

Long-Range Forecasting at Climate Prediction Center

Выпуск долгосрочных прогнозов в Центре по предсказанию климата

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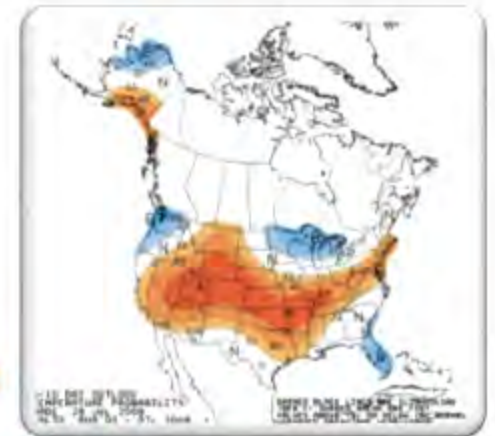
Outline **План доклада**

- Climate Prediction Center overview **Общие сведения о ЦПК**
 - Methods for making seasonal outlooks **Методы сезонного прогнозирования**
 - CPC's seasonal outlooks **Сезонные прогнозы ЦПК**
 - Other climate watches and seasonal outlooks from CPC
- Другие климатические и сезонные прогнозы ЦПК**
- Summary **Выводы**



Climate Prediction Center (CPC) Центр по предсказанию климата (ЦПК)

- Mission : CPC delivers real-time products and information that predict and describe climate variations on timescales from weeks to years... Миссия: ЦПК предоставляет продукты и информацию в реальном времени которые описывают и прогнозируют изменения климата в масштабах от недель до лет
- Primary activities Основная деятельность
 - Real-time climate monitoring Мониторинг климата
 - Extended-range predictions Прогнозы на увеличенные сроки
 - Applied research and development Прикладные исследования
 - Outreach and capacity building Просвещение общественности и повышение кадрового потенциала



Real-time climate monitoring at CPC

Мониторинг климата в реальном времени в ЦПК

- Real-time climate monitoring is an integral part of the CPC's activities **Мониторинг климата в реальном времени**

- Oceans – ENSO, ocean heat content... **ЭНЮК, теплосодержание океана**

- Surface – soil moisture, surface temperature, precipitation... **Влажность почвы, температура, осадки**

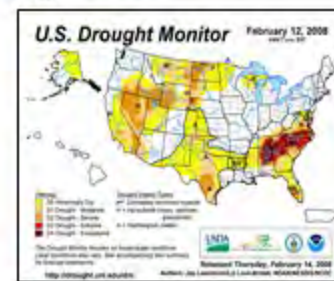
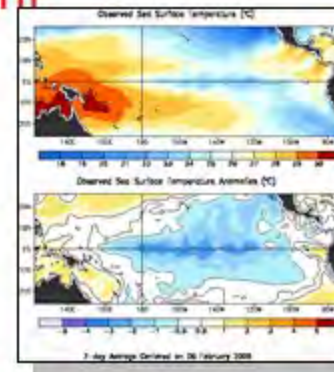
- Troposphere – modes of variability (MJO, blocking, PNA, NAO...), temperature, heights...

Тропосфера – моды изменчивости

- Stratosphere **Стратосфера**

- Monthly briefings – monsoons, drought, ocean, climate attribution

Ежемесячные брифинги – муссоны, засухи, океан, причины изменений климата



Extended-range predictions at CPC

Прогноз на увеличенные сроки в КПЦ

- Weeks, months, seasons (i.e. short term climate)

Недели, месяцы, сезоны (т.е. климат в ближайшей перспективе)

6-10 Day & 8-14 Day Precipitation & Temperature Outlooks

6-10 дней & 8-14 дней осадки & температура

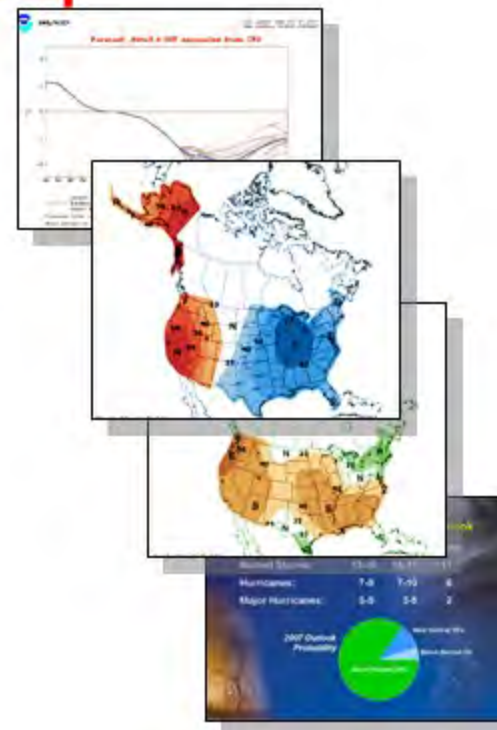
- Day 3-14 Hazards Outlooks (US, Global Tropics)

Прогноз опасных явлений на 3-14 дней (США, тропики по глобусу)

Monthly & Seasonal Precipitation & Temperature Outlooks

Месячные и сезонные прогнозы температуры и осадков

- Seasonal Drought Outlook **Сезонные прогнозы засух**
- Seasonal Hurricane Outlooks **Сезонные прогнозы ураганов (Атлантика, Тихий океан)**
- ENSO Prediction **Прогноз ЭНЮК**



What makes seasonal outlook feasible?

Что позволяет нам разработать сезонные прогнозы?

- Year-to-year changes in slowly evolving boundary conditions(SST, soil moisture, snow...) influence local and remote climate variability.

