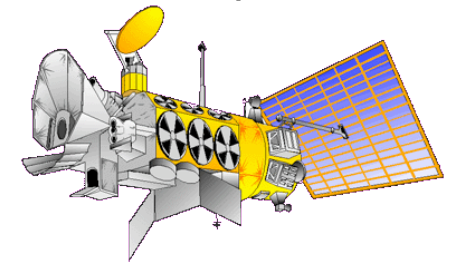
Parameters

- Precipitation (P):
  - neuronal net
  - training data: radiative transfer calculations (ECMWF, P. Bauer)

- Evaporation (E):
  - Bulk formula:
    $$E = (\rho_a/\rho_w)\, C_E\, U\, (q_s - q_a)$$
    - Wind speed (U) (neural net)
    - Near surface specific humidity (q_a) (Bentamy et al., 2003)
    - Sea surface saturation specific humidity (q_s) (SST, Magnus formula)
    - Latent heat transfer coefficient (C_E) (COARE; Fairall et. al., 1996/2003)

- Freshwater Flux: E-P

Mean Precipitation

HOAPS-3: Precipitation 1988- 2005 [mm/d]
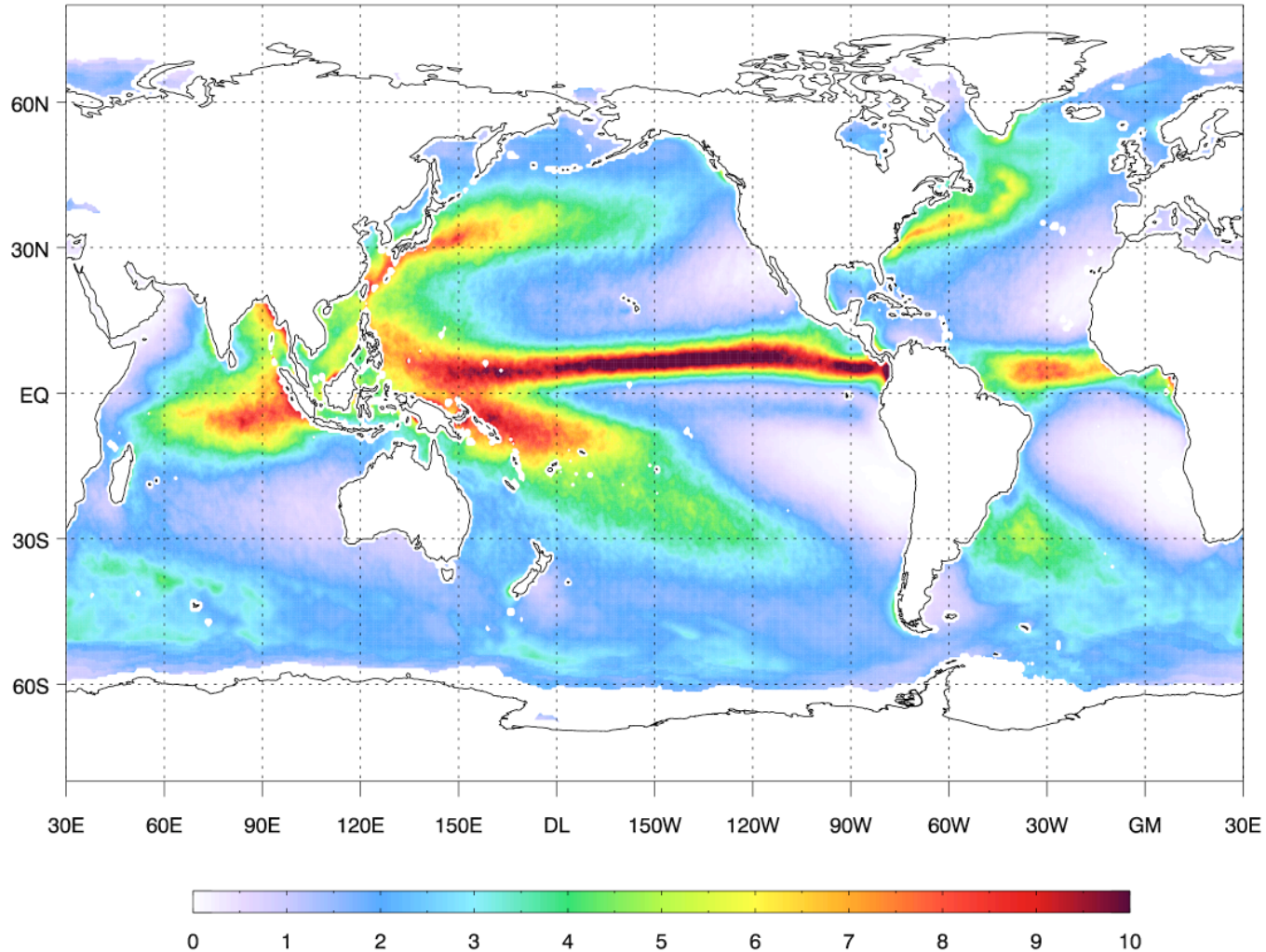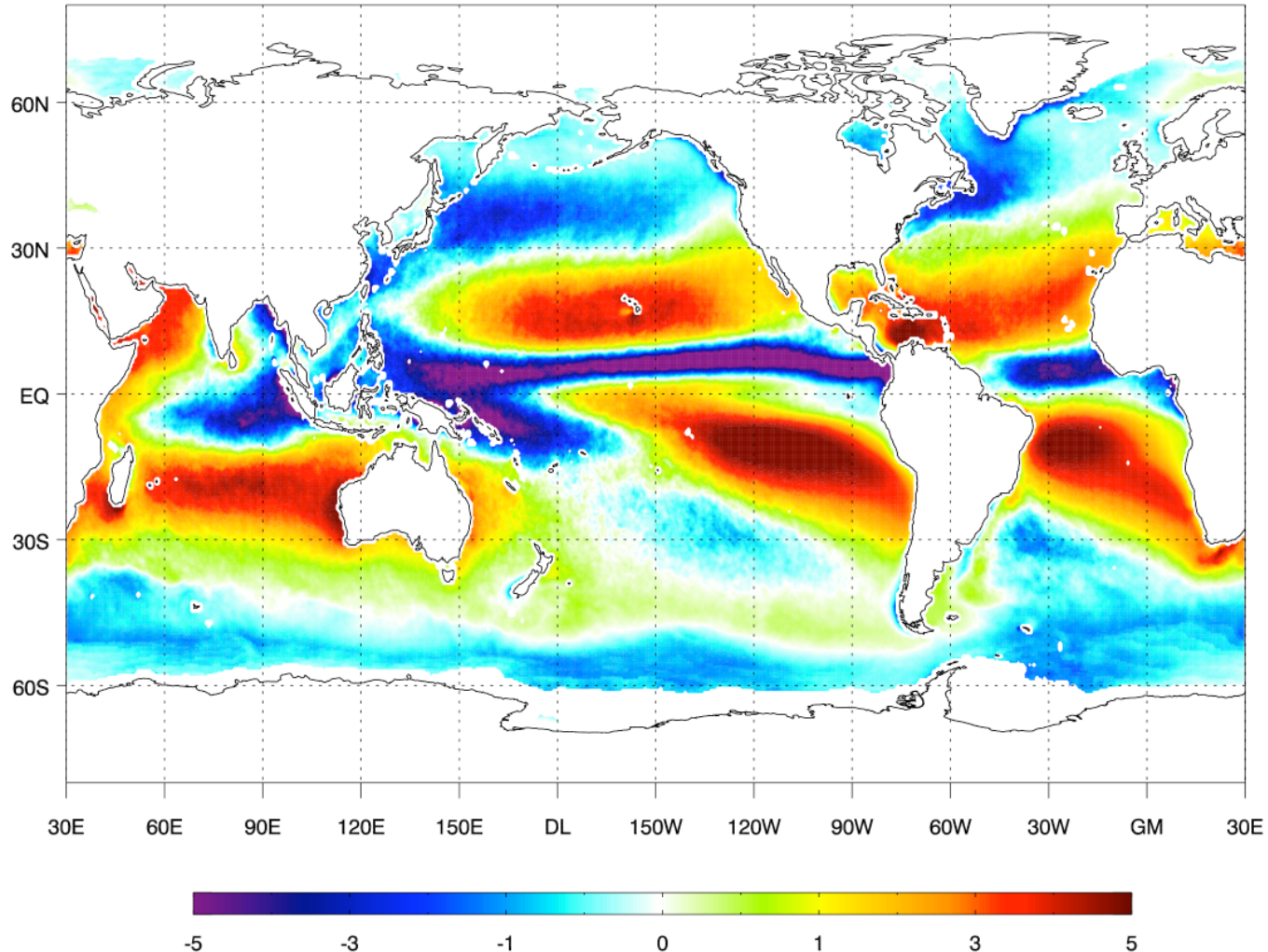
Mean Evaporation

