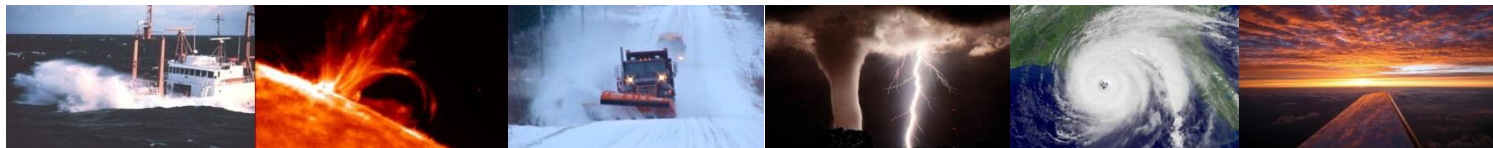




Overview of Climate Prediction Center

*Dr. Wayne Higgins, Director
Climate Prediction Center / NCEP*

January 26, 2010

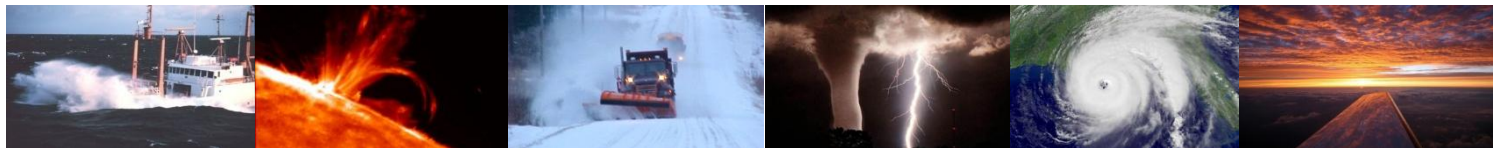




Outline



- NCEP within National Weather Service
- CPC within NCEP
- Ongoing CPC Activities
- Climate Prediction Advances
- Future Opportunities





NCEP within NWS



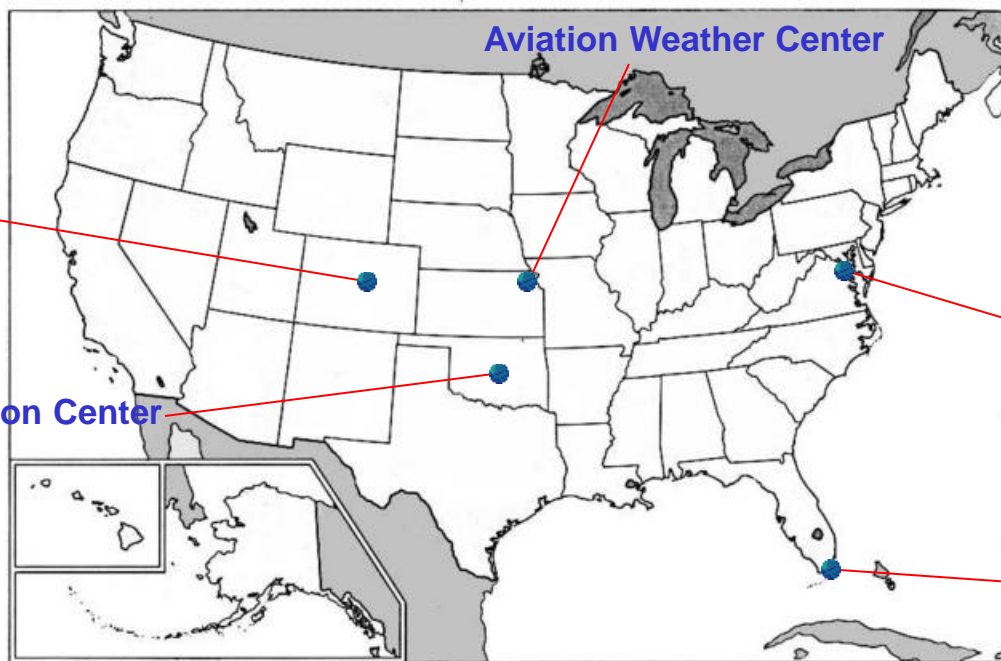


National Centers for Environmental Prediction (NCEP)



Organization: Central component of NOAA National Weather Service

Mission: NCEP delivers science-based environmental predictions to the nation and the global community. We collaborate with partners and customers to produce reliable, timely, and accurate analyses, guidance, forecasts and warnings for the protection of life and property and the enhancement of the national economy.