Относительно медленные изменений граничных условий

- An example of local influence
 - Drier soil moisture conditions lead to warmer surface temperature
 - Локальные обратные связи - например, сухость почвы приводит к более высоким температурам поверхности
- The largest contributor to our ability to make seasonal outlooks is the slowly evolving sea surface temperature (SST) conditions, particularly those related to ENSO. Главным средством является медленно меняющаяся ТПО
- Climate trends can also provide useful guidance Климатические тренды также информативны

Methods for generating seasonal outlooks (1)

Методы сезонного прогноза (1)

- Empirical prediction tools Эмпирические инструменты прогноза

- Advantages **Преимущества**

- Developed based on historical observations

Основаны на исторических данных

- Unbiased **Нет систематических ошибок**

- Simple and computationally efficient

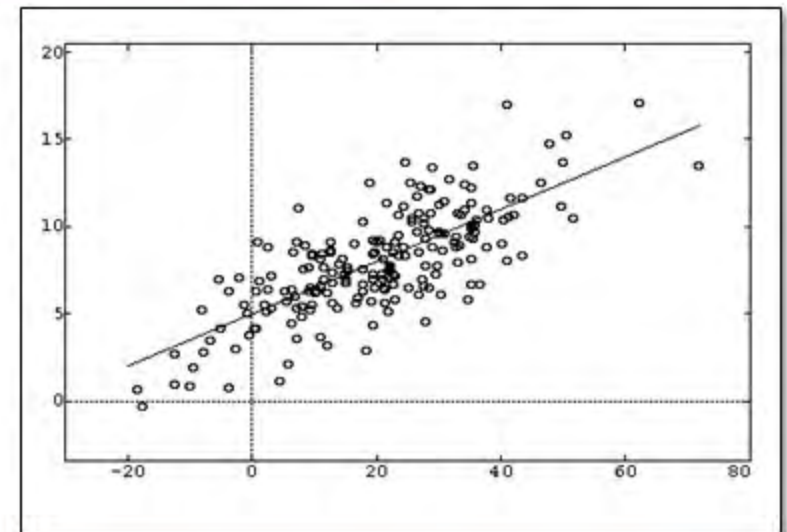
Простота и вычислительная эффективность

- Disadvantages **Недостатки**

- Limited by observational data **Зависят от ограниченных данных наблюдений**

- Mostly depend on linear relationships **Учитывают, в основном, линейные связи**

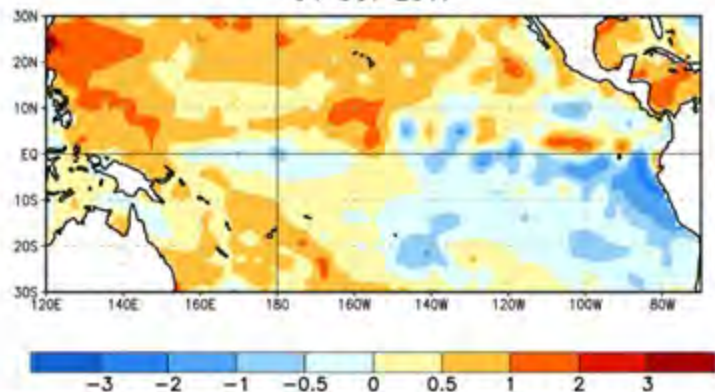
- Non-stationarity in climate is hard to include **Трудно учесть нестационарность климата**



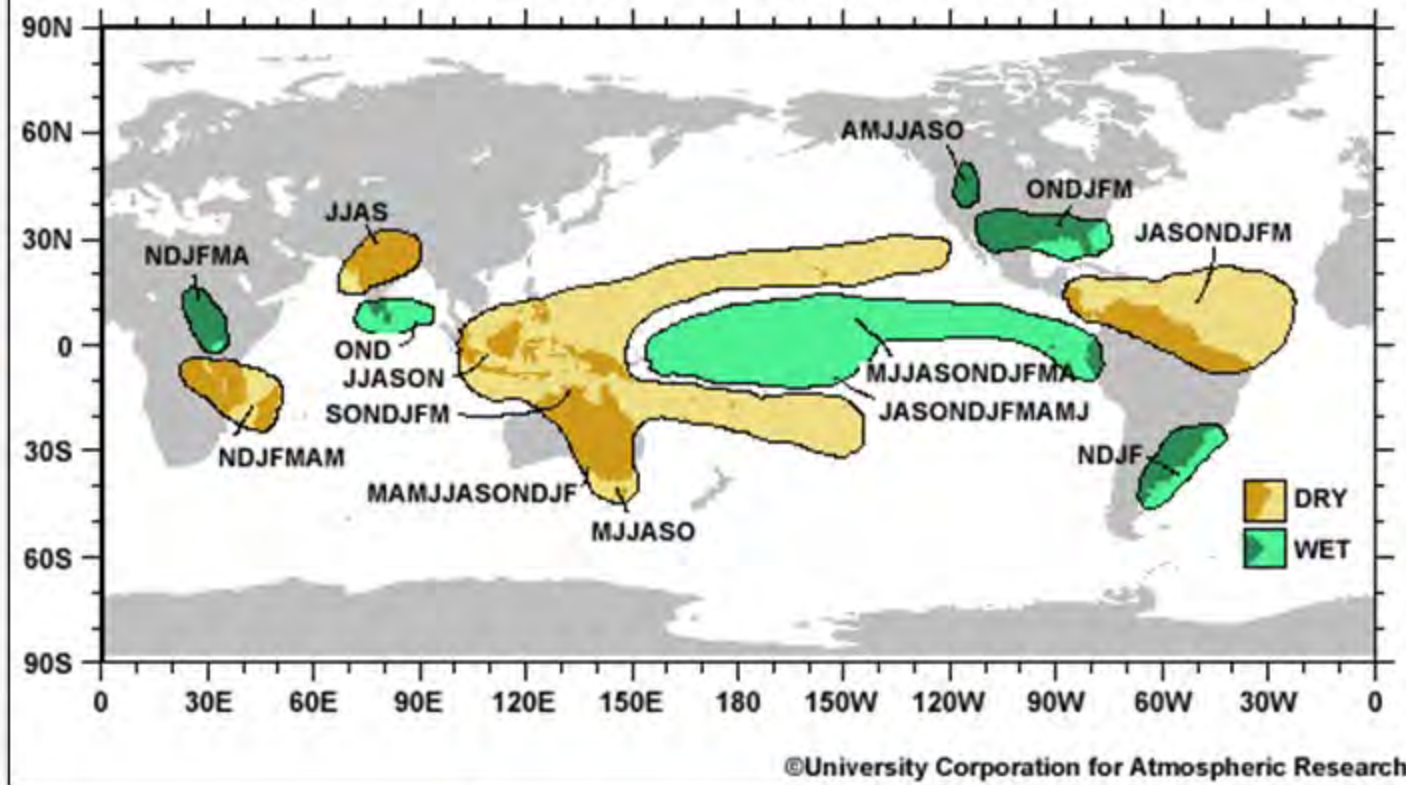
Крупномасштабное влияние ЭНЮК на осадки

ENSO

SST Anomalies (°C)
04 OCT 2017



Large-Scale Precipitation Anomalies Associated with ENSO Events



ENSO Influence

Methods for generating seasonal outlooks (2)