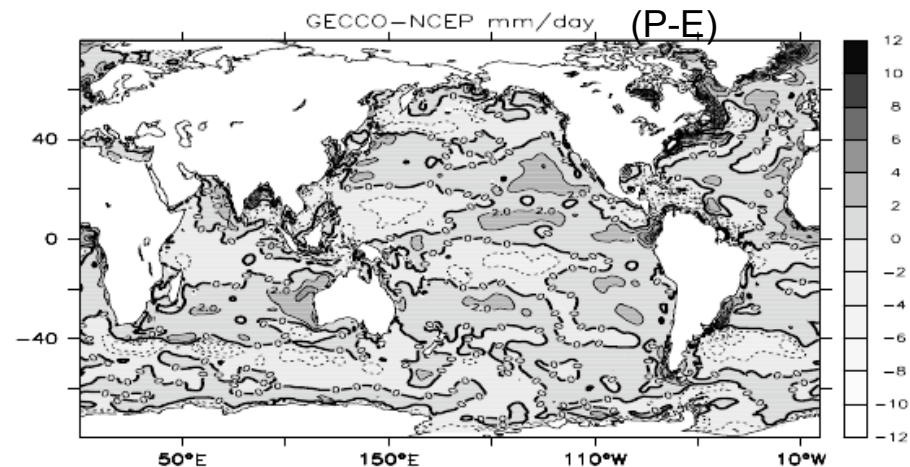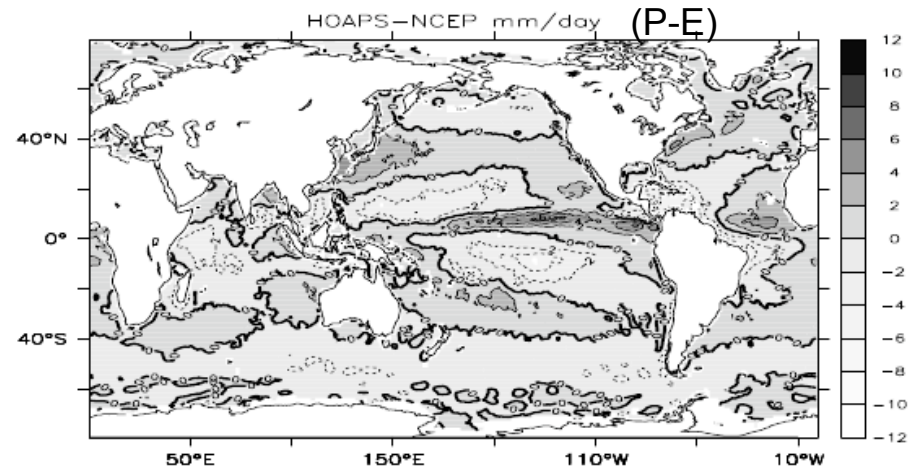HOAPS-3: