Surface Flux Intercomparison: Phase 1 Update

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Motivation:
Biases in surface fluxes were identified as an important and widespread issue during the WGNE Workshop on Systematic Errors 2017 and the PAN-WRCP and WGNE32 meeting in Exeter in October 2017. Recommendations from WGNE WSE-2017 included setting up a group to look at surface flux errors, and considering a cross weather-climate group looking at initial tendency analysis of common biases.

Progress:
We circulated a draft protocol to WGNE members as well as CLIVAR/GSOP (Arun Kumar) and GEWEX (Daniel Klocke). We received many comments which we have tried to incorporate into the current protocol draft.

What is next?
We will incorporate any comments we receive during WGNE33 and send the (final?) protocol for phase 1 to members and liaise with external groups as appropriate.

Surface Flux Intercomparison: Phase 1 Draft Protocol

1. Grid

All fields must be provided on a regular latitude – longitude grid at a grid spacing of 0.25° x 0.25°. CF compliant NetCDF format (http://cfconventions.org/) is recommended, but GRIB format is also accepted.

2. Initial time and forecast ranges

The aim is to compare surface fluxes in operational forecasts. Operational forecasts must start at 00 UTC.

The forecasts will be provided for January and July 2018 with the current operational model version. It is also possible to provide additional data from an experimental suite. Climate forecast centers are encouraged to participate if they can run their climate model off of a data assimilation update cycle.

For accumulated values (where the accumulation starts at the 0-h forecast) and for instantaneous values (which are valid at the given forecast range) the following forecast ranges have to be provided: +6h, +12h, +18h, +24h, +30h, +36h, +42h, +48h

Each forecast range has to be in a separate file.

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3. List of constant fields (to be provided only for the 0-h forecast range)

Name	Variable	Unit
ORO	Model orography (geometric height above msl)	m
LSM	Land sea mask (1: land, 0: water/sea ice)	Fraction

4. List of instantaneous variables

Name	Variable	Unit
SEAICE	Sea ice concentration (1: sea ice, 0: open water)	Fraction
T_Skin	Sea surface temperature or land surface temperature	K
W_SNOW	Water equivalent of accumulated snow depth	kg/m^2
U_10M	zonal wind component at 10 m above surface	m/s
V_10M	meridional wind component at 10 m	m/s
T_2M	temperature at 2 m above surface	K
TD_2M	dew point temperature at 2m above surface	K
SOILM	Soil Moisture (absolute water content) in the top layer of the surface model.	mm

3. List of accumulated Variables (since the start of the forecast)

Name	Variable	Unit
LS_PREC	Cumulative large-scale precipitation (total) flux at surface	kg/m^2
CO_PREC	Cumulative convective precipitation (total) flux at surface	kg/m^2
LS_SNOW	Cumulative large-scale snowfall (solid) flux at surface if available	kg/m^2
CO_SNOW	Cumulative convective snowfall (solid) flux at surface if available	kg/m^2
EVAP	Cumulative total evaporation flux at surface	kg/m^2
SO_DOWN	Cumulative downward short-wave radiation flux at surface	$W\ m^{-2}\ s$
SO_NET	Cumulative net short-wave radiation flux at surface	$W\ m^{-2}\ s$
SO_NET_CS	Cumulative net short-wave clear sky radiation flux at surface	$W\ m^{-2}\ s$
TH_DOWN	Cumulative downward long-wave radiation flux at the surface	$W\ m^{-2}\ s$
TH_NET	Cumulative net long-wave radiation flux at the surface	$W\ m^{-2}\ s$
TH_NET_CS	Cumulative net long-wave clear sky radiation flux at the surface	$W\ m^{-2}\ s$
SH	Cumulative surface sensible heat flux	$W\ m^{-2}\ s$
LH	Cumulative surface latent heat flux	$W\ m^{-2}\ s$
U_MOM_FL	Cumulative momentum flux, u component	kg/m/s
V_MOM_FL	Cumulative momentum flux, v component	kg/m/s

Sign convention for the fluxes of radiation or other quantities: **Positive** if **downward!**
Net fluxes are the sum of upward and downward fluxes.

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6. File names

The following naming convention for the files containing the data is proposed:

CENT_YYYYMMDDGG_xx

where CENT is the center identifier, e.g. ECMWF,

YYYYMMDDGG is the initial time of the forecast (YYYY: year, MM: month, DD: day, GG: time, i.e. 00 (UTC))

xx: forecast range in hours.

7. Meta-data

Additional information are required to interpret the data, such as the main characteristics of the NWP system: spatial resolutions (with lowest model level), physical parameterizations with more details on the parameterization of surface fluxes over open water, etc.

It is also important to describe the algorithm used to interpolate data from the model native grid to the regular lat-lon grid at 0.25° x 0.25°.

