

## Seasonal prediction at Hydrometcentre of Russia



M. Tolstykh, D. Kiktev, R. Zaripov, M. Zaichenko

24th WGNE session, 3-7 November 2008, Montreal, Canada

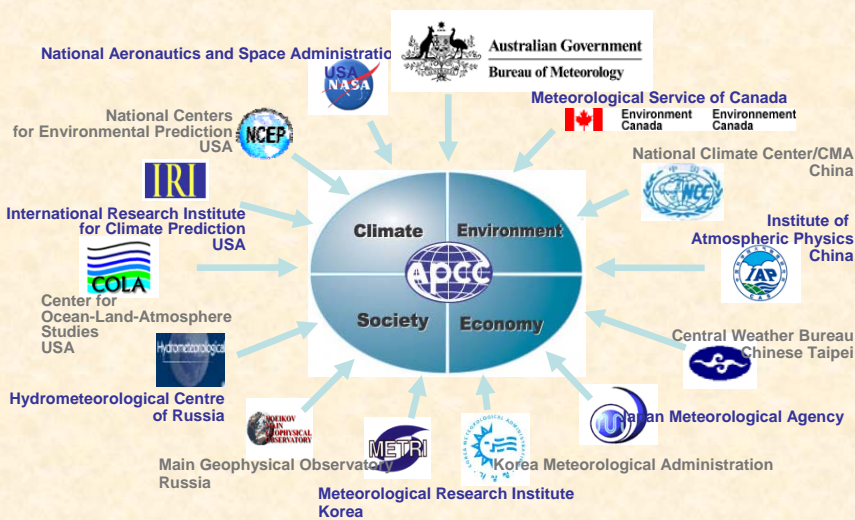
### SL-AV atmospheric model, seasonal version

- Global semi-Lagrangian finite-difference model.
- Horizontal resolution  $1,40625^{\circ} \times 1,125^{\circ}$ , lon-lat28 vertical levels
- Dynamic core of own development (vorticity-divergence formulation on the unstaggered grid; 4<sup>th</sup> order finite differences). Validated in Held-Suarez test (3yr integration)
- Subgrid-scale parameterizations from French model ARPEGE/IFS. No vegetation in the old version, ISBA scheme in the new version
- The model contributes to the multi-model ensemble of APCC. Forecasts are at <http://www.meteoinfo.ru/season>

