

New version for long-range forecast
technology at Hydrometcentre of
Russia based on SL-AV model
Новая версия технологии ДПП в
Гидрометцентре России на основе
модели ПЛАВ

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Seasonal version of SL-AV model at Hydrometcentre of Russia

- Semi-implicit semi-Lagrangian vorticity-divergence dynamical core of own development (Tolstykh 2010), mostly ALADIN/LACE parameterizations.
- Current version: Resolution 1.4x1.125 degrees lon/lat, 28 levels.
- Contributes to APCC multimodel ensemble, S2S project
- *Changes in 2017:*
 - *More accurate sea ice account*
 - *Some improvements in deep convection parameterization*
 - *Some bugfixes*



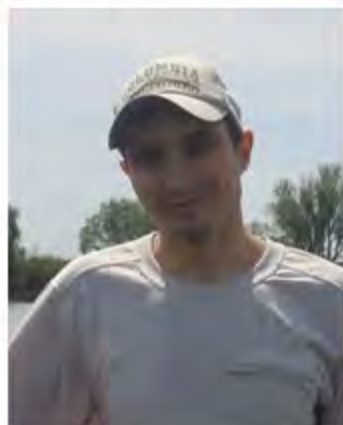
Глобальная полулагранжева модель атмосферы ПЛАВ

(ПолуЛагранжева, на основе уравнения
Абсолютной Завихренности)

<http://nwplab.inm.ras.ru>



Над развитием модели работают:



Защищено 3 кандидатские диссертации,
готовятся еще 4.

Дипломы 2 студентов ВМК МГУ,
2 студентов МФТИ и 1 студента МЭИ.

- “To improve forecast skill and understanding on the sub-seasonal to seasonal timescale with special emphasis on high-impact weather events”
- “To promote the initiative’s uptake by operational centres and exploitation by the applications community”
- “To capitalize on the expertise of the weather and climate research communities to address issues of importance to the Global Framework for Climate Services”

Наши долгосрочные прогнозы (HMCR) на сайте S2S

Файл Правка Вид Журнал Закладки Инструменты Справка

S2S, Realtime, Instantaneo... x +

apps.ecmwf.int/datasets/data/s2s/origin=rums/levtype=sfc/type=cf

Home My room Contact Search ECMWF Log in

About Forecasts Computing Research Learning

S2S sets

- Real time
- Reforecasts

Origin

- BoM
- CMA
- ECMWF
- HMCR**
- JMA
- Météo France
- NCEP

Statistical process

- Real time instantaneous and accumulated
- Real time daily averaged

Type of level

- Potential temperature
- Pressure levels
- Surface**

Type

- Control forecast**
- Perturbed forecast

S2S, Realtime, Instantaneous and Accumulated

Please **login** before retrieving data from this dataserver.

This dataset is available Wednesdays. [read more](#)

Select date

Select a date in the interval 2015-01-07 to 2015-09-09

Start date: End date:

[Reset](#)

Select a list of months

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

2015

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

[Select All](#) or [Clear](#)

Select step

<input type="checkbox"/> 0	<input type="checkbox"/> 6	<input type="checkbox"/> 12	<input type="checkbox"/> 18	<input type="checkbox"/> 24	<input type="checkbox"/> 30	<input type="checkbox"/> 36	<input type="checkbox"/> 42	<input type="checkbox"/> 48	<input type="checkbox"/> 54	<input type="checkbox"/> 60	<input type="checkbox"/> 66	<input type="checkbox"/> 72	<input type="checkbox"/> 78	<input type="checkbox"/> 84
<input type="checkbox"/> 90	<input type="checkbox"/> 96	<input type="checkbox"/> 102	<input type="checkbox"/> 108	<input type="checkbox"/> 114	<input type="checkbox"/> 120	<input type="checkbox"/> 126	<input type="checkbox"/> 132	<input type="checkbox"/> 138	<input type="checkbox"/> 144	<input type="checkbox"/> 150	<input type="checkbox"/> 156	<input type="checkbox"/> 162	<input type="checkbox"/> 168	<input type="checkbox"/> 174
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<input type="checkbox"/> 720	<input type="checkbox"/> 726	<input type="checkbox"/> 732	<input type="checkbox"/> 738	<input type="checkbox"/> 744	<input type="checkbox"/> 750	<input type="checkbox"/> 756	<input type="checkbox"/> 762	<input type="checkbox"/> 768	<input type="checkbox"/> 774	<input type="checkbox"/> 780	<input type="checkbox"/> 786	<input type="checkbox"/> 792	<input type="checkbox"/> 798	<input type="checkbox"/> 804
<input type="checkbox"/> 810	<input type="checkbox"/> 816	<input type="checkbox"/> 822	<input type="checkbox"/> 828	<input type="checkbox"/> 834	<input type="checkbox"/> 840	<input type="checkbox"/> 846	<input type="checkbox"/> 852	<input type="checkbox"/> 858	<input type="checkbox"/> 864	<input type="checkbox"/> 870	<input type="checkbox"/> 876	<input type="checkbox"/> 882	<input type="checkbox"/> 888	<input type="checkbox"/> 894

Характеристики моделей-участниц проекта S2S

This table shows the centres that provide data to this project together with the latest configuration of their systems. Follow the link of each Data Provider for specific model description and examples of retrievals.