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8. Collection of Data

TBD: Would like this to be available to all those who contribute (perhaps google drive?)

Remarks:

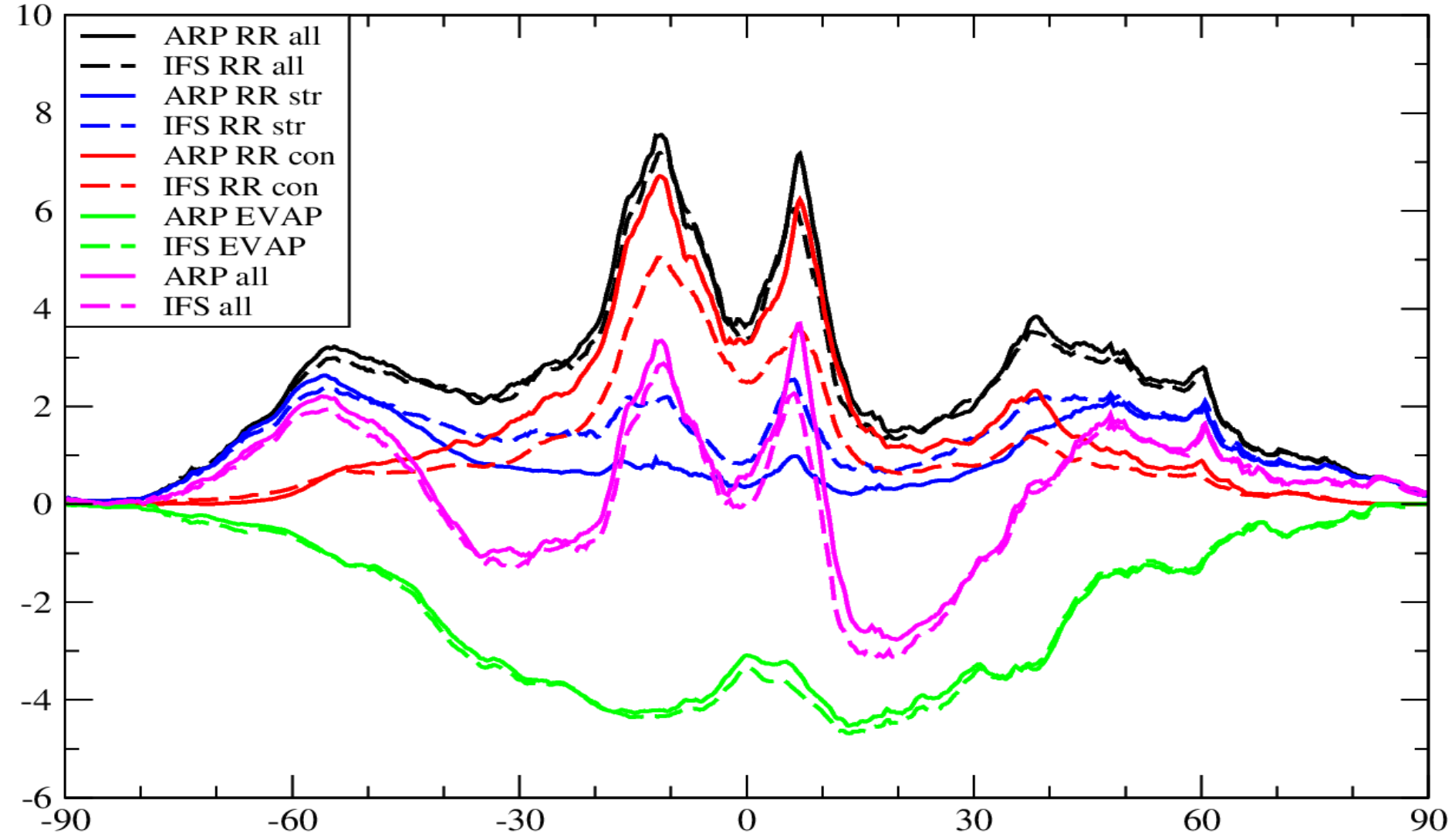
- need to liaise with WDAC co-chairs and the WDAC Task Team on Fluxes leadership
- need to liaise with CLIVAR/GSOP (http://www.clivar.org/clivar-panels/gsop)
- need to liaise with GEWEX GLASS
- link with OceanSites effort (http://www.oceansites.org/index.html)
- need to identify contact persons in each participating center

Preliminary Intercomparison of surface fluxes forecasted by ARPEGE (Météo-France) and IFS (CEPMMT) global operational NWP systems