Методы сезонного прогноза (2)

- Dynamical Prediction Tools Динамические методы прогноза

- Advantages Преимущества

- Non-linearity and non-stationarity is not an issue

Нелинейность и нестационарность – не проблема

- Easier to infer probabilities for various seasonal mean outcomes Легче использовать вероятностный подход

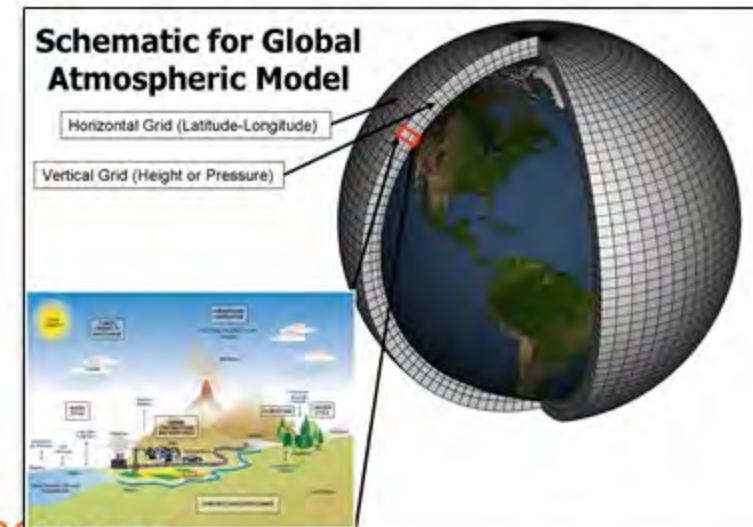
- Easier to handle unprecedented situations

Легче анализировать ситуации, не имевшие аналогов в прошлом

- Disadvantages Недостатки

- Computationally expensive and require a large infrastructure Требуются большие вычислительные ресурсы

- Forecast systems have biases that requires special attention Систематические ошибки

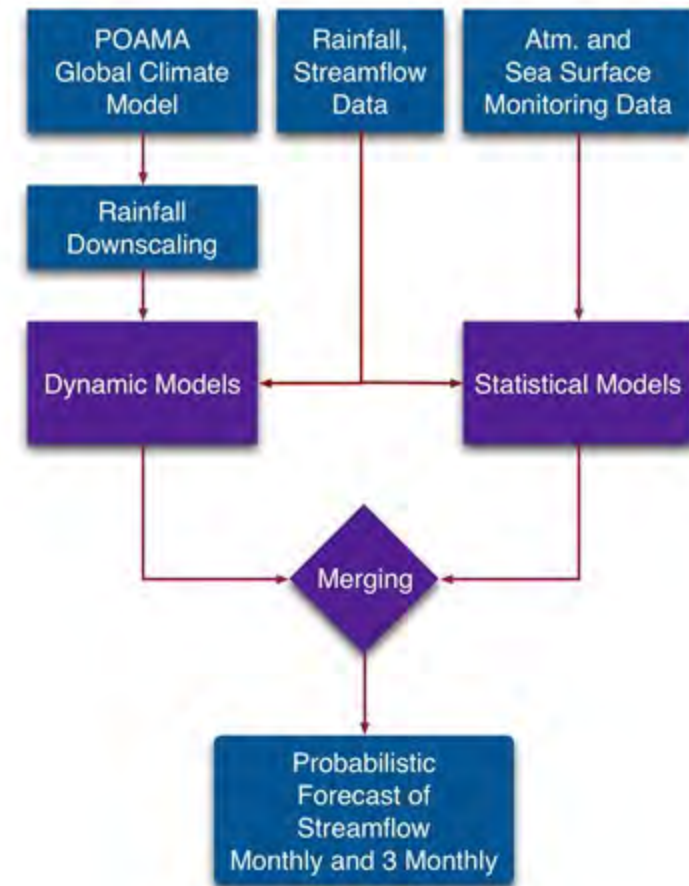


Methods for generating seasonal outlooks (3)

Методы сезонного прогноза (3)

- Properties of empirical and dynamical prediction tools are complementary, and in general, and generally both are used in the development of final seasonal outlook

Эмпирические и динамические средства прогноза дополняют друг друга и используются совместно



CPC's seasonal outlook process (1)

Процесс составления прогноза в ЦПК (1)

- The outlook is based on guidance from many different prediction tools (both empirical and dynamical). **Используются различные инструменты**
- An objective (skill based) consolidation of various tools provides the first guess for the seasonal outlook. **Объективная оценка различных прогнозов**
- Discussion of various tools (somewhat similar to the Climate Outlook Forums) **Обсуждение различных прогнозов**
- Final seasonal outlook released to the public ~ 15 of the calendar month and is associated with a text discussion **Выпуск сезонного прогноза и обсуждение с общественностью**
- Seasonal outlook is updated once a month **Ежемесячные корректировки прогноза**
- Verifications are an integral part of the seasonal outlook process **Верификация – важная часть процедуры**
- Operational since January 2015 **Операционный режим с января 2015 г**