Status on 1st July 2015	Time range	Resolution	Ens. Size	Frequency	Re-forecasts	Rfc length	Rfc frequency	Rfc size	Volume of real-time forecast per cycle	Volume of reforecast per update
BoM (ammc)	d 0-60	T47L17	33	2/week	fix	1981-2013	6/month	33		6 TB
CMA (babj)	d 0-60	T106L40	4	daily	fix	1994-2014	daily	4		
EC (cwaao)	d 0-32	0.6x0.6 L40	21	weekly	on the fly	past 15y	weekly	4		
ECMWF (ecmf)	d 0-46	T639/319 L91	51	2/week	on the fly	past 20 years	2/week	11		
ISAC-CNR (isac)	d 0-32	0.75x0.56 L54	40	weekly	fix	1981-2010	6/month	1		
HMCR (rums)	d 0-63	1.1x1.4 L28	20	weekly	fix	1985-2010	weekly	10		
JMA (rjtd)	d 0-34	T319L60	25	2/week	fix	1981-2010	3/month	5	3.8 Gb	900 Gb
KMA (rksl)	d 0-60	N216L85	4	daily	on the fly	1996-2009	4/month	3		
Météo-France (lfpw)	d 0-61	T255L91	51	monthly	fix	1993-2014	2/monthly	15		6.75 Go/start date
NCEP (kwbc)	d 0-44	T126L64	16	daily	fix	1999-2010	day	4		
UKMO (egrr)	d 0-60	N216L85	4	daily	on the fly	1996-2009	4/month	3		

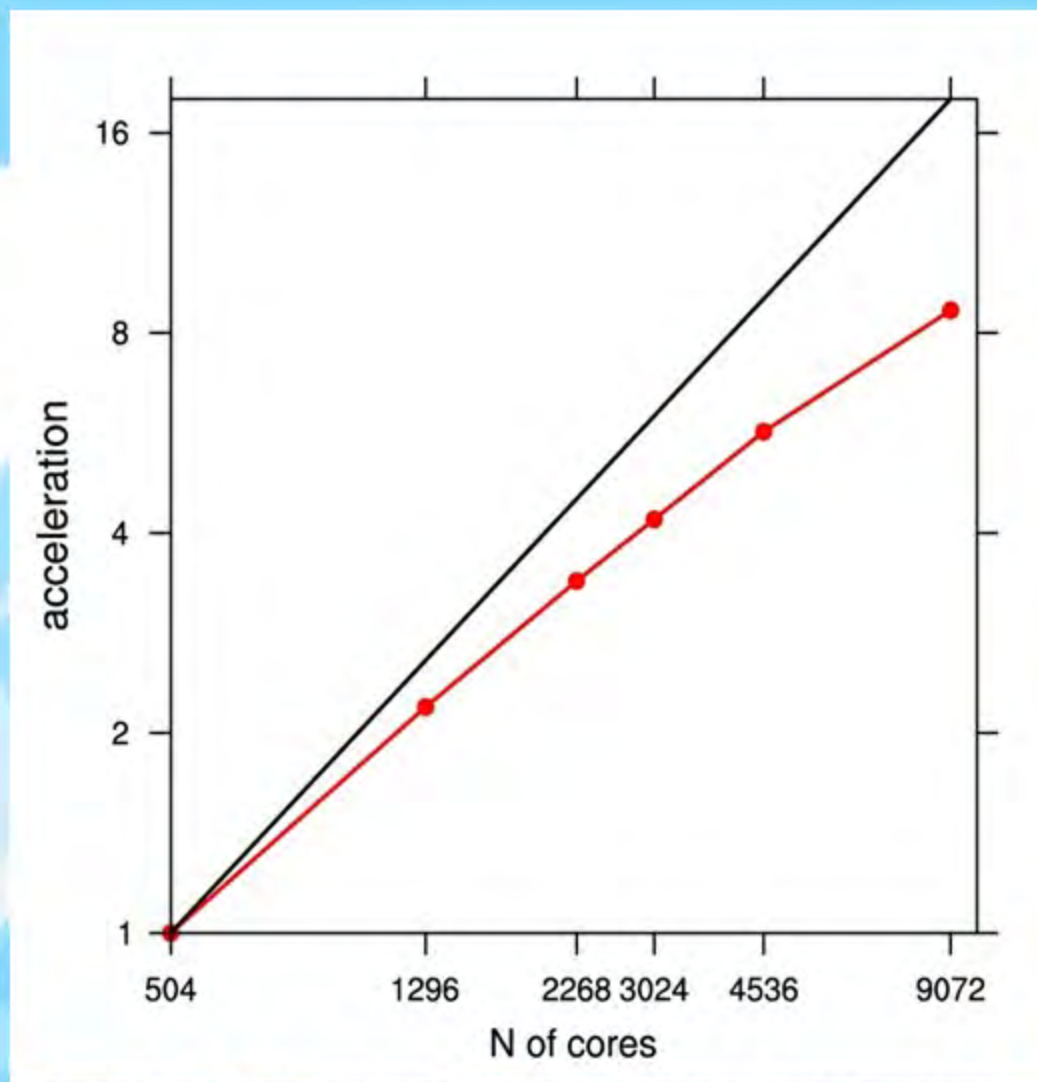
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В настоящее время, у нас 2e с конца горизонтальное и вертикальное разрешение.

New version of the model

- More accurate SW and LW radiation parameterization (CLIRAD SW + RRTM LW).
- ALARO-0 microphysics
- Increased horizontal resolution ($0.72^{\circ} \times 0.9^{\circ}$ lat-lon)
- **In 2017 – 85 vertical levels, highest at 0.5 hPa**
- INM RAS multilayer soil model (from INMCM)
- Requires new computer (expected in 03/2018)

SL-AV code parallel speedup w.r.t to 504 cores



Ускорение модели ПЛАВ на традиционных системах по отношению к времени расчета на 504 ядрах.