NCEP Central Operations
Climate Prediction Center
Environmental Modeling Center
Hydromet Prediction Center
Ocean Prediction Center

Tropical Prediction Center

Vision: The Nation's trusted source, first alert and preferred partner for environmental prediction services



What Does NCEP Do?

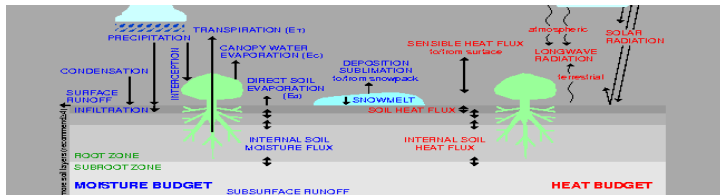
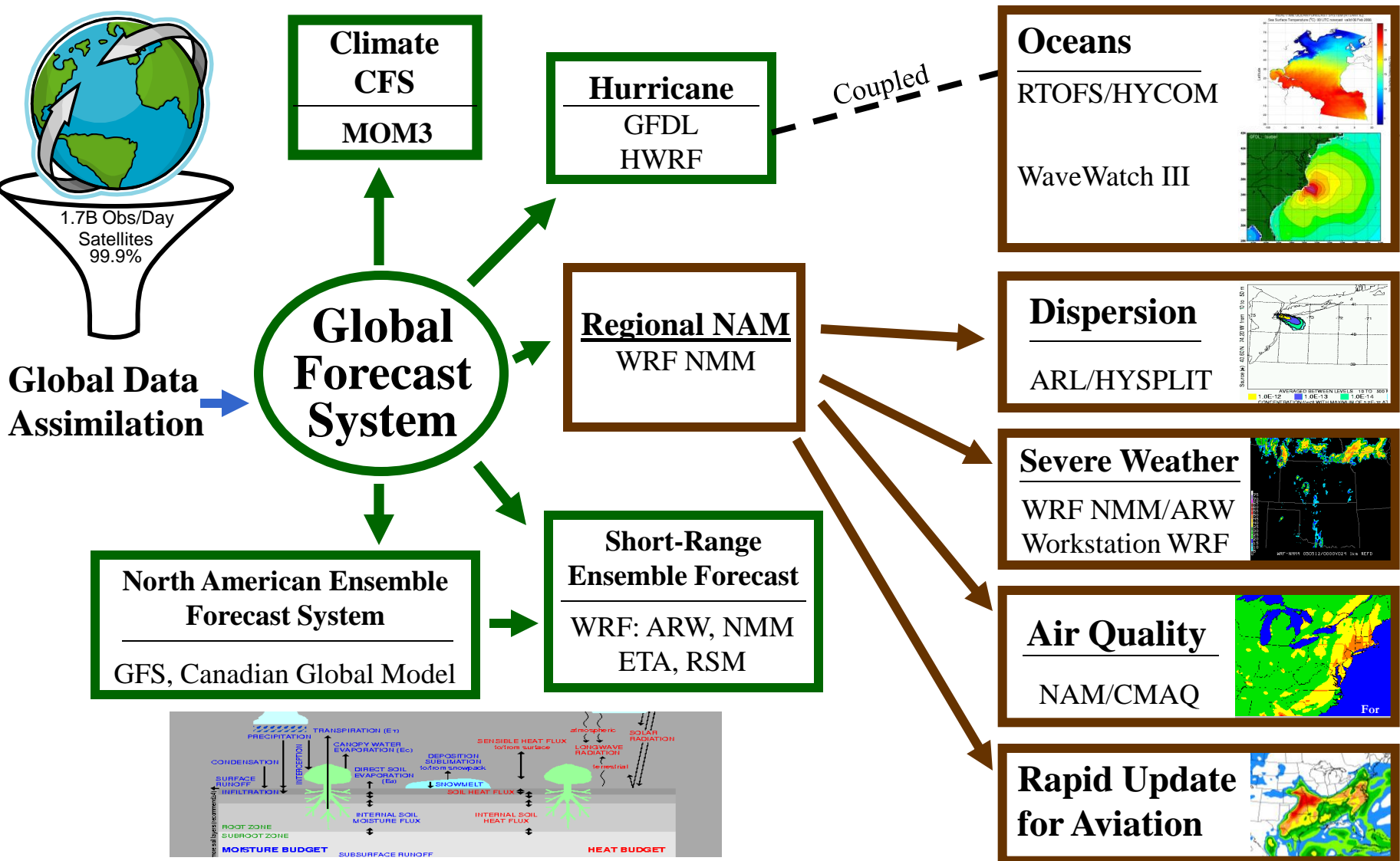
“From the Sun to the Sea”