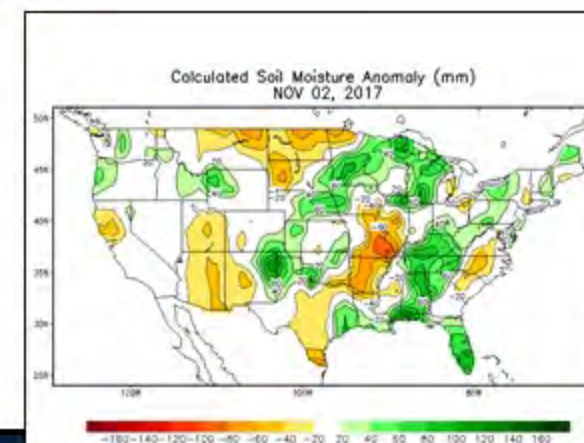
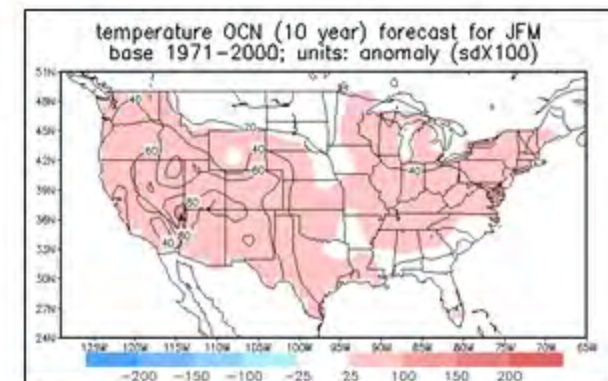
CPC's seasonal outlook process (2)

Процесс составления прогноза в ЦПК (2)

- Empirical prediction tools **Эмпирические**

- инструменты прогноза**

- ENSO composites **Композиты ЭНЮК**
- Recent trends (relative to 30-year climatology) **Тренды**
- Canonical correlation analysis (CCA) **Канонические корреляции**
- Multiple linear regression (MLR) **Множественная линейная регрессия**
- Constructed analog (CA) **Построение аналогов**



CPC's seasonal outlook process (3)

Процесс составления прогноза в ЦПК (3)

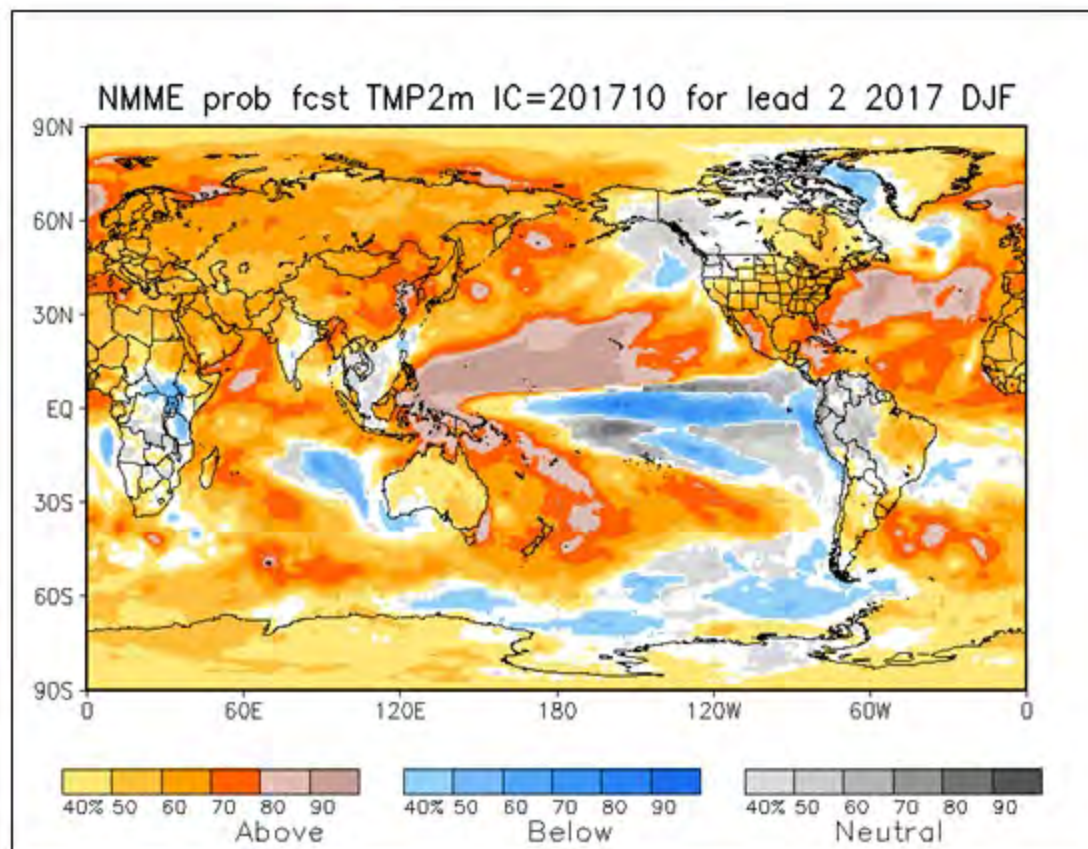
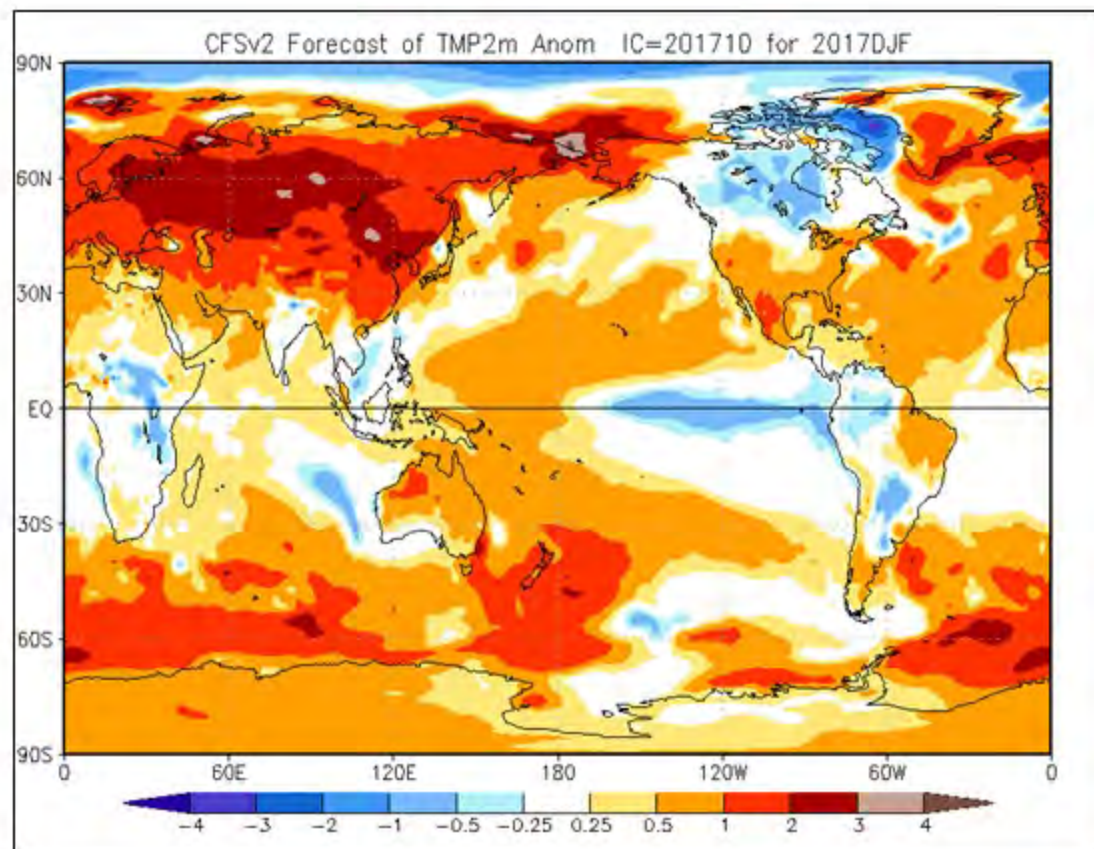
- Dynamical prediction tools **Динамические средства прогнозирования**
 - NCEP's Climate Forecast System v2 (CFSv2)
 - North American Multi-Model Ensemble (NMME)
 - Seasonal forecasts from six different dynamical models that exist across various institutions in North America
 - Seasonal forecasts from WMO's Global Producing Centers (GPCs) for Long-range forecasts
 - 13 GPC-LRF
 - One lead center to facilitate the exchange and coordination of data among GPCs