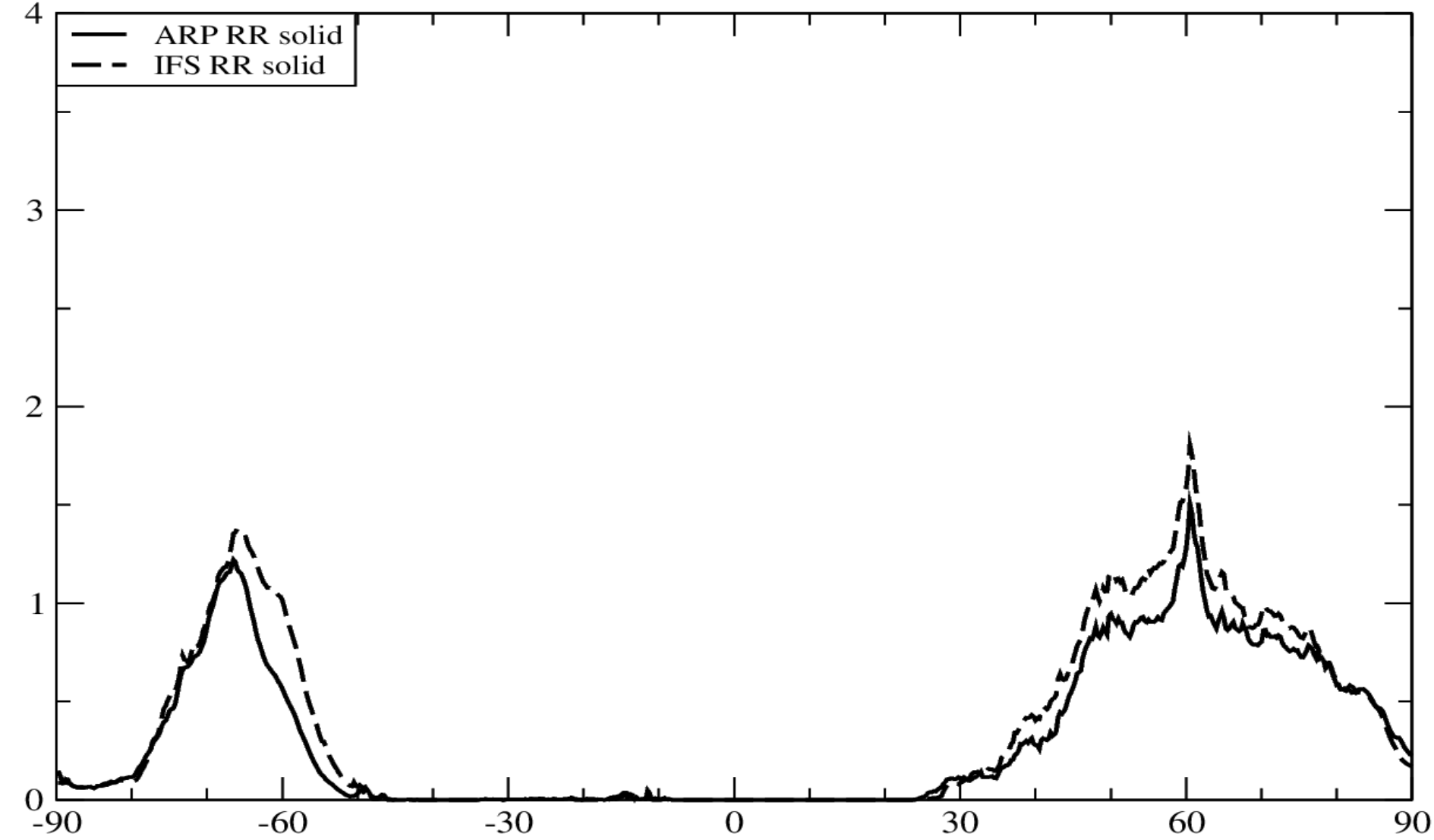
- Period : January 2018 (and July 2018 not shown)
- 48h forecasts from r0 analysis
- 0.25° x 0.25° grid

- Zonal mean monthly surface fluxes
- Mean surface fluxes differences (maps)

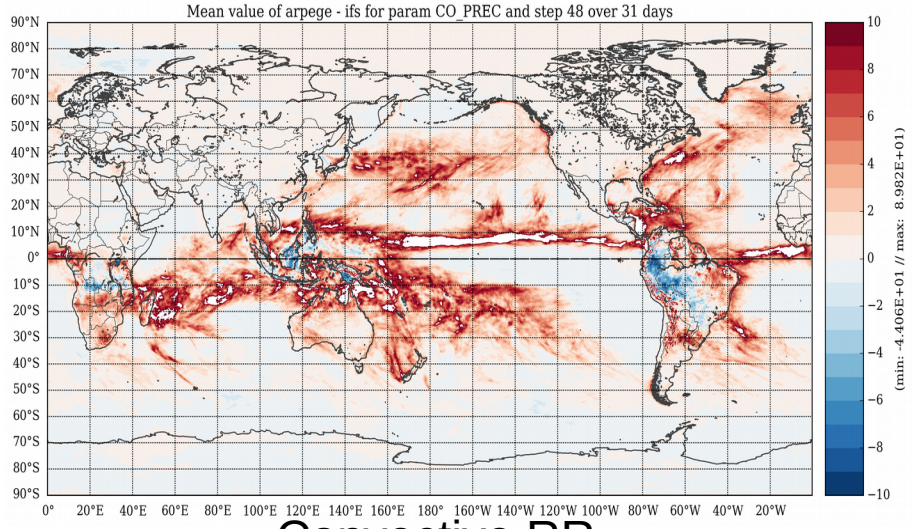
Zonal-mean surface water fluxes (mm/day)
averaged over 48h forecasts (r0 based) for January 2018