- Solar Monitoring, Warnings and Forecasts
 - Climate Forecasts: Weekly to Seasonal to Interannual
 - El Nino – La Nina Forecast
 - Weather Forecasts to Day 7
 - Hurricanes, Severe Weather, Snowstorms, Fire Weather
 - Aviation Forecasts and Warnings
 - Offshore and High Seas Forecasts and Warnings
- Model Development, Implementation and Applications for Global and Regional Weather, Climate, Oceans and now Space Weather
 - International Partnerships in Ensemble Forecasts
 - Data Assimilation including the Joint Center for Satellite Data Assimilation
 - Super Computer, Workstation and Network Operations



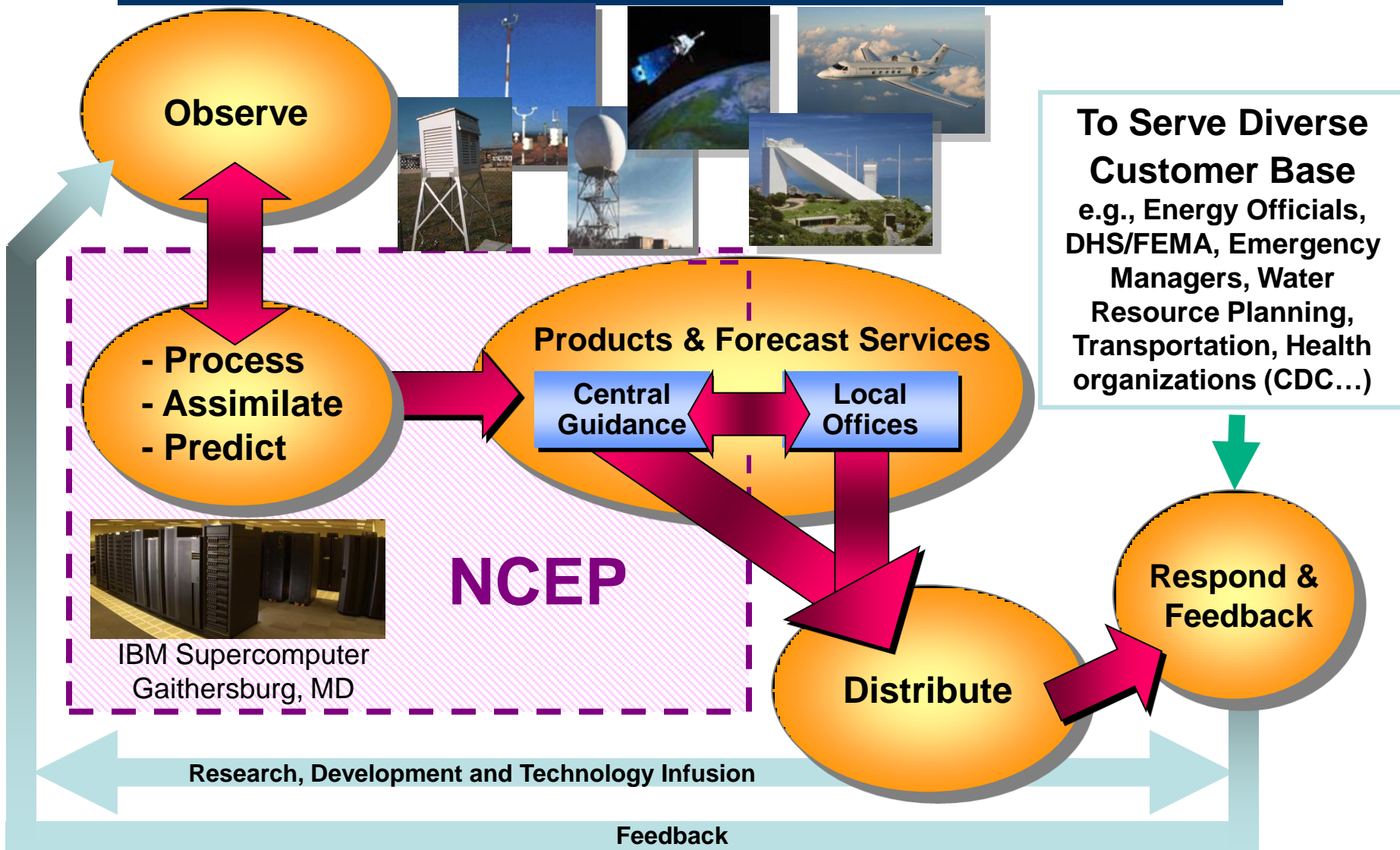
NOAA Model Production Suite



NOAH Land Surface Model



The Path to NOAA's Seamless Suite of Products and Forecast Services



Prediction is now inherently linked to numerical models



CPC within NCEP





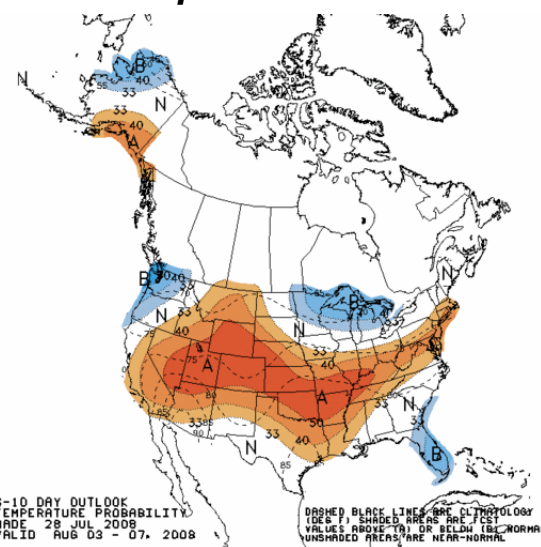
CPC Mission



We deliver climate prediction, monitoring, and assessment products for timescales from weeks to years to the Nation and the global community for the protection of life and property and the enhancement of the economy.