Development of SL-AV model (2015-2016)

- Coupling to the INMIO ocean model
- Update of longwave radiation scheme to RRTMG LW v4.85
- Introducing new parameterizations:
INM RAS multilayer soil model, marine stratocumulus, sea-ice temperature.
- Complex tuning for all parameterizations

Потоки тепла в атмосфере и их интегральные осредненные за год значения, рекомендованные IPCC (Вт/м²).

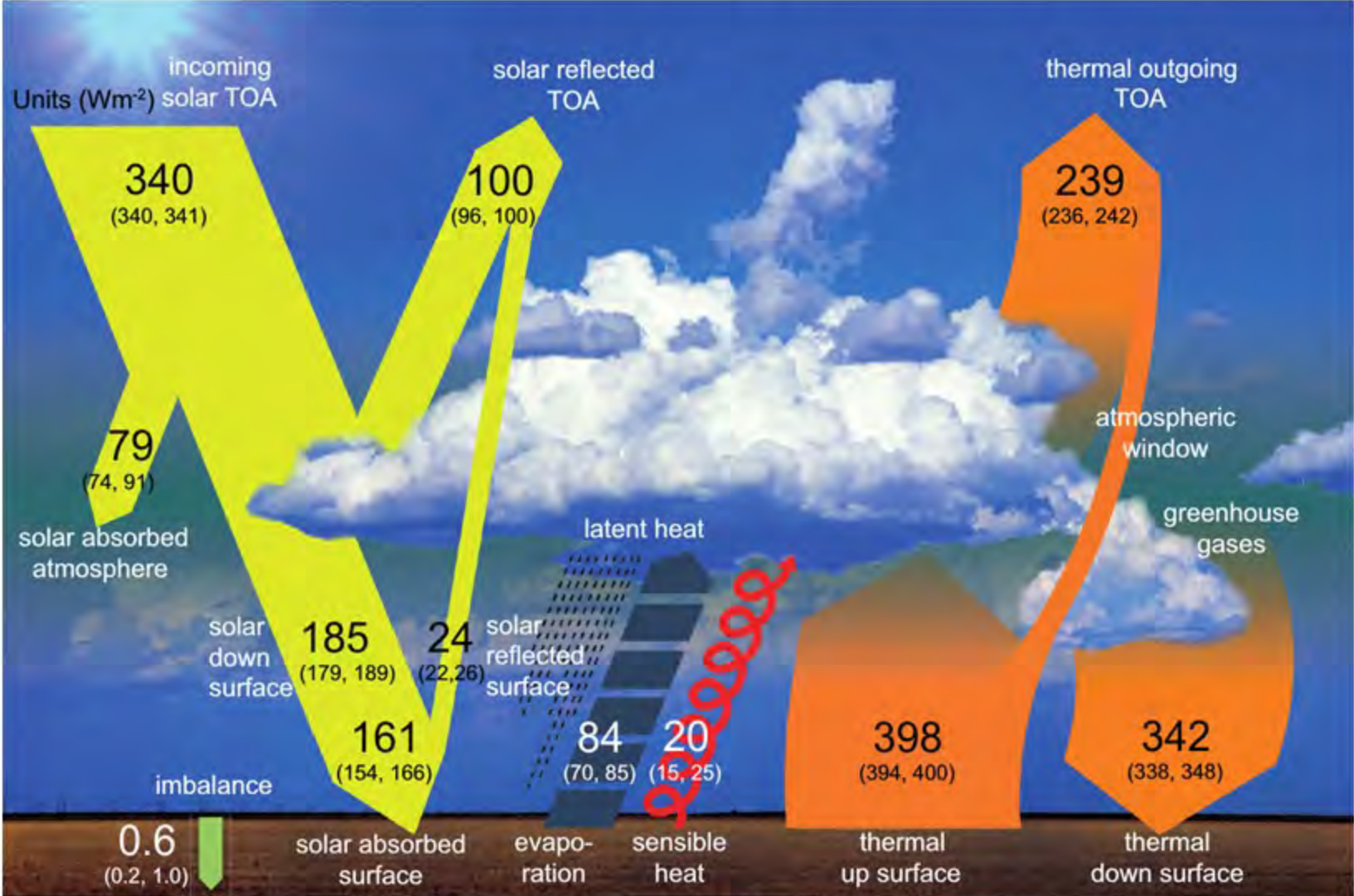
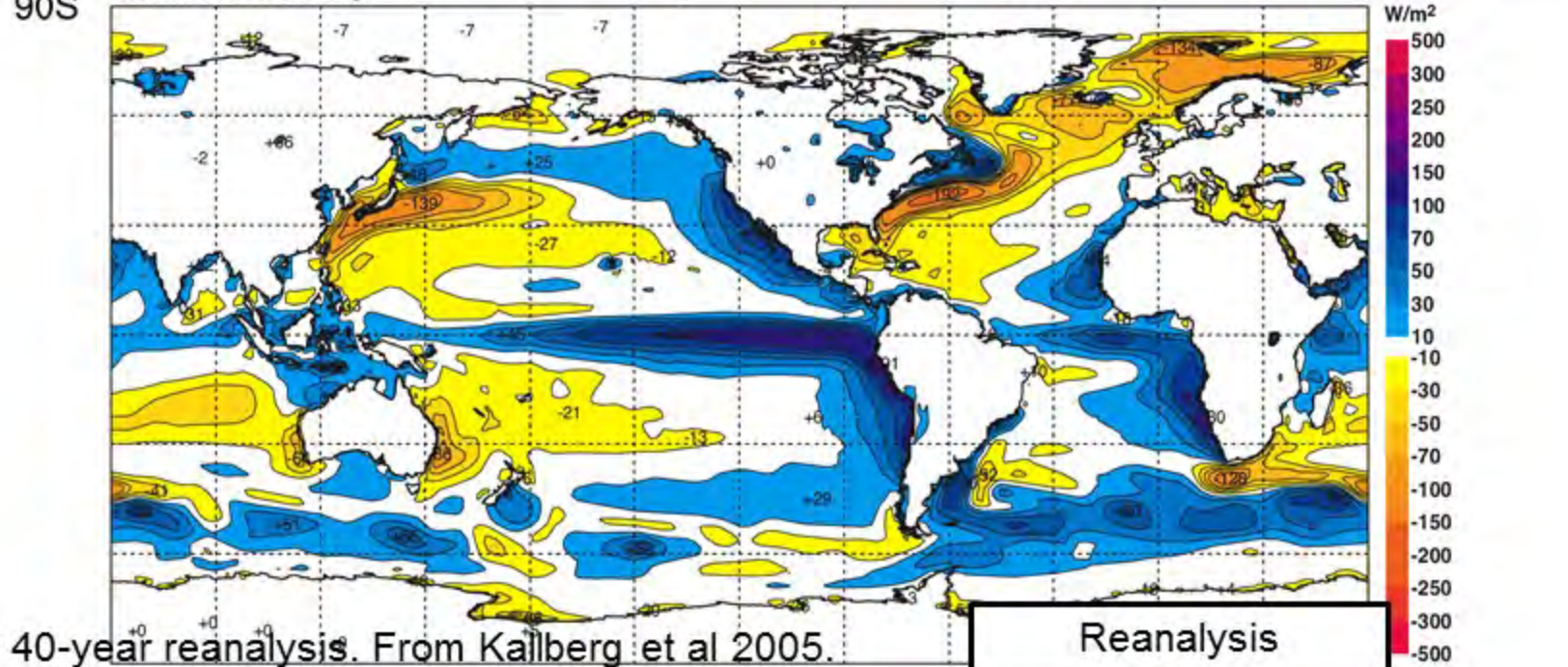
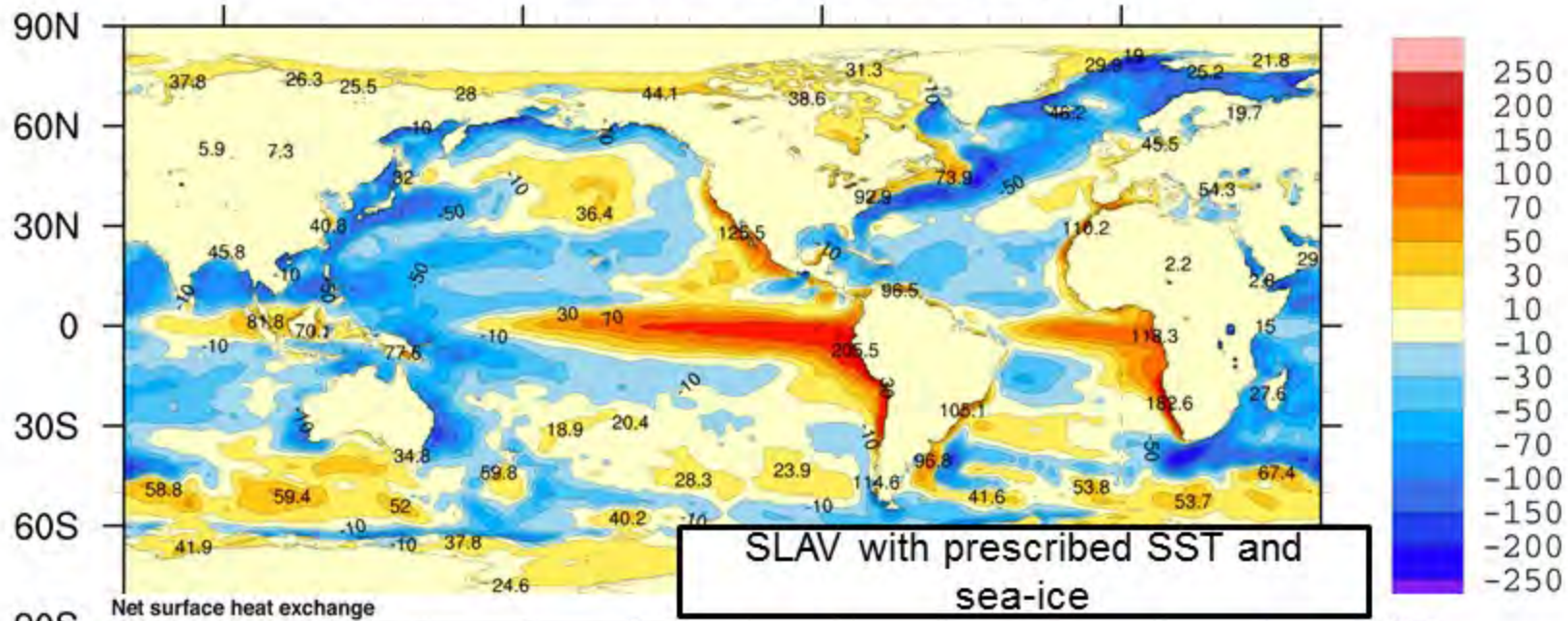


Image: IPCC Fifth Assessment Report (AR5). Climate Change 2013: The Physical Science Basis // <http://www.ipcc.ch/report/ar5/wg1>.