# Old version of the model

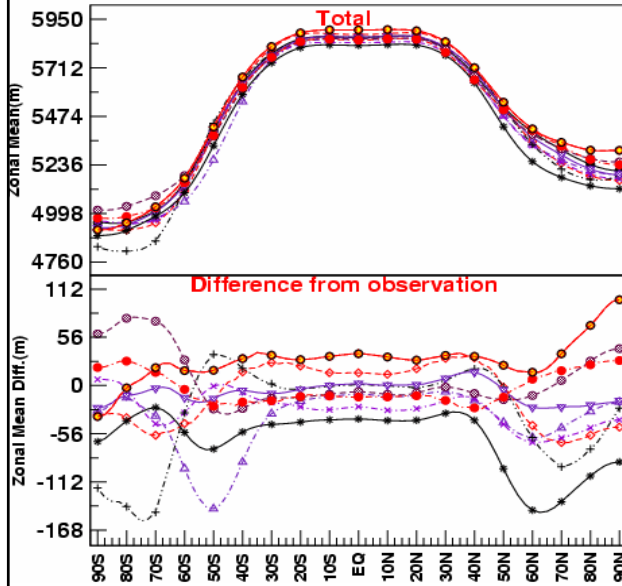
## SMIP-2/HFP, Independent validation

### Multi-Institutional Cooperation

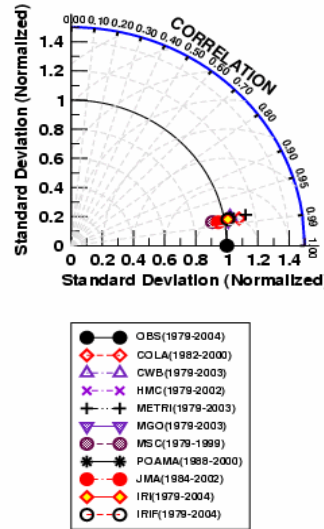


# Zonal mean H500 in SMIP2/HFP

Geopotential Height at 500hpa

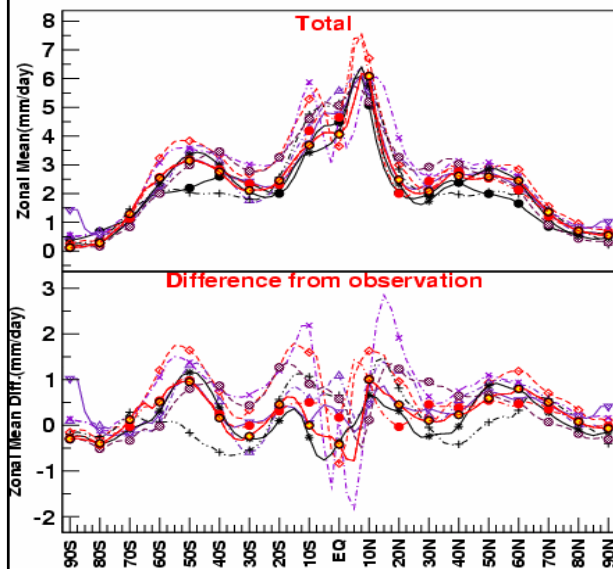


Taylor Diagram

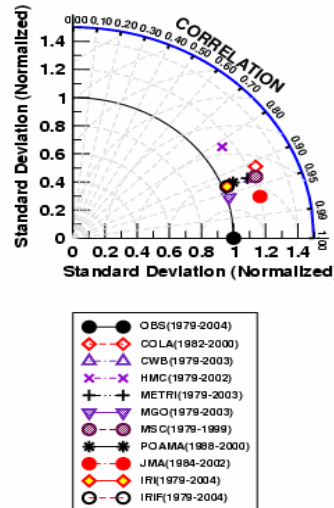


# Zonal mean precipitation

Precipitation



Taylor Diagram



## Drawbacks of the old seasonal version

- Unrealistic high precipitation in tropics, wrong geographical distribution (lack of precipitation in continental tropics)
- T850 too warm over Antarctica, too cold ( by 2 degrees) over tropics
- H500 is 30-40 m lower

All this was attributed to the absence of modern surface (soil-vegetation-snow) parameterization

## New version of seasonal prediction model

- In the old version, there was no vegetation; 100 % daily relaxation to climate values of deep temperature  $T_p$  and water content  $W_p$
- New version – parameterization of interaction between soil, vegetation, snow, soil ice and the atmosphere ISBA (Noilhan, Planton 1989, Giard, Bazile, 2000) + weak ( $<1.e-2$  per day) relaxation to climate values of  $T_p$  and  $W_p$
- Modified radiation parameterization (RC LACE'2007)
- Changes in PBL parameterization: interactive mixing length
- Necessary requirement for ISBA to work – realistic initial conditions for soil water content of the deep (mean) layer. In seasonal context – also climate water content field, appropriate for ISBA

## Assimilation of soil variables (N.N. Bogoslovskii)

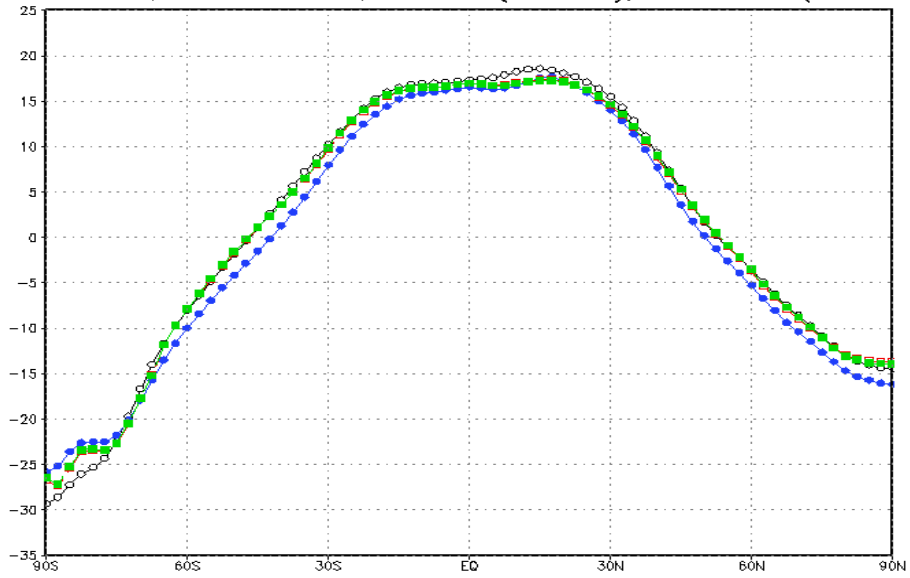
- The scheme (Giard, Bazile, 2000) developed especially for ISBA was implemented in medium-range forecast version. This scheme uses increments of T2m and RH2m analyses to produce increments of soil variables using some restrictions.
- Due to large biases in T2m and RH2m analyses, development and implementation of own analyses was required
- Now we have assimilated soil water content field for more than 1 yr, which can be used as climate