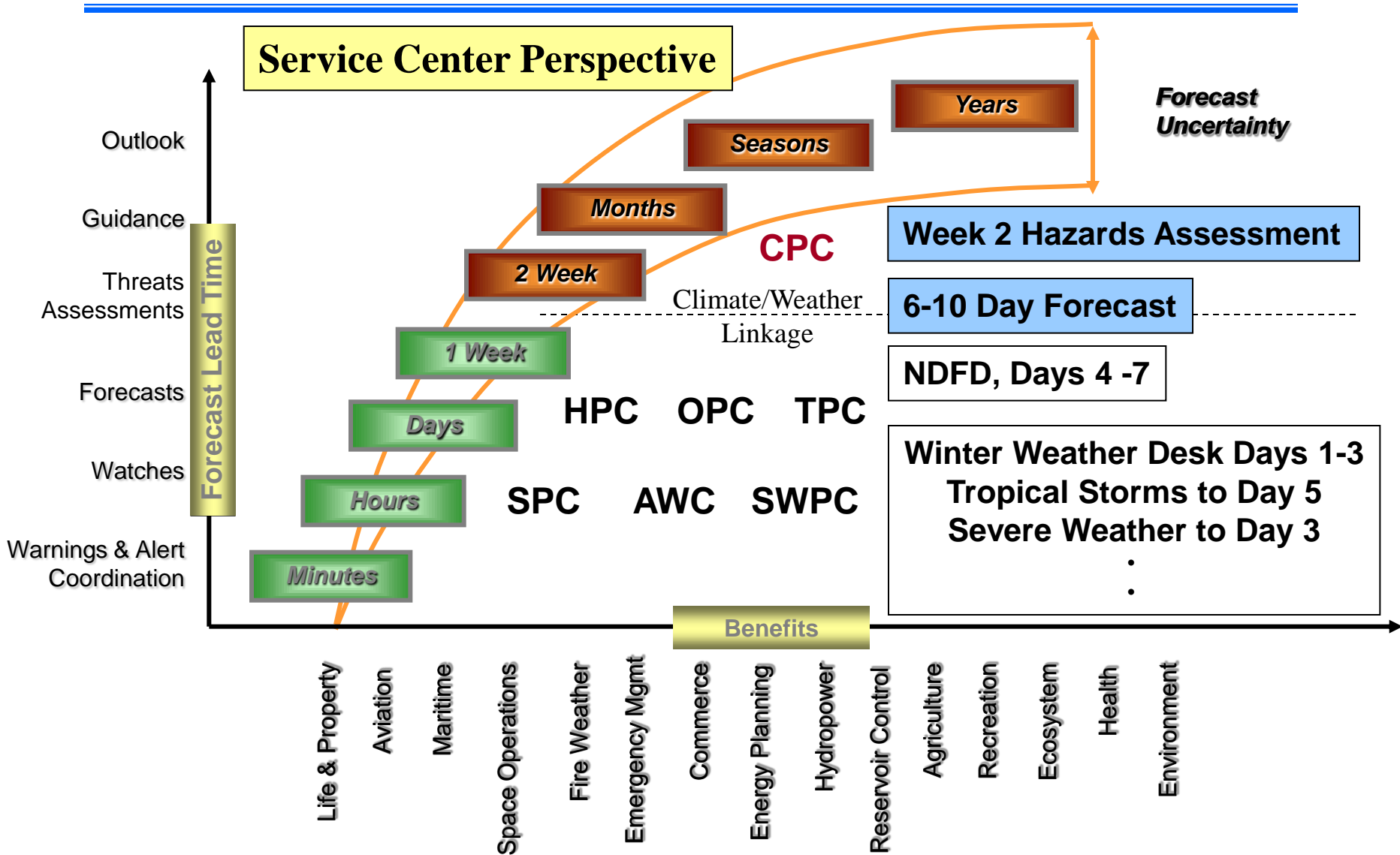
- National temperature and precipitation outlooks, but not monthly / seasonal rankings
- Focus: weeks, months, seasons, years (i.e. short term climate)
- Forecasts in collaboration with other NCEP Centers, NOAA line offices, other agencies and labs
- Integral to NWS Seamless Suite of Products