Components of the heat balance (Wm⁻²)

Title	IPCC data (range, abs values)	IPCC data (recommend ed values)	Model with prescribed ocean	Coupled model
Top downward solar radiation	340-:-341	341.3	341.6	341.6
Top upward solar radiation	96-:-100	100	109.3	107.1
Top outgoing longwave radiation	-(236-:-242)	-239	-232.4	-234.6
Solar radiation absorbed by the surface	154-:-166	161	164.9	165,5
LW radiation surface balance	-(54-:-58)	-56	-60.5	-60.4
Surface sensible heat flux	-(15-:-25)	-20	-17.9	-21.8
Surface latent heat flux	-(70-:-85)	-84	-86.4	-83.9
Surface heat balance	-	1	0.1	-0.6

Mean annual surface heat flux (W/m^2)



Successes and drawbacks of the model (January 2017 r)

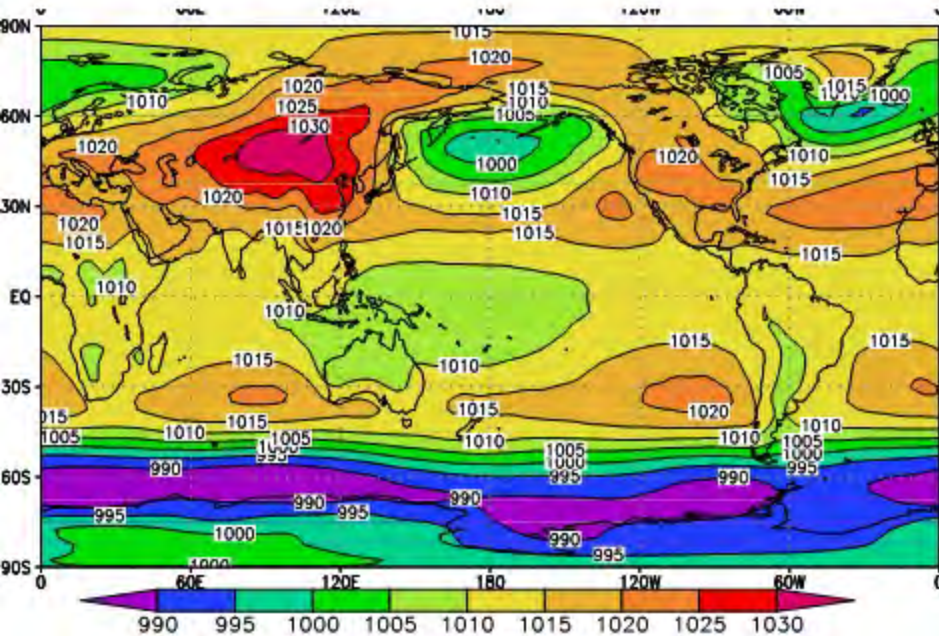
- ✓ Surface heat flux (balance and components)
- ✓ Vertical distribution of clouds (almost)
- ✓ Seasonal variations
- - High annual mean average precip (3.7 instead of 2.9), wide ITCZ
- - Low sea level pressure in tropics

Development of SL-AV model in 2017

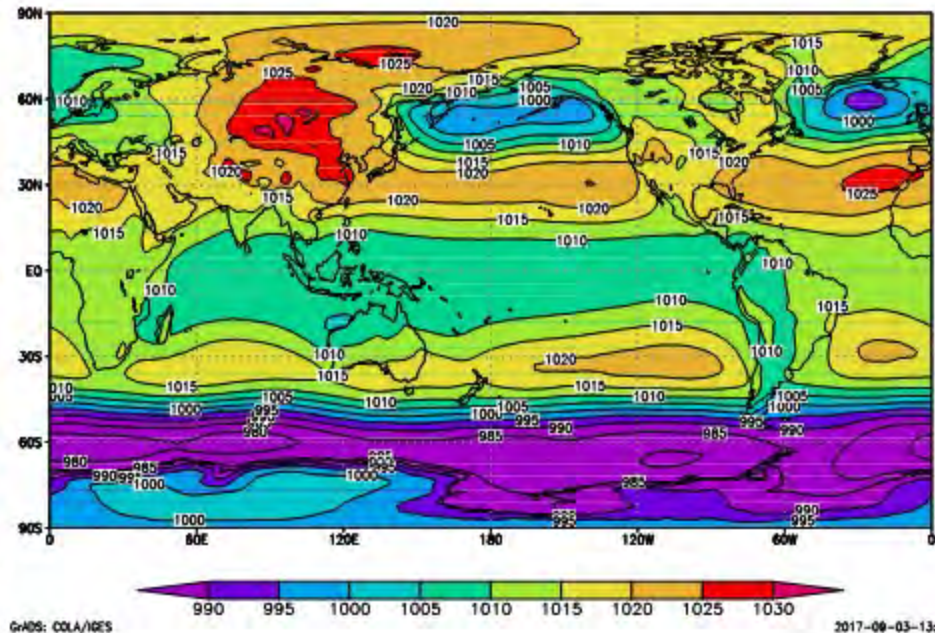
- Further improvements in deep convection parameterization
- New shallow convection scheme (mass-flux based)
- Some improvements of cloudiness and microphysics.
- New boundary layer parameterization.