Evaporation 1988- 2005   [mm/d]
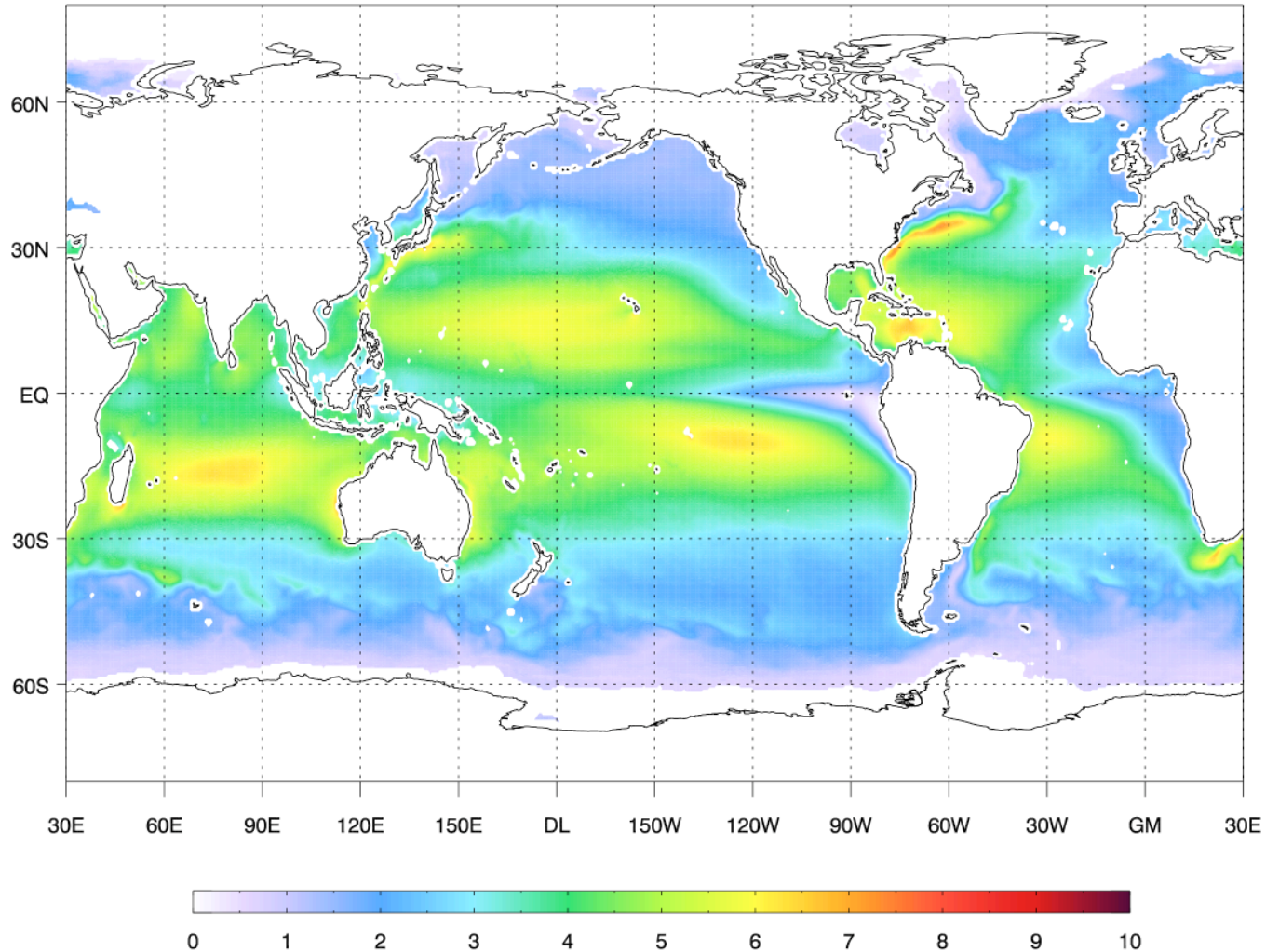
Mean Freshwater Flux