Temperature Outlook



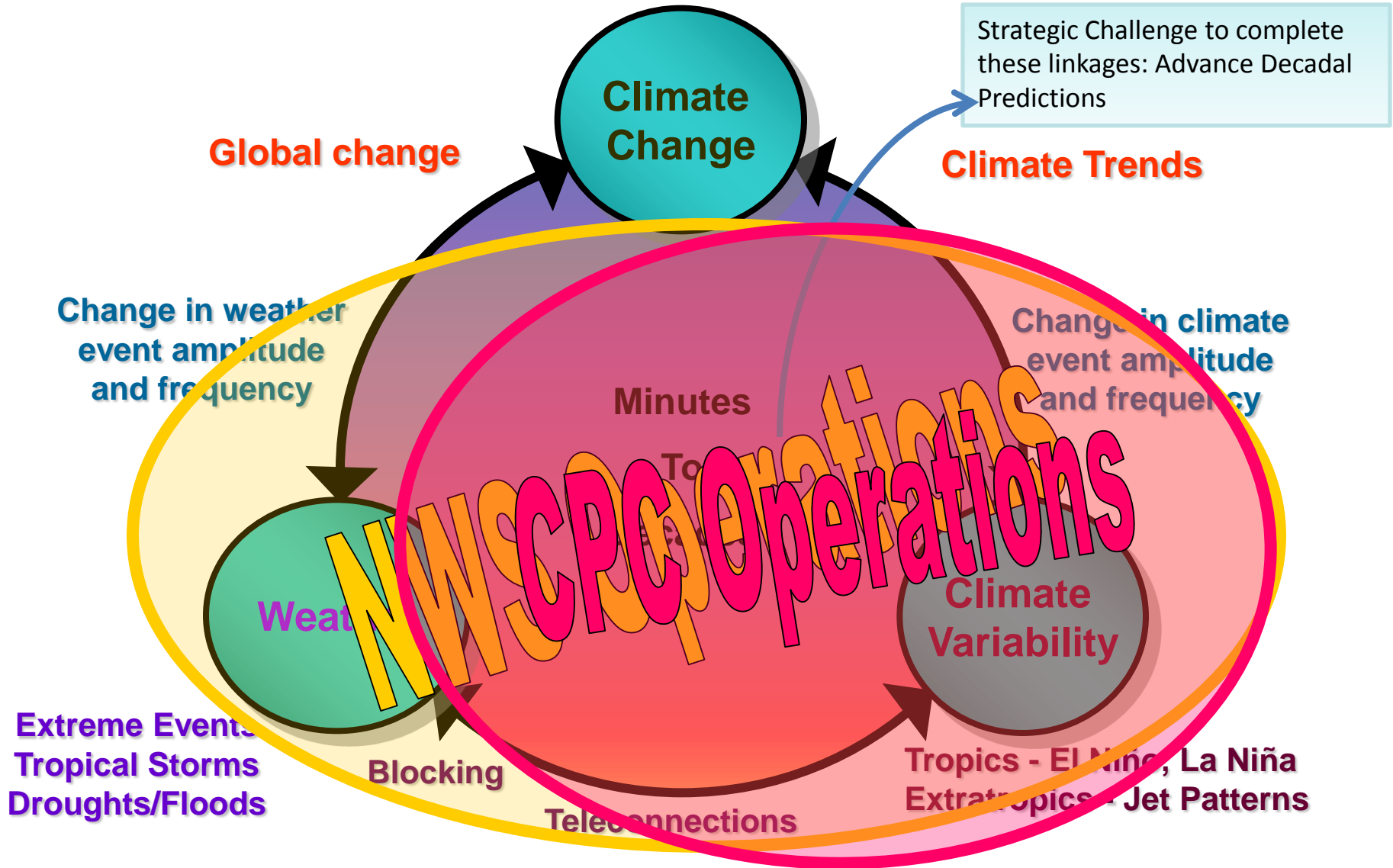


CPC Supports the NOAA Seamless Suite of Forecast Products Spanning Climate and Weather





Strategic Challenge: Weather- Climate Linkage





Climate Prediction Center

Office of the Director

- *Management & Administrative Issues*
- *Formulate and Implement CPC Projects*
- *Business Practices*
- *Human Capital and Organizational Culture*
- *Climate Education and Outreach*

Operations Branch

- *Extended-Range, Monthly, Seasonal Predictions*
- *Climate Hazards*
- *Joint Agriculture Weather Facility (JAWF)*
- *Computer Systems and Information Technology*
- *Operational Product Reliability*

Development Branch

- *Real-time Monitoring (Sfc., Trop., Strat., Ocean)*