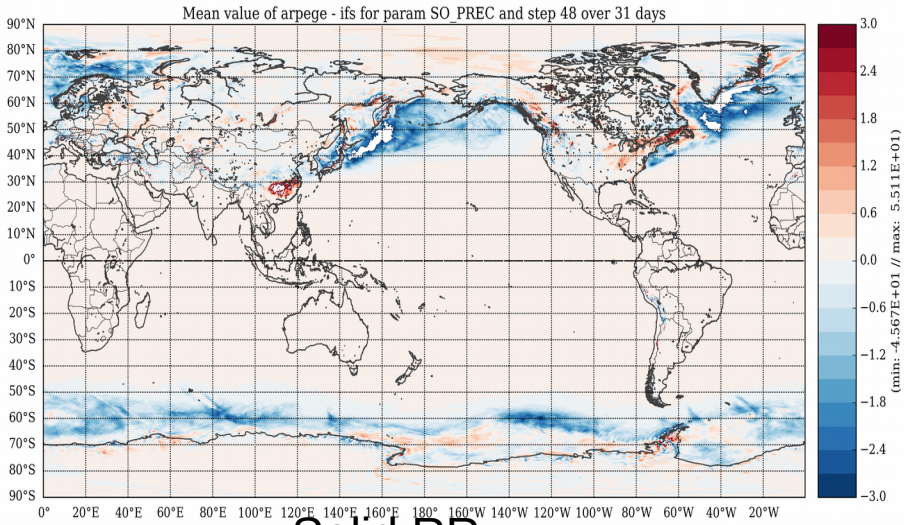
Zonal-mean surface solid precipitation fluxes (mm/day) averaged over 48h forecasts (r0 based) for January 2018



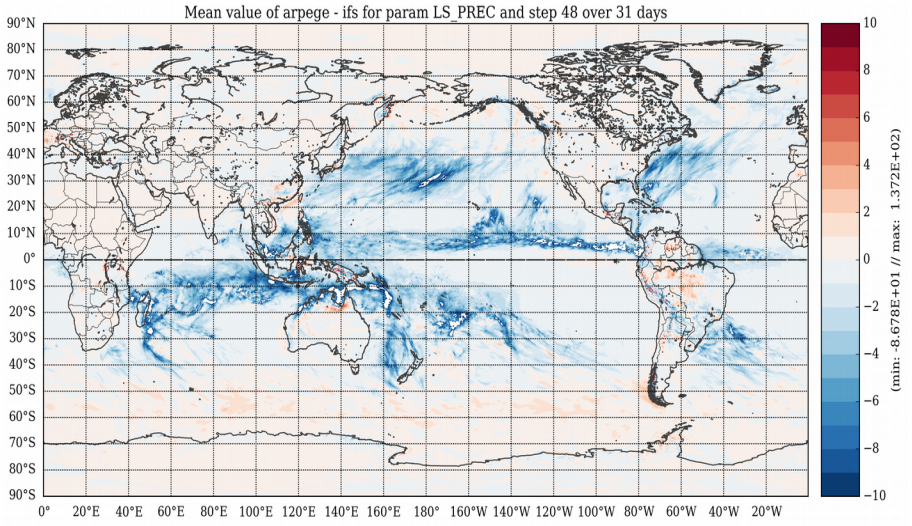
Surface water flux (mm/day) différences « ARPEGE » minus « IFS » averaged over 48h forecasts (r0 based) for January 2018