HOAPS-3: Freshwater flux 1988- 2005   [mm/d]
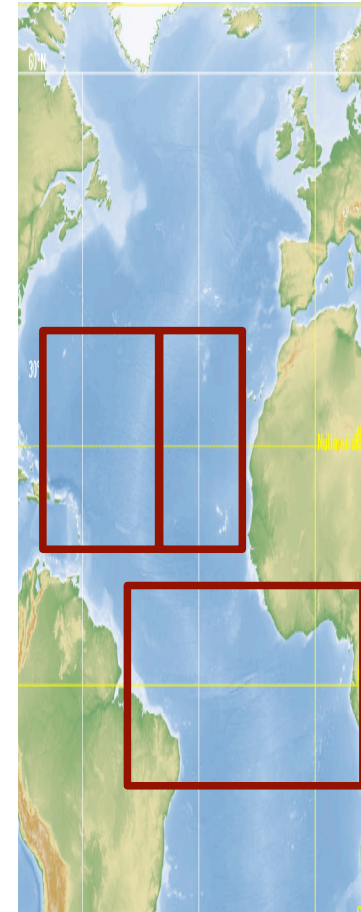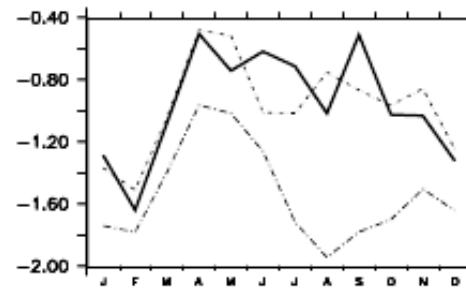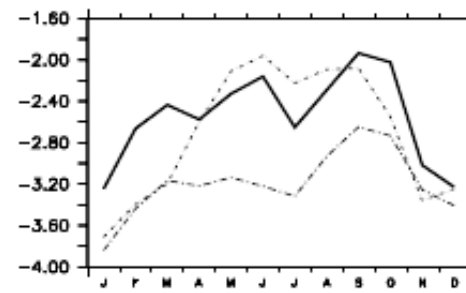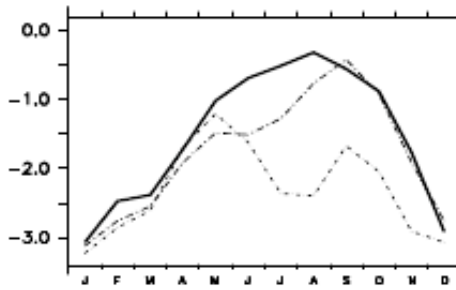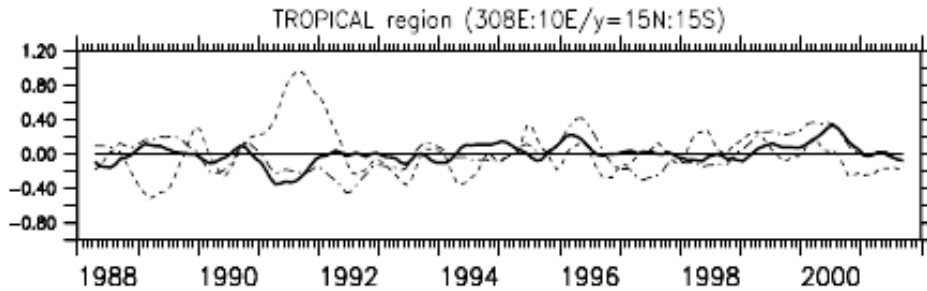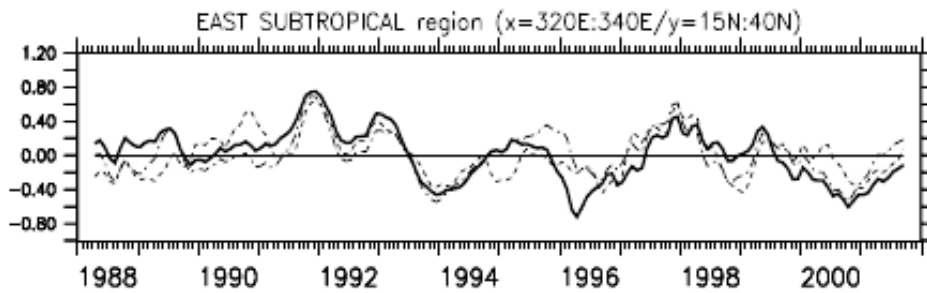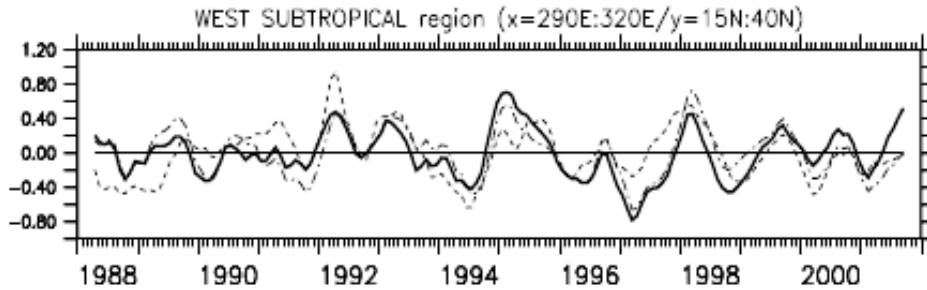
Comparison with GECCO and NCEP