## Validation of the new version of seasonal model

- Ensemble forecasts with 10 members for initial data of 28/07/07, 28/10/07, 28/01/08, 28/04/08. All 4 ensembles showed similar improvements. First hindcasts starting from NCEP reanalyses
- Study EOFs for H500 and MSLP fields

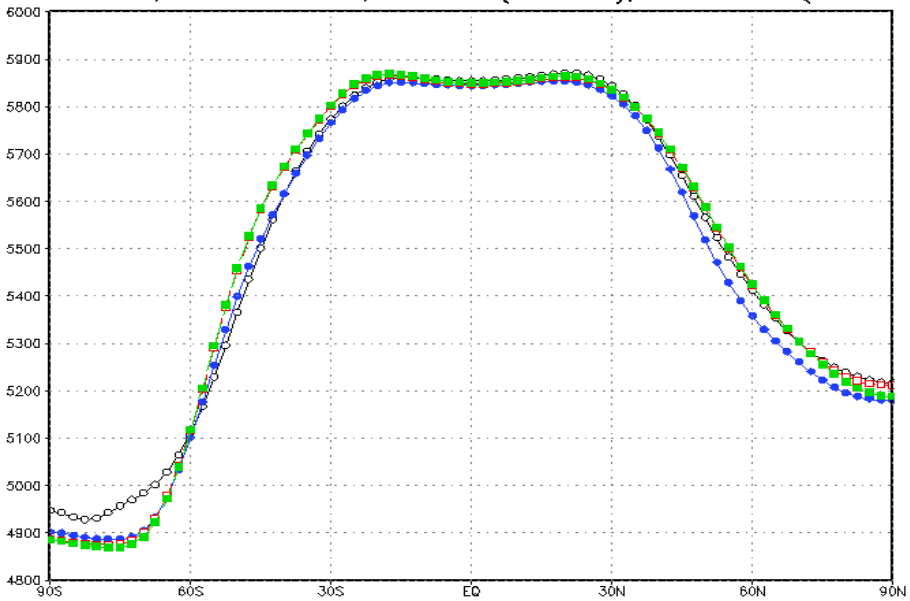
# Zonal mean T850

T850. SEP-NOV 2007.  
BLACK=obs, BLUE=old frc, RED=frc(070728), GREEN=frc(070728n)



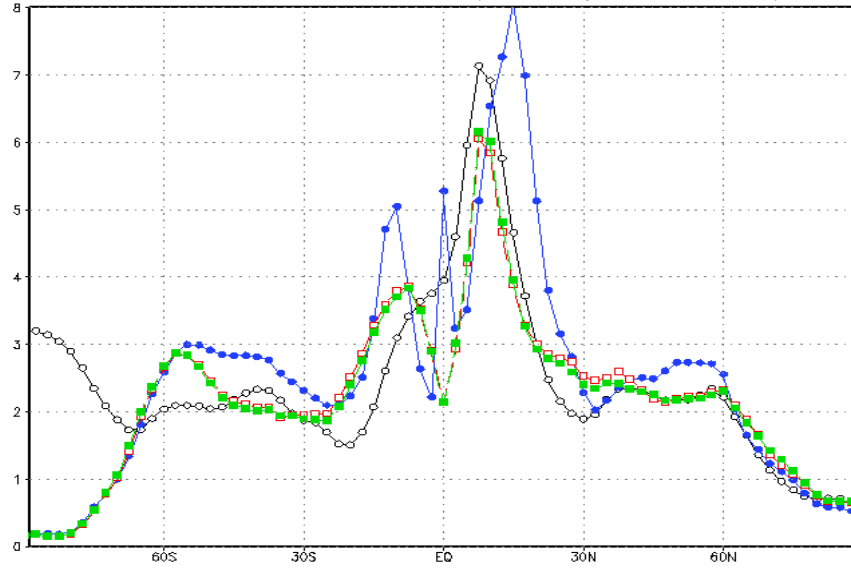
# Zonal mean H500

H500. SEP-NOV 2007.  
BLACK=obs, BLUE=old frc, RED=frc(070728), GREEN=frc(070728n)