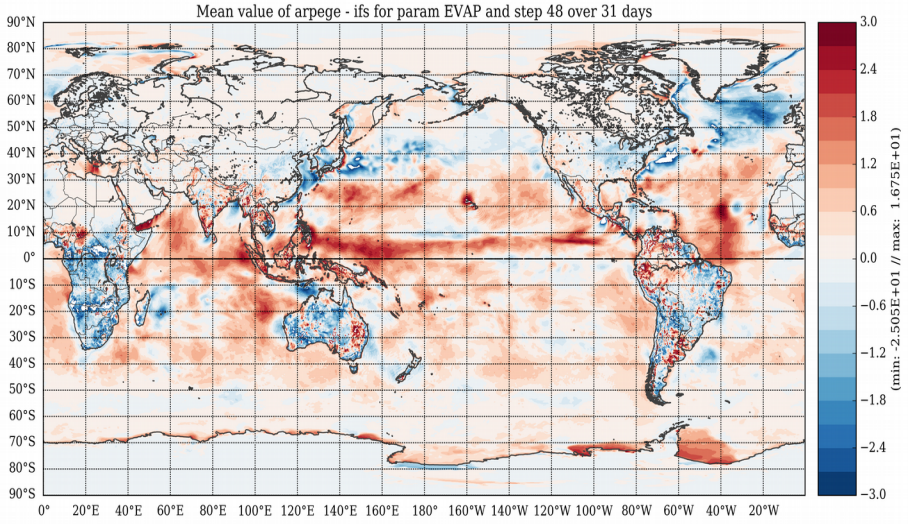
Convective RR



Solid RR

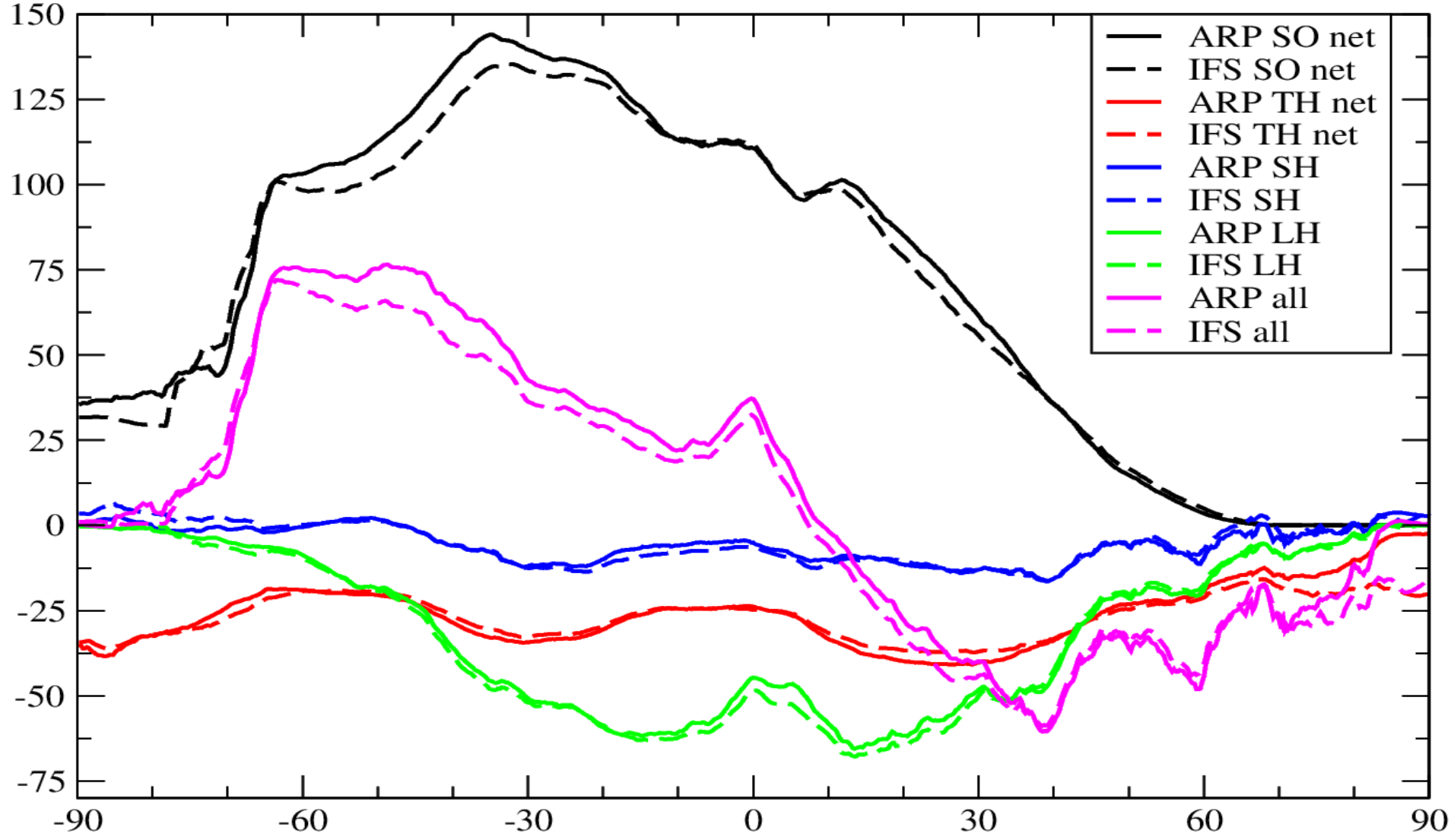


Stratiforme RR

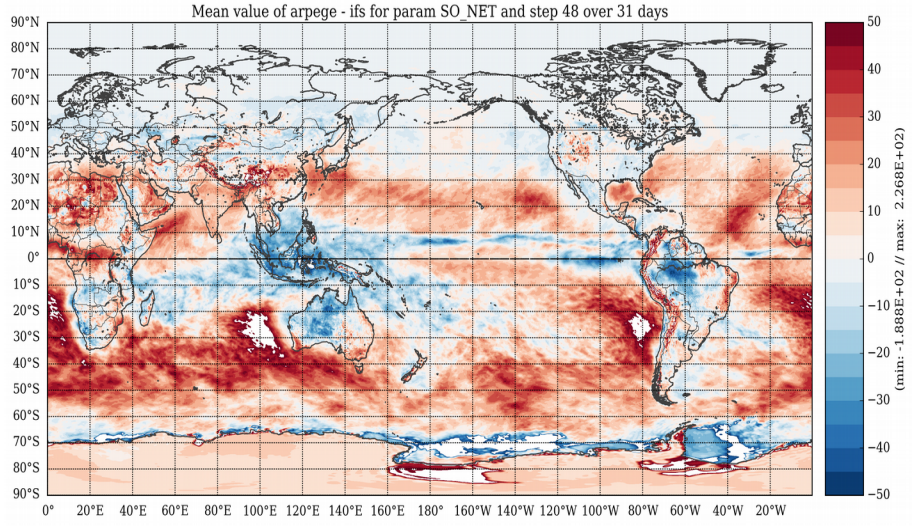


Evaporation

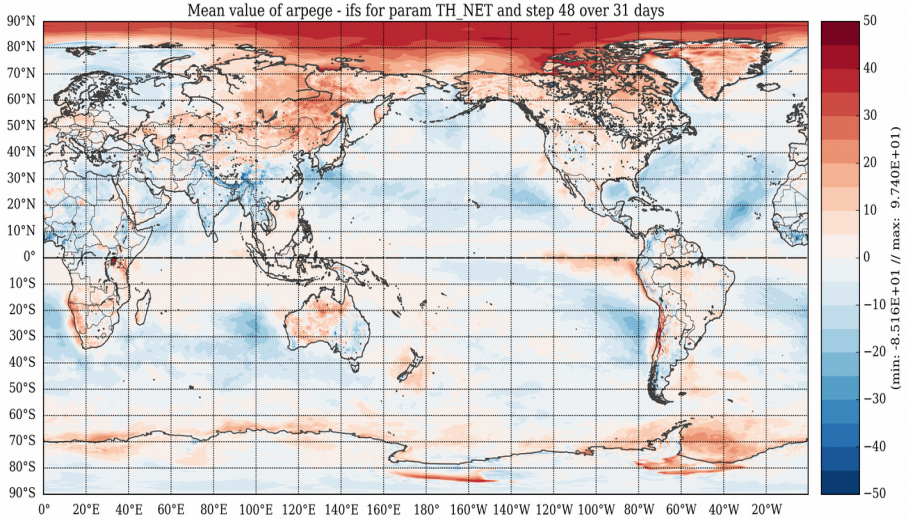
