Update on HMCR long range prediction system

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SL-AV global atmosphere model

SL-AV: Semi-Lagrangian, based on Absolute Vorticity equation.

- Many parameterizations algorithms for subgrid-scale processes developed by ALADIN/ALARO consortium.
- Parameterizations for shortwave and longwave radiation: CLIRAD SW + RRTMG LW.
- INM RAS- SRCC MSU multilayer soil model (Volodin, Lykossov, Izv. RAN 1998).
Old and new long-range prediction system at Hydrometcentre of Russia

**SL-AV 2008**
- Resolution 1,4x1,125° lon-lat, 28 levels
- Uppermost level at 5 hPa
- 1.5-3 km resolution in the stratosphere
- SW and LW radiation: Ritter, Geleyn 1992 (1+1 band)
- Boundary layer – improved version of Geleyn 1982
- ISBA surface scheme
- 4 months forecast in 40 min at 8 cores of Cray XC40

**SL-AV 2015**
- Resolution 0,9x0,72° lon-lat, 96 levels
- Uppermost level at 0,04 hPa
- 500-700 m resolution in the stratosphere
- SW radiation: CLIRAD SW, LW radiation: RRTMG LW (11 + 16 spectral bands)
- Boundary layer: Bastak-Duran et al JAS 2014
- Marine stratocumulus, sea-ice T
- INM RAS multilayer soil scheme
- 4 months forecast in 88 min at 128 cores of Cray XC40 (1 member)
Initial data

• Hindcast initial data are now prepared for 1991-2020 using SEKF for multilayer soil initialization and ERA5 for atmosphere data

• Current forecasts use SEKF for soil initialization
Multilayer soil initialization – simplified extended Kalman filter (SEKF) using 2m observations
Recent works and studies

• Model improvements
  - surface characteristics for partial snow cover
  - improvement in coupling between multilayer soil and atmosphere
    - climate mode retuning
  - LETKF-based system for generating initial ensemble to replace breeding technology
• Multilayer soil model coupling and initialization
• Model uncertainties – implementation of SPP and SPPT scheme (SPPT is not used for LRF)
• Use of ERA5, including new initial data for hindcasts (1991-2019)
• Experimental parallel seasonal forecasts have started
• Diagnostics of surface flux components after model changes
Zonal mean winter U velocity

SLAV, 96 lvl, 2020

Era-Interim
Mean DJF model error in 2020 and now
Mean JJA model error in 2020 (left) and now (right)

- ITCZ doubling is nearly removed!
- Near-surface wind in Pacific is now OK!
Ongoing works

• Ozone with photochemistry
• New deep convection parameterization with memory (L.Gerard et al)
• Improvement of multilayer soil, implementation of lakes
• Diagnostics of teleconnections
• Experiments in coupled mode.

Plans

• SL-AV version with the resolution of 0,9x0,72° lon-lat, 96 levels – so far without ocean – implementation after parallel runs
• INM RAS coupled model (CMIP) – experimental seasonal forecasts
Thank you for attention!