Model Based DJF 17/18 Surface Temperature Forecast

Модельный прогноз температуры на зиму 17/18

CFSv2

NMME



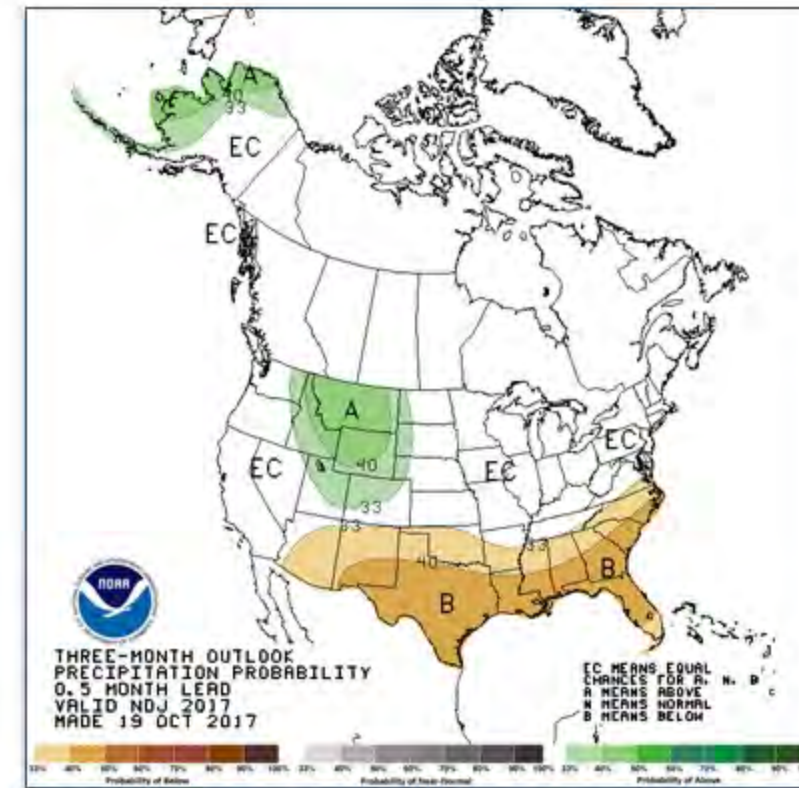
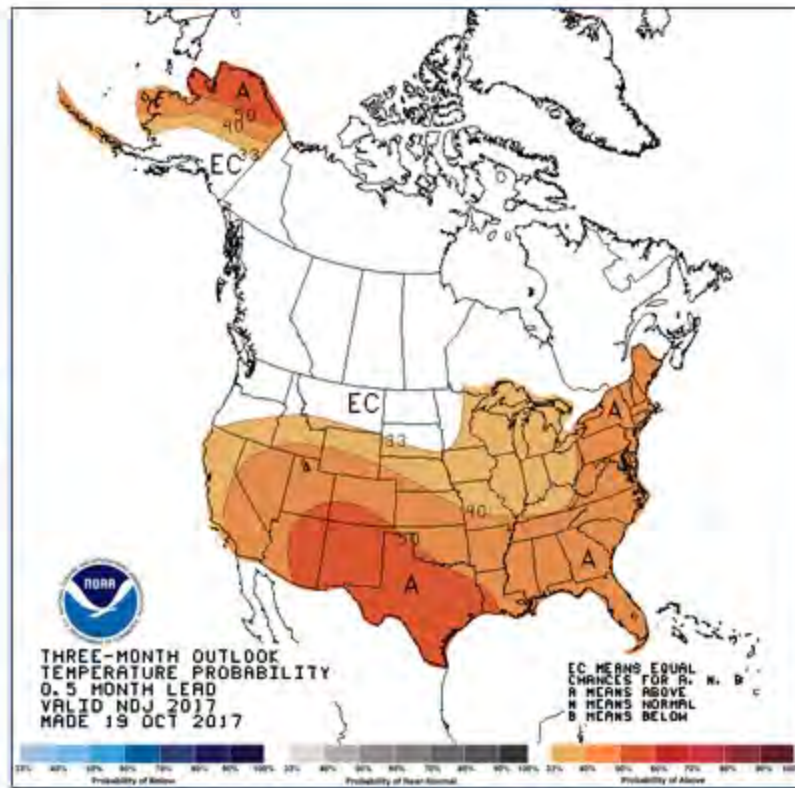
An example of CPC's seasonal outlook