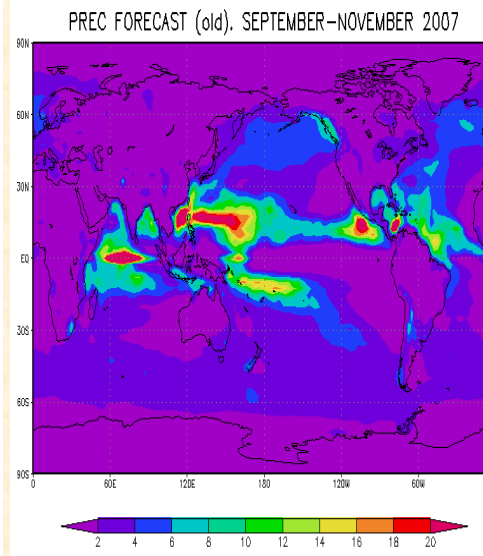
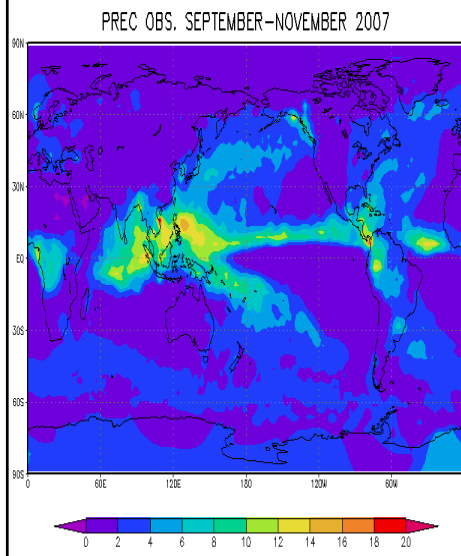


# Zonal mean precipitation

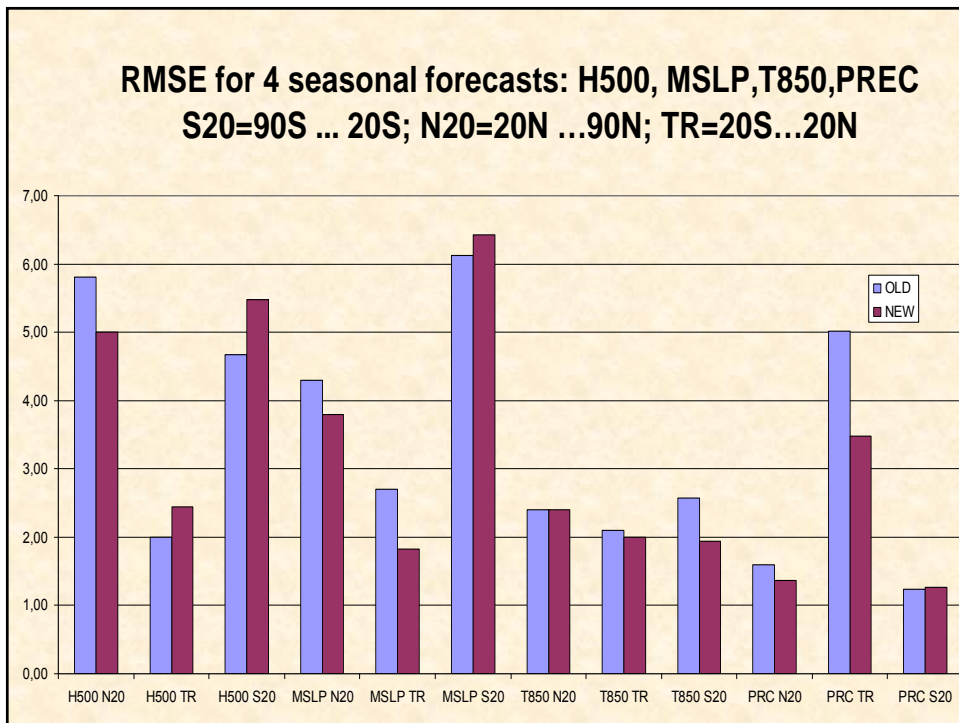
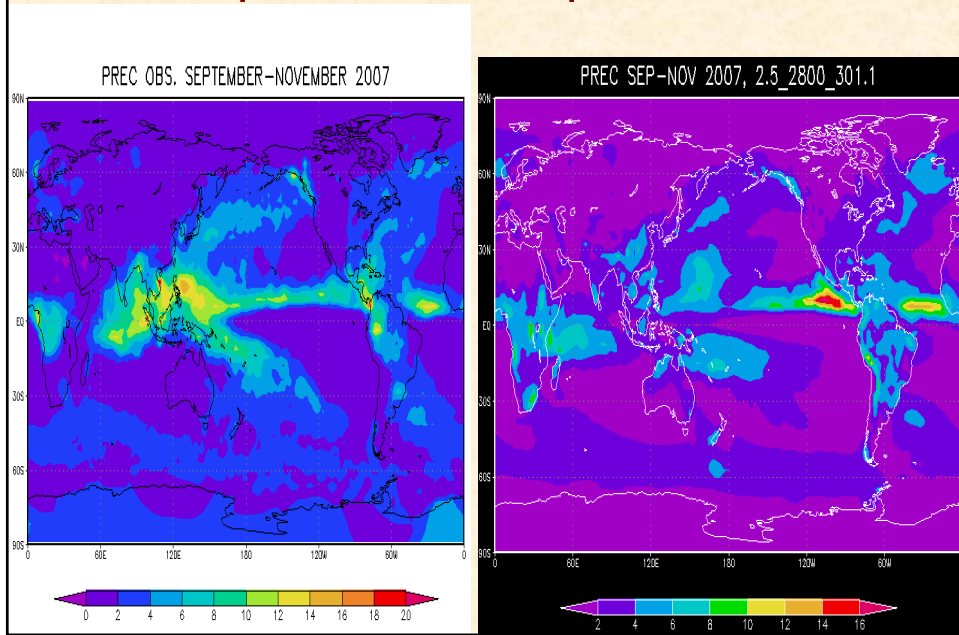
PREC [/day]. SEP-NOV 2007.  
BLACK=obs, BLUE=old frc, RED=frc(070728), GREEN=frc(070728n)



