Update on INM RAS and 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.
- Shortwave and longwave radiation: CLIRAD SW + RRTMG LW.
- INM RAS- SRCC MSU multilayer soil model (Volodin, Lykossov, Izv. RAN 1998).
- Hindcast initial data are prepared using SEKF for multilayer soil initialization and ERA5 for atmosphere data
- Current forecasts use SEKF for soil initialization
- Resolution 0.9x0.72° lon-lat, 96 levels (top at 0.04 hPa)
- 41 members for forecasts, 11 members for hindcasts
Changes of RMSE and ACC in SL-AV new version for current 1-month forecasts: forecast with zero (blue) and 2-weeks lead time (red). CIS region (20-180E, 40-70N), 18 cases.
Recent works and studies

• Retuning (better stratosphere and QBO picture)
• MJO diagnostics: SL-AV is capable to predict MJO for ~3 weeks
• Coupling with NEMO ocean model successful, climate reasonable
• Study of forecasting Northern midlatitudes summer heatwaves

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• Seasonal operational forecasts with INM RAS coupled model – under evaluation
• Model uncertainties revision: only 3 parameters are perturbed now (SPP) instead of 15 in long-range forecasts version
Mechanism of soil impact on heatwave generation

(Domeisen et al., Nature 2023)
Experiments setup

• 10-member ensemble 4-month forecasts initialized 30 Apr 1991-2015 with SL-AV atmosphere model using persistent SST anomalies:
  - with ECOCLIMAP data for sand and clay percentage
  - with GSDE data for sand and clay
• Processing different ensemble size (from 4 to 12)
Monthly mean T850 anomalies of 10-member ensemble forecast for July 2010 initialized 30 Apr 2010 (all figures use the same scale)

Impact of soil composition on long-range heatwave forecast
Impact of soil composition on long-range heatwave forecast

Monthly mean H500 anomalies of 10-member ensemble forecast for July 2010 initialized 30 Apr 2010
More results

• Results are robust: the amplitude depends on ensemble size, but the sign of response remains the same.
• Similar results for heatwaves in European part of Russia 1998 and in Europe 2003.
• Response in T2m, unlike T850, is noisy
Ongoing works

• Improvement of multilayer soil, implementation of lakes in SL-AV model
• Interactive aerosols in SL-AV
• Further examination of teleconnections in SL-AV
• Operational technology for initialization of SL-AV – NEMO coupled model

Plans

• Multimodel seasonal ensemble of SL-AV coupled with NEMO and INM RAS climate model
Thank you for attention!

The part of these studies is supported with Russian RSF grant 21-17-00254