- *Integrated Climate Assessments*
- *Forecast Tool Development / Improvement*
- *Interagency and International Commitments*
- *Climate Test Bed*



CPC Federal / Support Staff & Budget



<u>Unit</u>	<u>Count</u>	<u>Budget Source</u>	
		NWS Base	Reimbursible*
Director's Office	4	X	
Operations Branch	25	X	
Development Branch	21	X	
Contractors **	25		X
UCAR; UMD; Visitors	15		X
Total	90		

*Sources:
 Climate Program Office
 NWS/Intl Affairs
 NESDIS
 USAID
 NASA

** WYLE Information Systems,
 McLean, VA



Ongoing CPC Activities



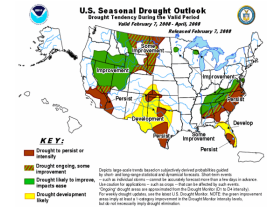
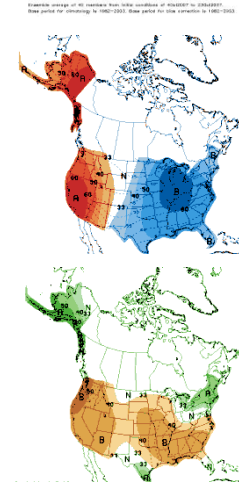
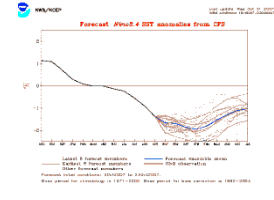
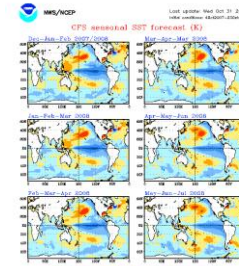