Mean January 1979-1983 MSLP field after model improvements

ERA

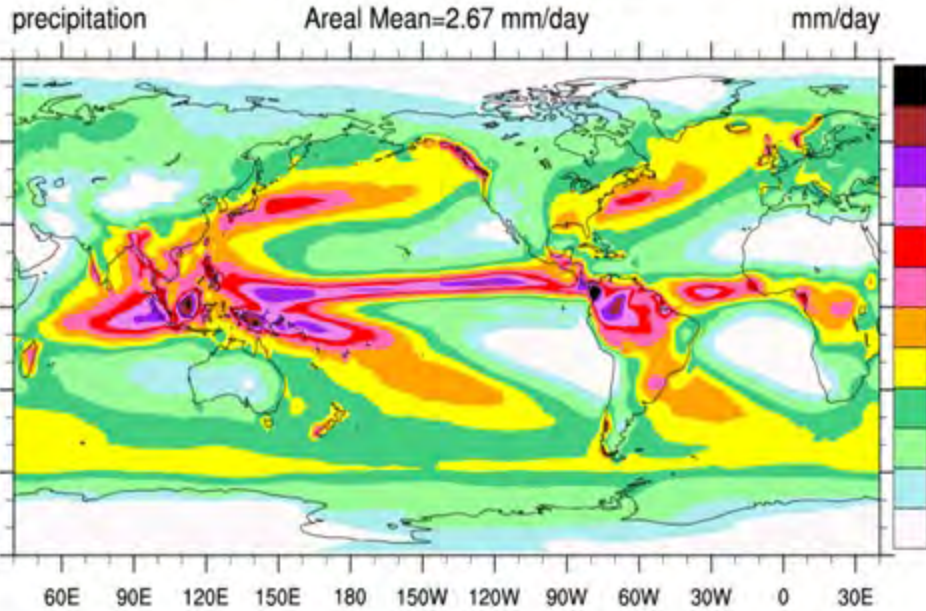


SL-AV , 28 levels

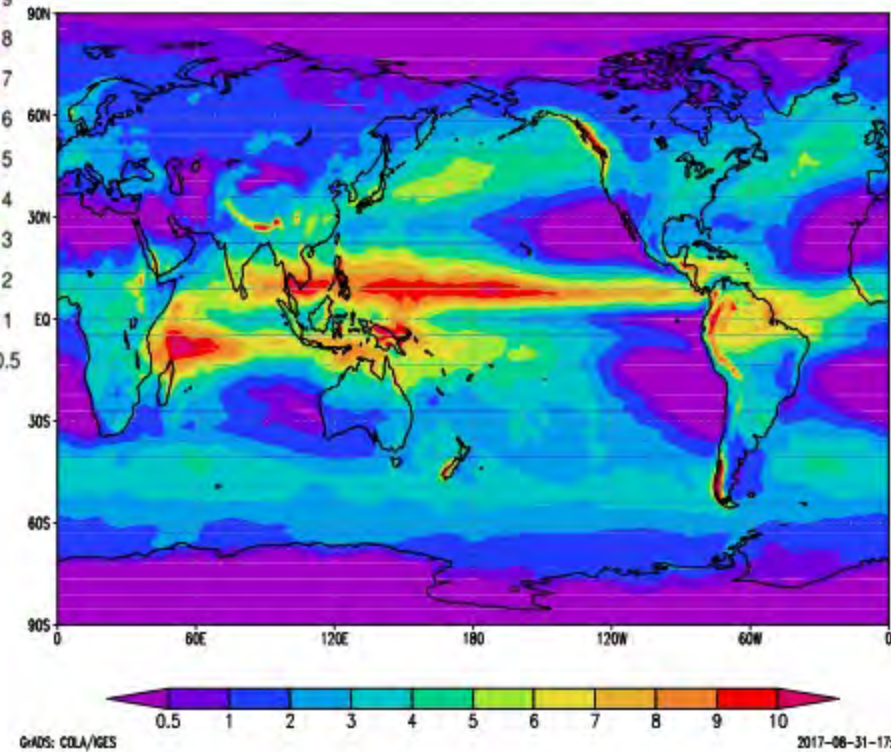


Mean annual precipitation after model improvements