Пример сезонного прогноза ЦПК

Temperature

Precipitation

NDJ 17/18



Seasonal Outlook: Prognostic Discussion

Сезонный прогноз – прогностическая дискуссия

National Weather Service
Climate Prediction Center

[Site Map](#) [News](#)

[HOME](#) > [Outlook Maps](#) > [Seasonal Forecast Discussion](#)

PROGNOSTIC DISCUSSION FOR LONG-LEAD SEASONAL OUTLOOKS
NWS CLIMATE PREDICTION CENTER COLLEGE PARK MD
830 AM EDT THU OCT 19 2017

SUMMARY OF THE OUTLOOK FOR NON-TECHNICAL USERS

THE NOVEMBER-DECEMBER-JANUARY (NDJ) 2017-18 OUTLOOK FAVORS ABOVE NORMAL TEMPERATURES FOR THE MAJORITY OF THE FORECAST DOMAIN, INCLUDING MUCH OF ALASKA. THE HIGHEST PROBABILITIES FOR ELEVATED ODDS OF WARMER THAN NORMAL TEMPERATURES ARE LOCATED ACROSS PORTIONS OF THE SOUTHWEST AND TEXAS. DURING THE WINTER MONTHS THROUGH FEBRUARY-MARCH-APRIL (FMA) 2018 SEASON, ENHANCED ODDS FOR BELOW NORMAL TEMPERATURES ARE HIGHLIGHTED IN VARYING AREAS OF THE NORTHERN CONUS, SOUTHEAST ALASKA AND THE ALASKA PANHANDLE, WHILE ABOVE NORMAL TEMPERATURES REMAIN FAVORED FOR MUCH OF THE WESTERN AND SOUTHERN CONUS, AND NORTHERN ALASKA.

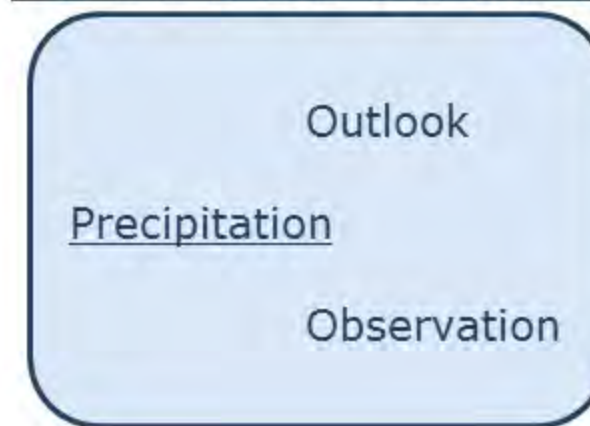
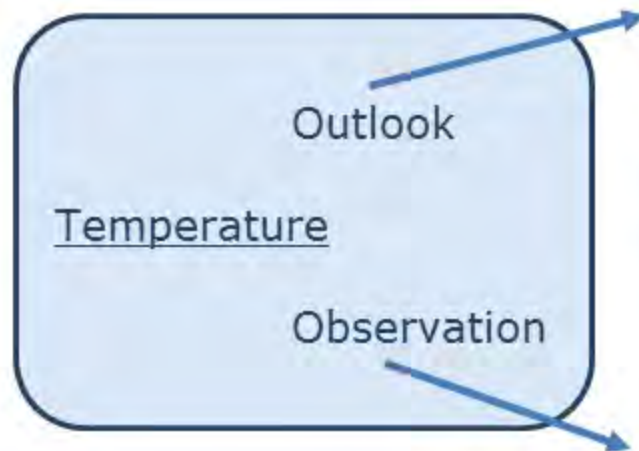
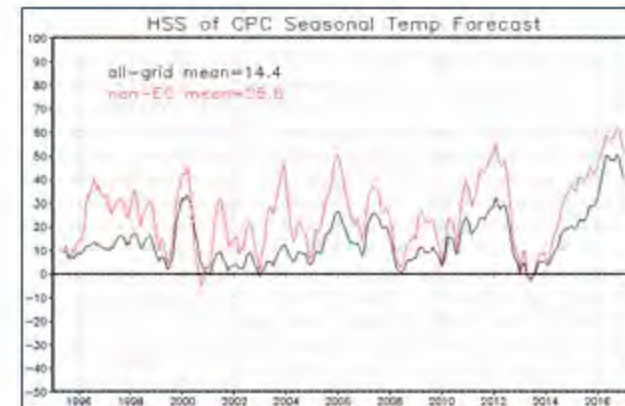
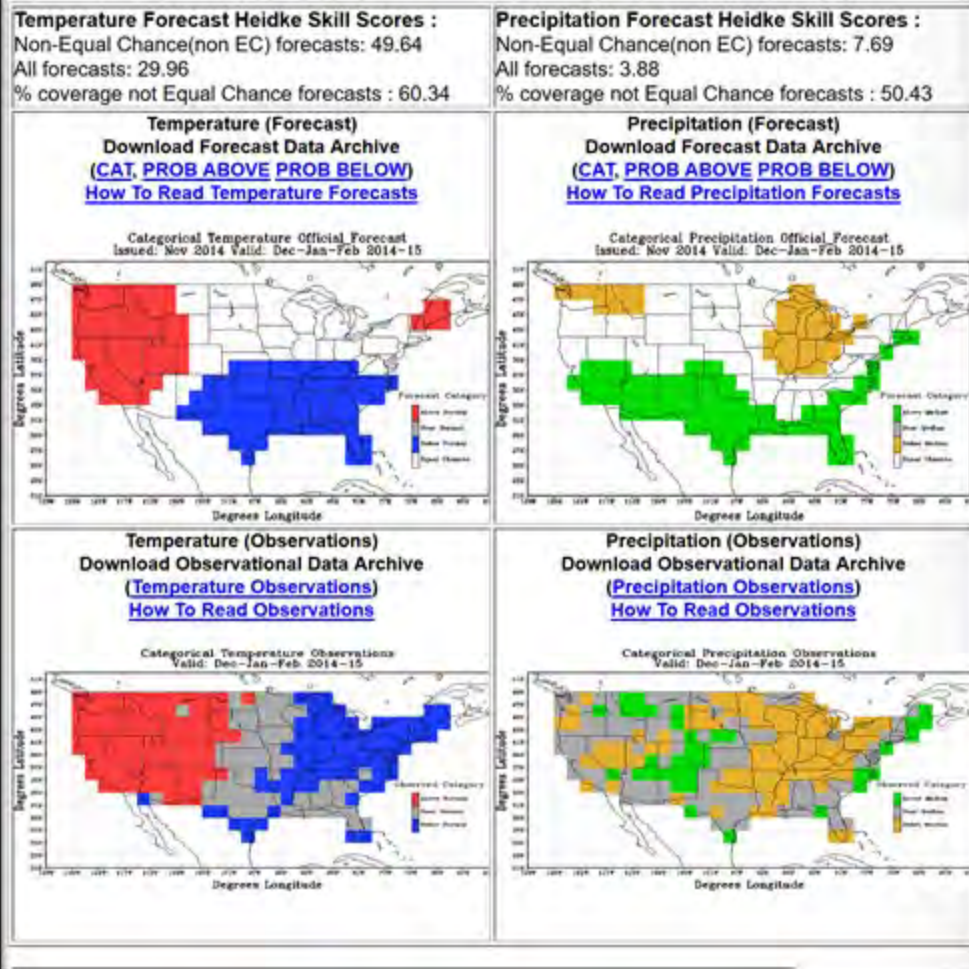
THE NDJ 2017-18 PRECIPITATION OUTLOOK INDICATES INCREASED CHANCES OF ABOVE NORMAL PRECIPITATION FOR WESTERN AND NORTHERN ALASKA, AS WELL AS AREAS OF THE NORTHERN AND CENTRAL ROCKIES. DURING NDJ 2017-18, BELOW NORMAL PRECIPITATION IS FAVORED ALONG THE SOUTHERN TIER OF THE CONUS, EXCLUDING SOUTHERN CALIFORNIA. AS WE MOVE THROUGH THE WINTER SEASON, ELEVATED ODDS FOR ABOVE NORMAL PRECIPITATION