- GECCO (Köhl, 2008)
  - NCEP first guess
  - assimilated observations (satellite, in-situ)
  - adjoint model is used to iteratively reduce the model-data misfit.

- NCEP

- 1988-2001

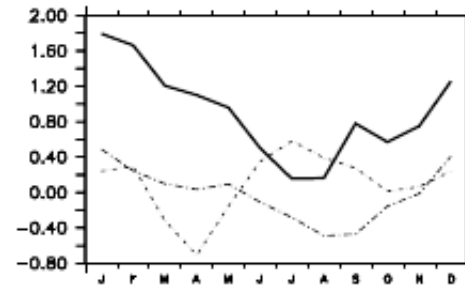→ Is GECCO moving away from NCEP towards HOAPS?

HOAPS−NCEP mm/day (P-E)

GECCO−NCEP mm/day (P-E)

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Comparison with GECCO and NCEP

WEST SUBTROPICAL region (x=290E:320E/y=15N:40N)

EAST SUBTROPICAL region (x=320E:340E/y=15N:40N)

TROPICAL region (308E:10E/y=15N:15S)

GECCO ········ NCEP ― ― HOAPS
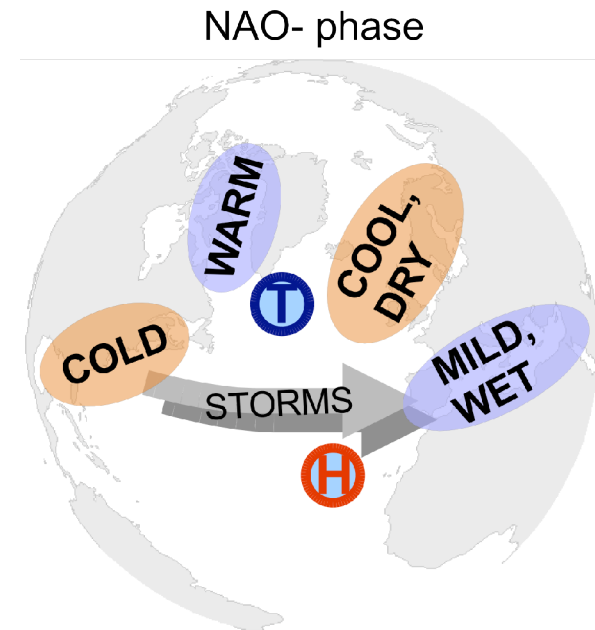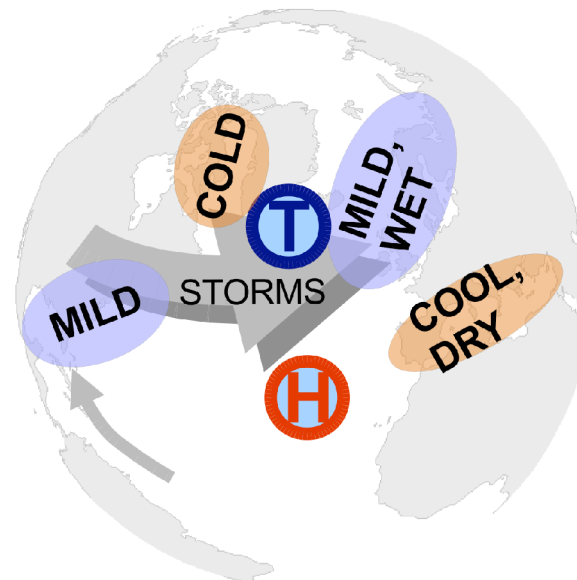
Comparison with GECCO and NCEP
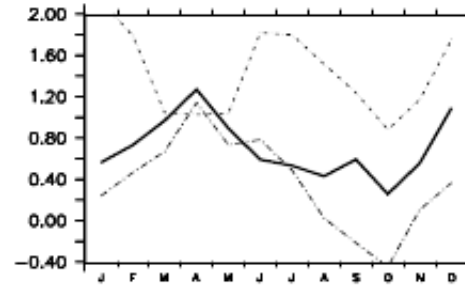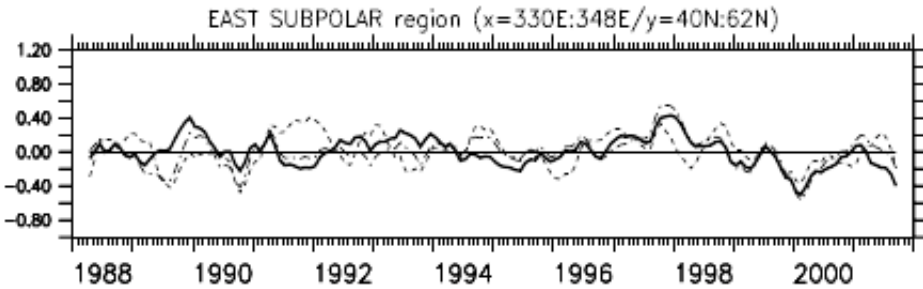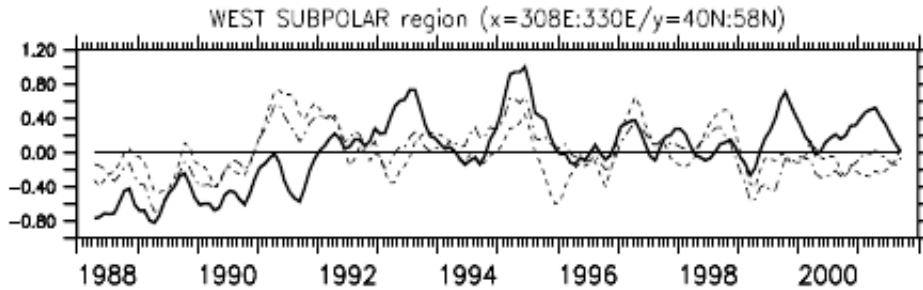
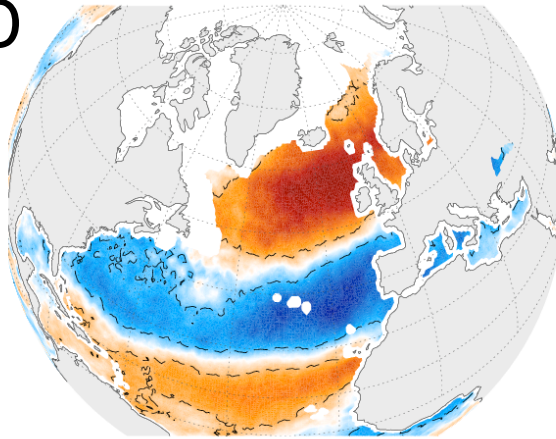GECCO ······· NCEP — — HOAPS