Zonal-mean surface heat fluxes (W/m2)
averaged over 48h forecasts (r0 based) for January 2018



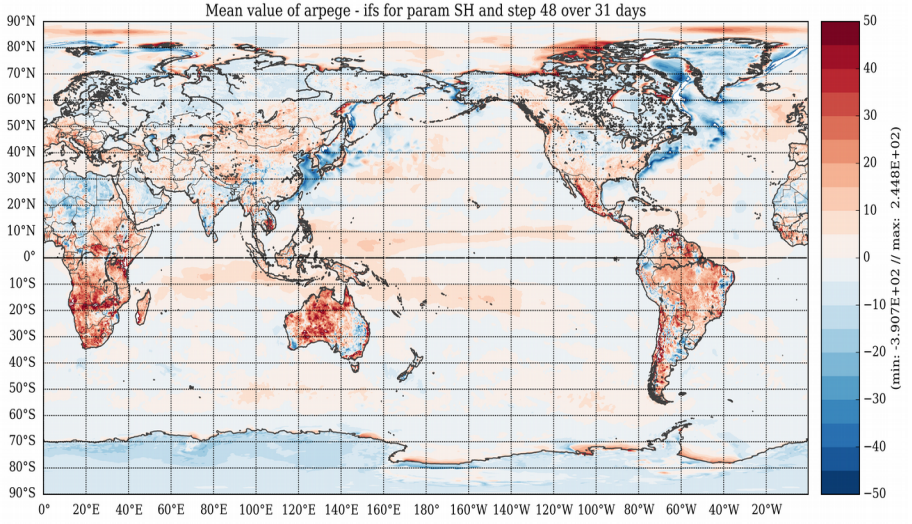
Surface heat flux (W/m2) différences « ARPEGE » minus « IFS » averaged over 48h forecasts (r0 based) for January 2018