- Summary of outlook
- Current atmospheric/ocean conditions
- Prognostic discussion of SSTs
- Prognostics tools used in the outlook
- Prognostic discussion of outlooks
 - ❖ Temperature
 - ❖ Precipitation

Seasonal outlook verification

Верификация сезонного прогноза

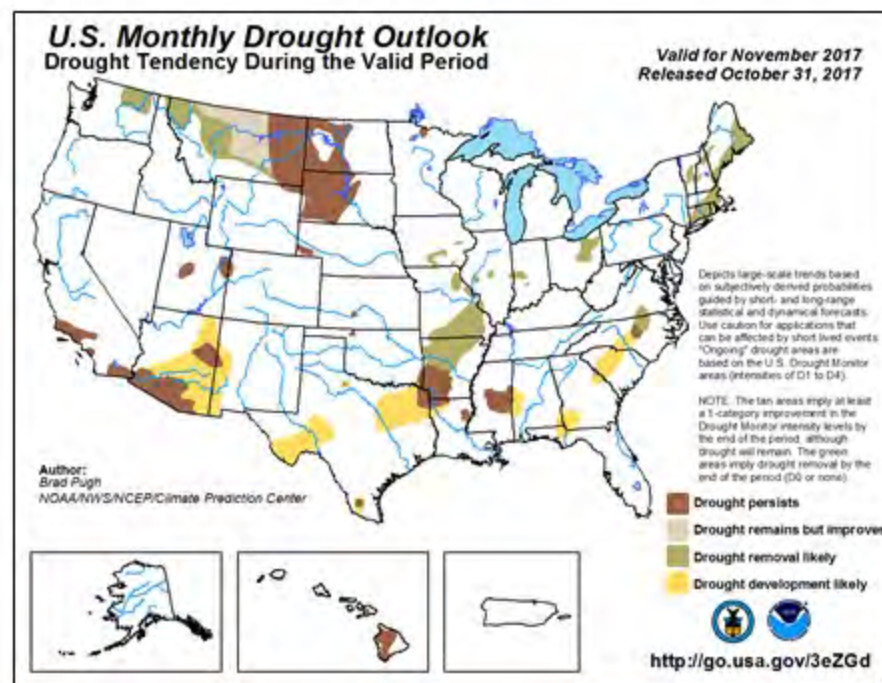
[Temperature](#) [Precipitation](#)
[Click here for skill score explanation](#)



Other CPC seasonal outlooks and climate watches

Другие сезонные прогнозы ЦПК и мониторинг климата

- Monthly temperature and precipitation outlook Месячные прогнозы Т и осадков
- ENSO outlook Прогнозы ЭНЮК
- Drought outlook Прогнозы засух
- Seasonal hurricane outlooks Сезонные прогнозы ураганов
- US Hazards Опасные природные явления по территории США