North Atlantic Oscillation

- Assess the response of HOAPS-3 over ocean freshwater fluxes with respect to atmospheric variability associated with the NAO.
  - NAO is the dominating pattern of atmospheric variability in the Northern Hemisphere
  - Wintertime NAO (Dec-Mar)

NAO+ phase   NAO- phase

NAO - Freshwater Flux
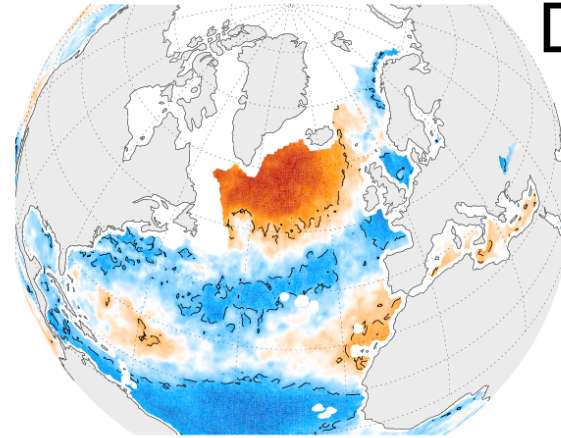## Correlation with NAO Index
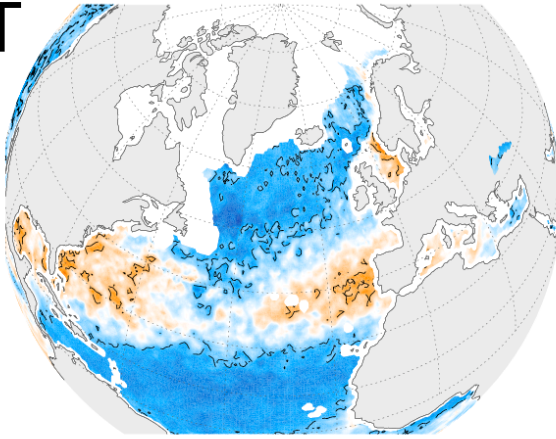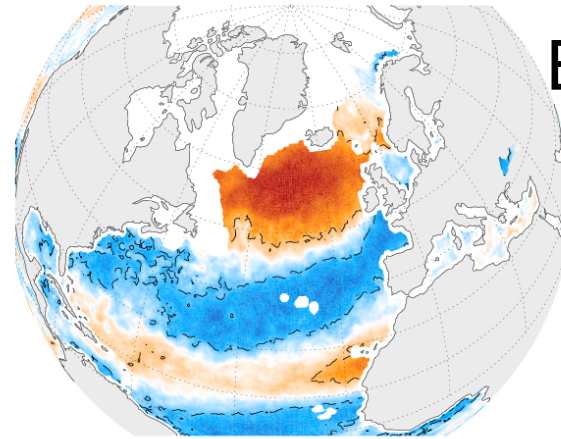