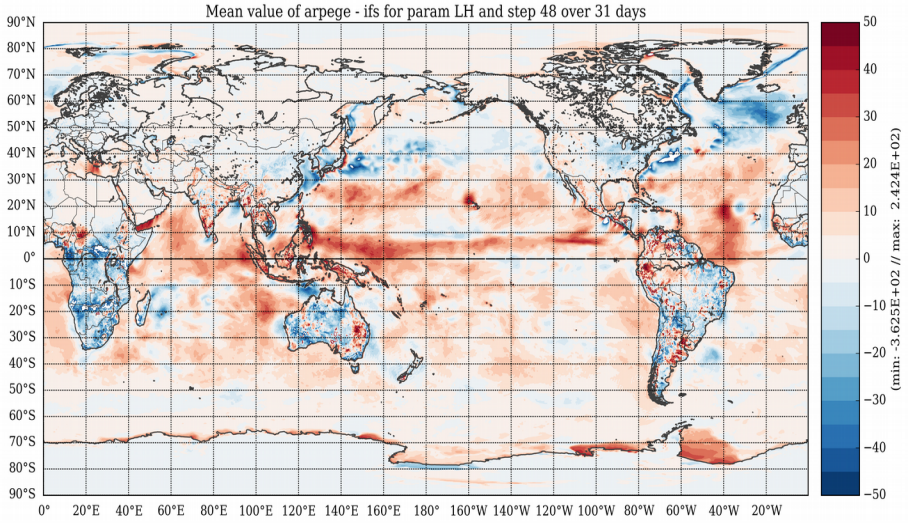
Net shortwave radiation



Net longwave radiation

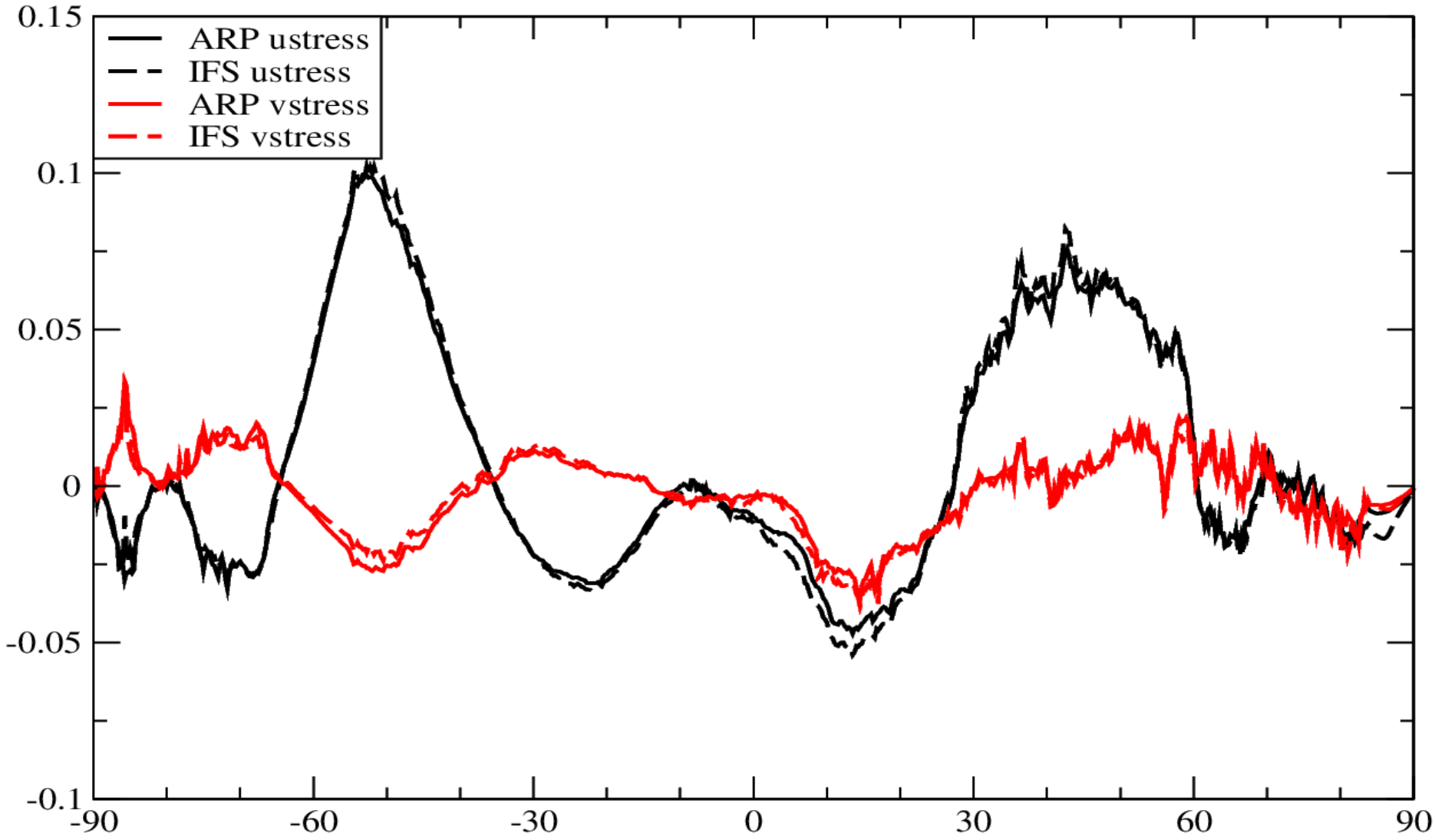


Sensible heat flux

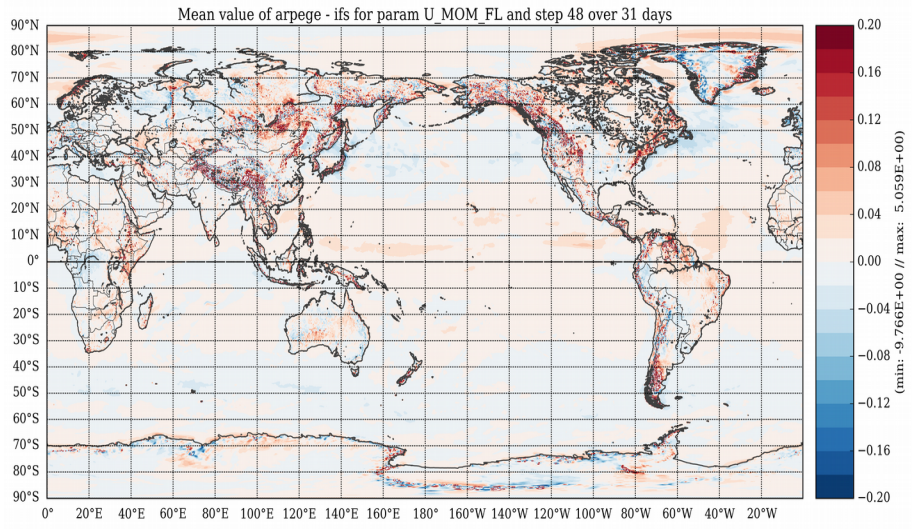


Latent heat flux

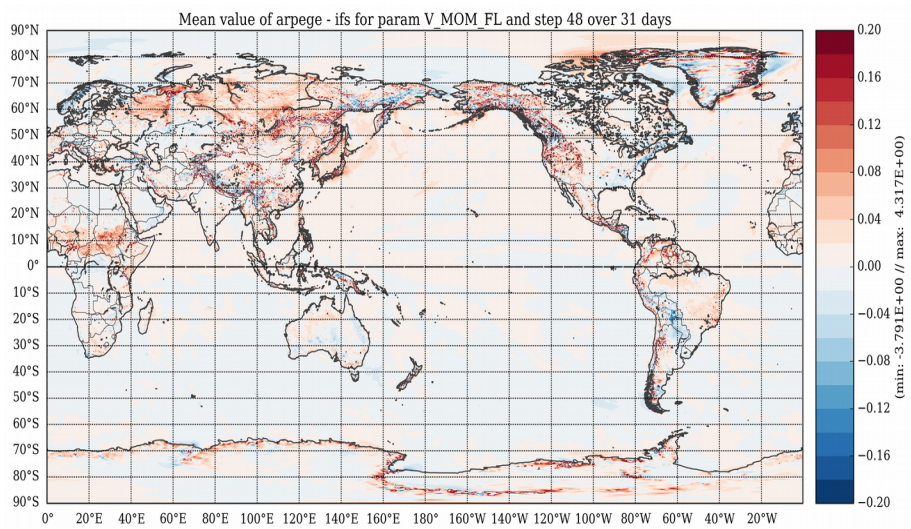
Zonal mean surface momentum fluxes (kg/m/s2) averaged over 48h forecasts (r0 based) for January 2018



Surface momentum flux (km/m/s2) différences « ARPEGE » minus « IFS » averaged over 48h forecasts (r0 based) for January 2018



Zonal momentum flux



Meridional momentum flux