Monthly ENSO outlook

Месячные прогнозы ЭНЮК

National Weather Service
Climate Prediction Center

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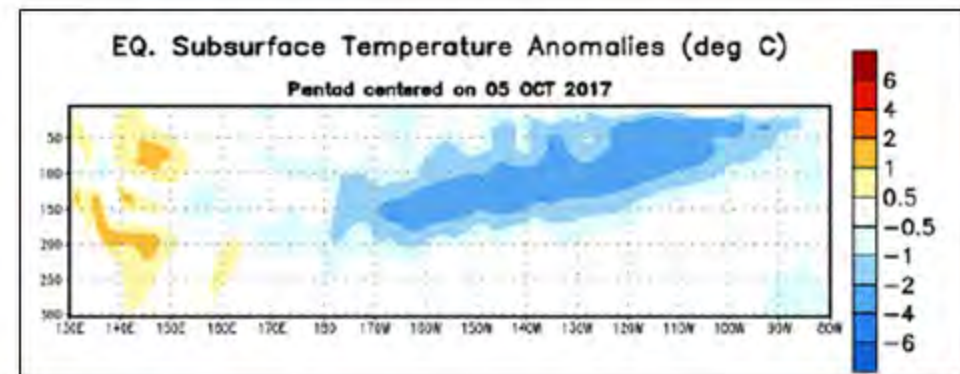
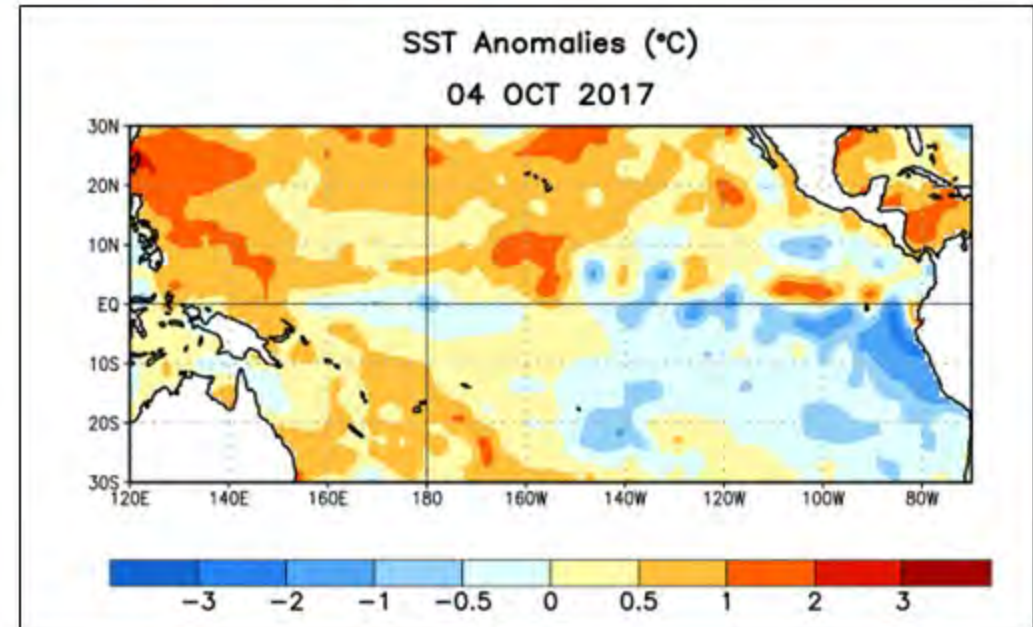
EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

issued by
CLIMATE PREDICTION CENTER/NCEP/NWS
and the International Research Institute for Climate and Society
12 October 2017

ENSO Alert System Status: [La Niña Watch](#)

Synopsis: **La Niña conditions are favored (~55-65%) during the Northern Hemisphere fall and winter 2017-18.**

During September, ENSO-neutral conditions were reflected in near-to-below average sea surface temperatures (SSTs) across most of the central and eastern Pacific Ocean [Fig. 1]. The weekly Niño indices were volatile during the month, with negative values increasing to near zero during the past week in the Niño-4, Niño-3.4, and Niño-3 regions [Fig. 2]. In contrast, sub-surface temperature anomalies were increasingly negative during September [Fig. 3], reflecting the shallow depth of the thermocline across the central and eastern Pacific [Fig. 4]. Also, convection was suppressed near the International Date Line and enhanced near Indonesia [Fig. 5]. Over the western equatorial Pacific Ocean, low-level trade winds were anomalously easterly and upper-level winds were anomalously westerly. Overall, the ocean and atmosphere system remains consistent with



Seasonal hurricane outlook

Сезонные прогнозы ураганов

National Weather Service
Climate Prediction Center

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[NOAA PRESS RELEASE](#)

NOAA 2017 Atlantic Hurricane Season Outlook

Issued: 9 August 2017

[Realtime monitoring of tropical Atlantic conditions](#)
[Realtime monitoring of tropical East Pacific conditions](#)

[Atlantic Hurricane Outlook & Seasonal Climate Summary Archive](#)

The updated 2017 Atlantic hurricane season outlook is an official product of the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center (CPC). The outlook is produced in collaboration with hurricane experts from the National Hurricane Center (NHC) and the Hurricane Research Division (HRD). The Atlantic hurricane region includes the North Atlantic Ocean, Caribbean Sea, and Gulf of Mexico.

Interpretation of NOAA's Atlantic hurricane season outlook
 This outlook is a general guide to the expected overall activity during the upcoming hurricane season. It is not a seasonal hurricane landfall forecast, and it does not predict levels of activity for any particular location.

NOAA's Updated 2017 Atlantic Hurricane Season Outlook

60% Chance of Above-Normal Season, Possibly Extremely Active

Probability of Season Type

Updated Outlook Issued 9 August

Outlook Issued 25 May

Predicted Activity

70% Probability For Each Range

	August Update	May Outlook	Season Averages (1981-2010)
Named Storms	14-19	11-17	12
Hurricanes	5-9	5-9	6
Major Hurricanes	2-5	2-4	3
ACE (% median)	100-170%	75-155%	

Summary

Выводы

- CPC's seasonal outlooks are based on empirical and dynamical prediction tools and are complemented by real-time climate monitoring products. Сезонные прогнозы основаны на эмпирических и динамических средствах и мониторинге в реальном времени
- There is a wealth of historical observations available that are also used to the development of empirical prediction tools. Также используются исторические данные
- Dynamical seasonal forecasts – CFSv2, NMME, LC-LRFMMF – are also used. Также используются динамические средства сезонного прогноза
- Final outlook is a blend of empirical and dynamical prediction tools. Окончательный прогноз составляется на основе сочетания всех этих средств.