WIND

DHUM

SST

EVAP

ASST NAO DJFM correlation

-1.00   -0.50   0.00   0.50   1.00

EVAP NAO DJFM correlation

-1.00   -0.50   0.00   0.50   1.00
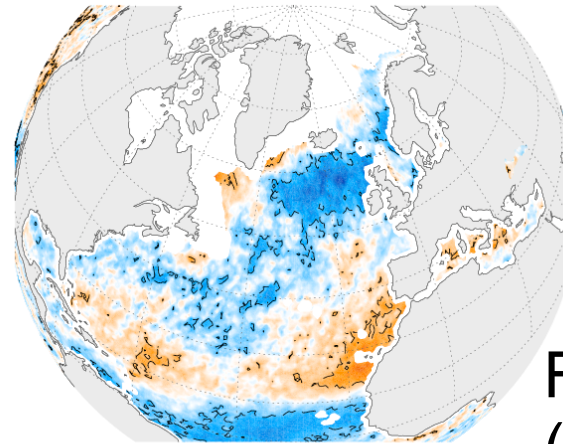
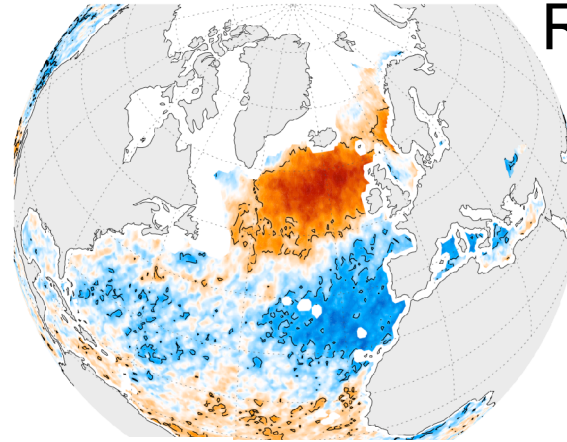Max-Planck-Institut
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HOAPS

NAO - Freshwater Flux
Correlation with NAO Index

EVAP (E)
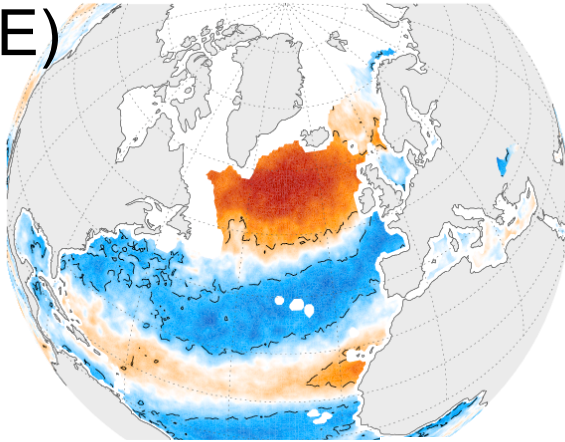
RAIN (P)

Freshwater Flux
(E-P)

-1.00   -0.50   0.00   0.50   1.00
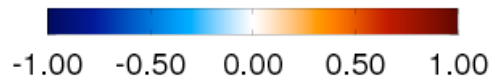
Future Development

- Transition of HOAPS from University of Hamburg / MPI Hamburg into CM-SAF (Satellite Application Facility on Climate Monitoring, hosted at DWD)

- First Thematic Climate Data Record (TCDR) of total column integrated water vapour derived from SSM/I released in 2009 (available via http://www.cmsaf.eu/)

- Next release of key HOAPS parameters within CM-SAF framework is planned for autumn 2010 and will include precipitation, evaporation, the resulting freshwater flux, near surface wind speed and near surface humidity
  - Extend HOAPS time series to 2008
  - Based on an improved version of inter-sensor calibrated SSM/I brightness temp.

- Further development shared between Hamburg and CM-SAF to
  - manage transition to SSMI/S
  - include TMI and AMSR-E (SMMR)
  - Update SST data set ((A)ATSR) + diurnal cycle?

- HOAPS simulator for climate model evaluation

- Over ocean snowfall validation (C. Klepp)

Summary

- HOAPS-3 contains 18 years of intercalibrated satellite based time series of global ocean E-P and related atmospheric state parameters

- 3 data products available, 15 parameters

- data freely accessible via *www.hoaps.org*

- Climatological global patterns and annual variations of freshwater flux components are well represented by HOAPS.

- Comparison with GECCO and NCEP shows that GECCO has moved away from NCEP towards HOAPS in some regions but distinct regional biases and differences in trends remain.

- North Atlantic variability related to the NAO is realistically and coherently reproduced in the HOAPS-3 freshwater flux parameters.

- Future development of HOAPS in cooperation with CM-SAF

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