# Precipitation for Sep-Nov 2007:

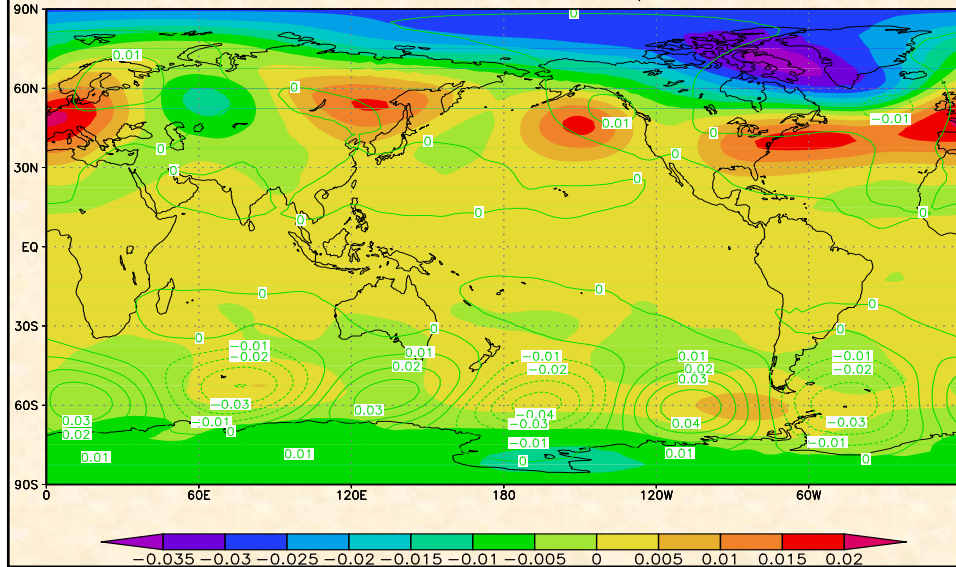


# Precipitation for Sep-Nov 2007:



# EOF analysis based on real data forecasts (new version)

EOF1+2 winter mslp



## Conclusions

- Implementation of soil-vegetation-snow parameterization allowed to significantly reduce systematic biases in precipitation, H500 and T850 fields in seasonal forecasts
- The use of own-produced deep soil water content field for relaxation helped to further reduce spurious precipitation over deserts
- First EOFs of model circulation seem to be in a agreement with observations

## Future work

- Redo SMIP2/HFP forecasts
- Coupling with the INM ocean general circulation model
- Further upgrade in parameterizations

Thank you for attention !