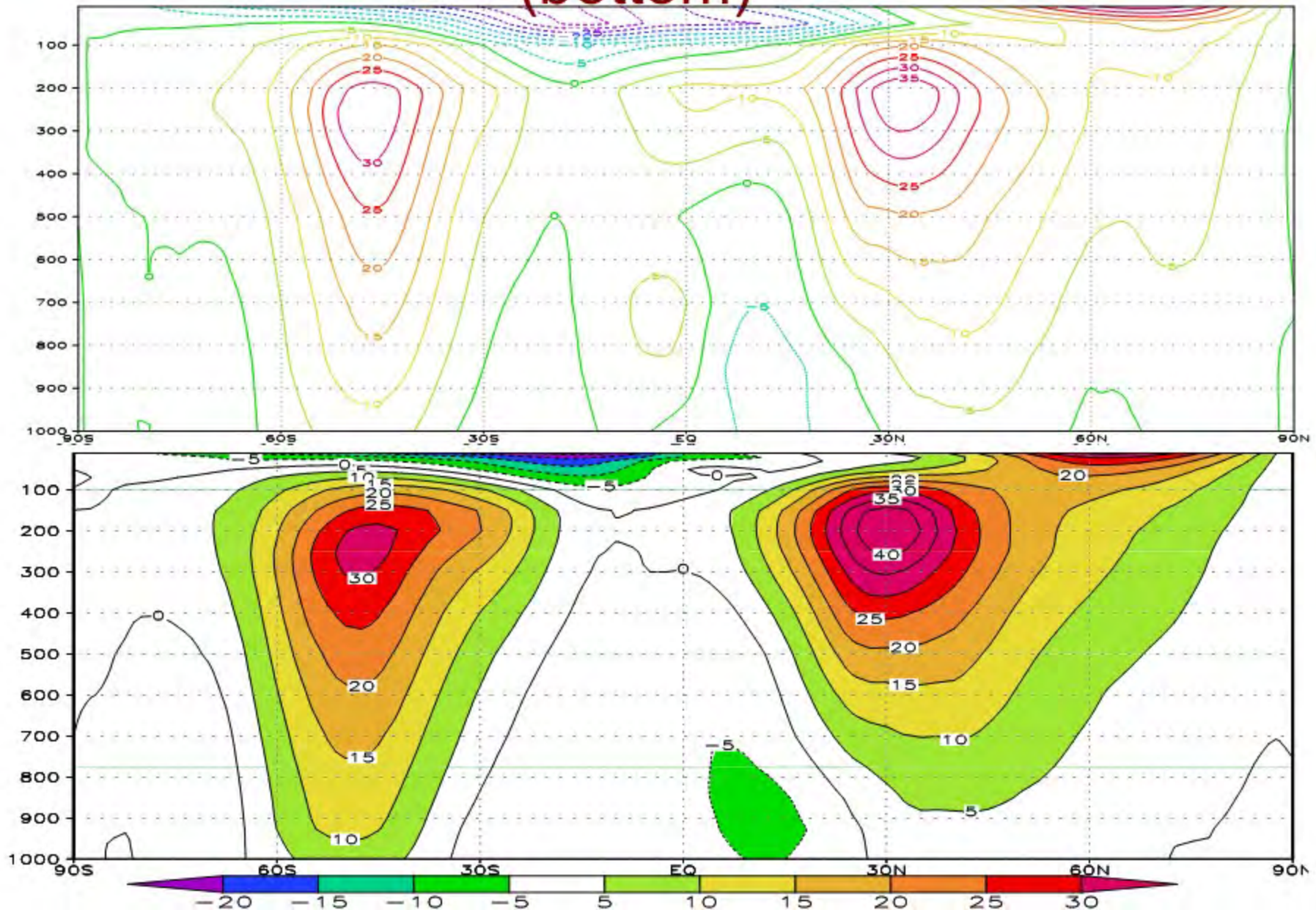
TRMM GPCP: 1979-2010



Annual mean = 2.99 mm/day

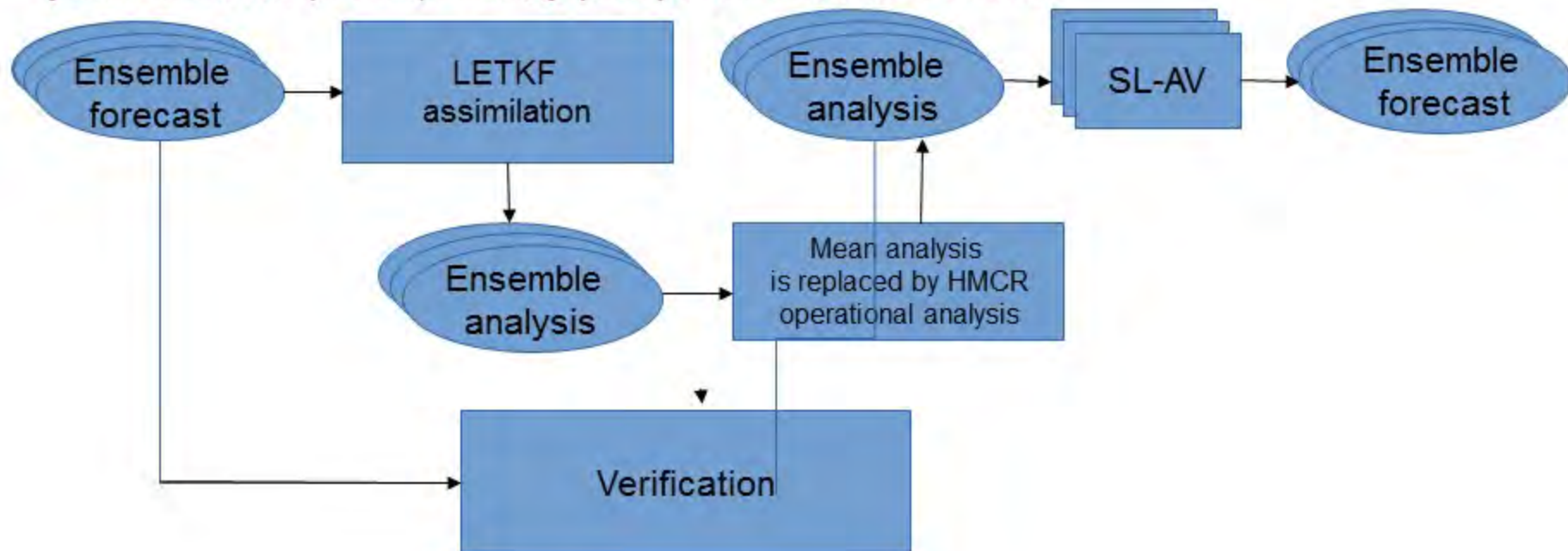


Mean January zonal wind: model (top), ERA (bottom)



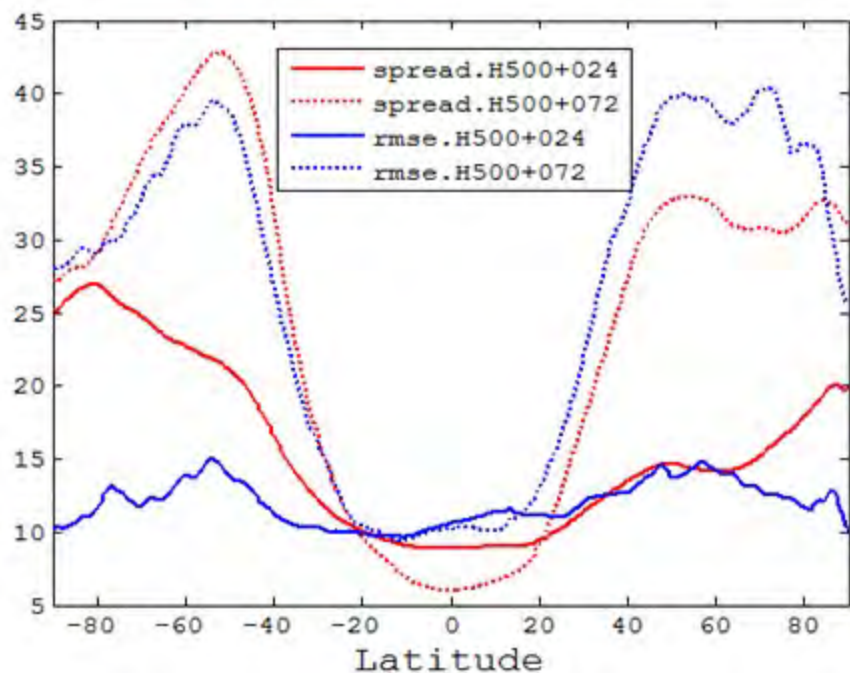
New system for generating initial data ensemble (LETKF+ SL-AV + operational analysis)

- Для повышения точности заменяем средний анализ, полученный LETKF, на оперативный анализ Гидрометцентра. (Большая часть спутниковых наблюдений пока не усваивается LETKF.)
- Это позволяет уменьшить СКО среднего по ансамблю прогноза, при этом увеличивается разница между разбросом ансамбля и СКО.

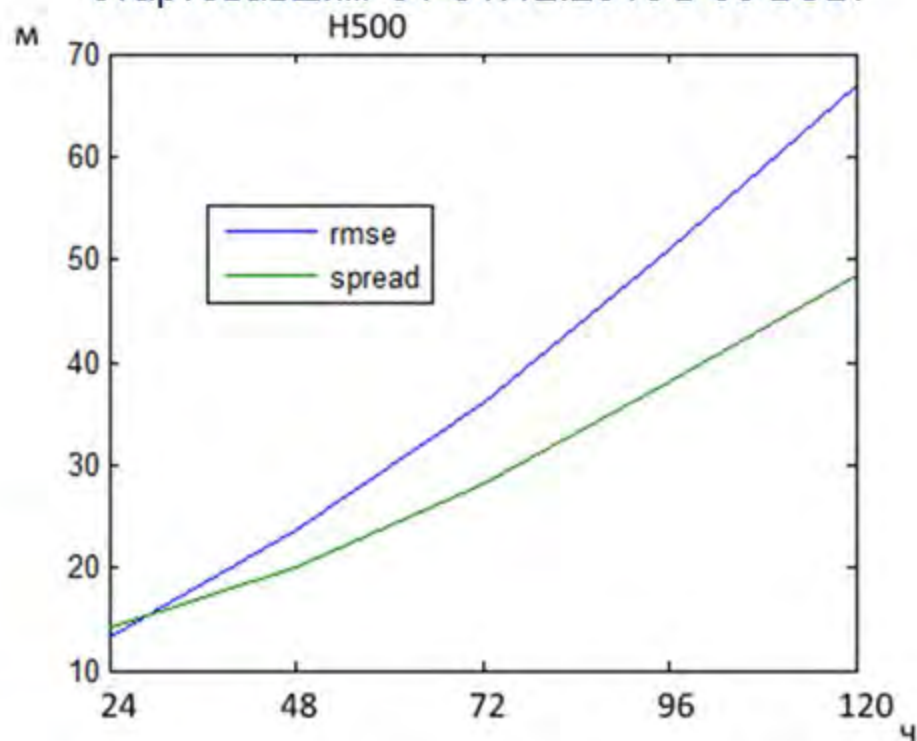


RMS errors vs spread in new ensemble generating system

Разбросы ансамблей (красным) и RMSE (синим) H500 для заблаговременности 24 часа (сплошные линии) и 72 часа (пунктирные линии) в зависимости от широты. Усреднение по прогнозам стартовавшим 01-31.12.2016 в 00 ВСВ.



Разброс ансамбля и среднекв. ошибка среднего по ансамблю прогноза в Северном полушарии (20° – 90° с.ш.) для поля H500 в зависимости от заблаговременности прогноза. Усреднение по прогнозам стартовавшим 01-31.12.2016 в 00 ВСВ.



Plans

- After finalising tuning at AMIP2 for 85-level version, run seasonal hindcasts.
- Switch to LETKF-based ensemble generation system.
- Hindcasts for the coupled SL-AV - INMIO – CICE model.
- Switch to new version in operations
- Trying decadal prediction

Thank you for attention!