Climate Outlook Products



Focus on week-2 to seasonal-to-interannual

- 6-10 Day & 8-14 Day Precipitation & Temperature Outlooks
- Day 3-14 Hazards Assessments (US, Global Tropics)
- Monthly & Seasonal Precipitation & Temperature Outlooks
- Seasonal Drought Outlook
- Seasonal Hurricane Outlooks (Atlantic and Eastern Pacific)
- Monthly ENSO Prediction



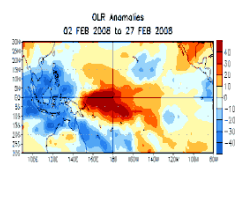
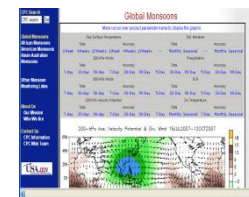
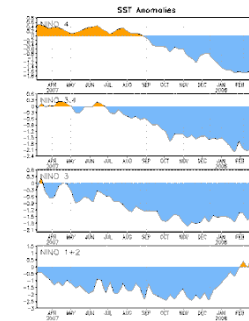
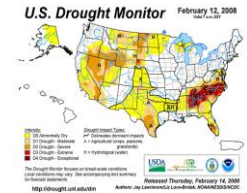
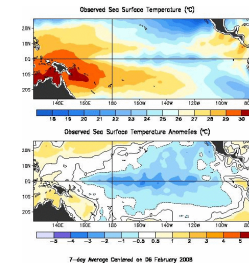
Note: We recognize that we need to do more than T & P – and in particular – more climate-weather type products, more variables. What are users' needs?



Climate Monitoring Products



- Primary modes of climate variability (ENSO, MJO, NAO, PNA, AO,...)
- Atmospheric Circulation (global troposphere and stratosphere)
- Storm Tracks and Blocking
- Monsoons
- Oceanic Conditions (global and coastal)
- Precipitation and Surface Temperature (global and US)
- Drought (US, North America; NIDIS)



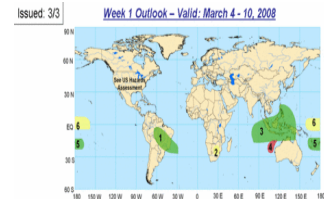
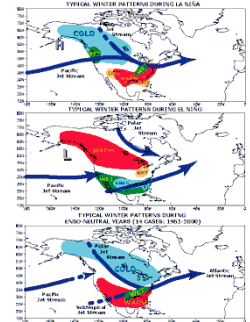
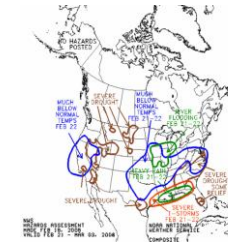
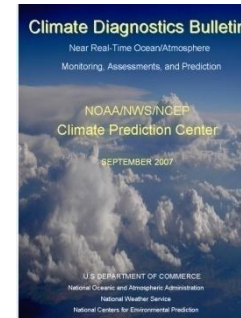
Note: *There has been a concerted effort to improve and expand the CPC monitoring product suite in response to user community requests. What are users' needs?*



Climate Assessment Products



- Climate Diagnostics Bulletin (monthly, web)
- ENSO Diagnostics Discussion (monthly, PDF and WORD)
- Weekly ENSO / MJO / Monsoon / Ocean updates (.ppt, PDF, web)
- Seasonal Climate Summaries (web)
- Special Climate Assessments (extreme events, web)
- Annual Climate Assessment (multi-agency; published in the AMS Bulletin)
- Hazards Assessments (US, Africa, & Global Tropics) Day 3-14 – WX/CX Connection



1. An increased chance for above average rainfall for much of Brazil and adjacent states. Persistent strong high pressure is expected to reduce the South Atlantic Convergence Zone (SACZ) and reduce rainfall in this region. [Click here](#) to view details.

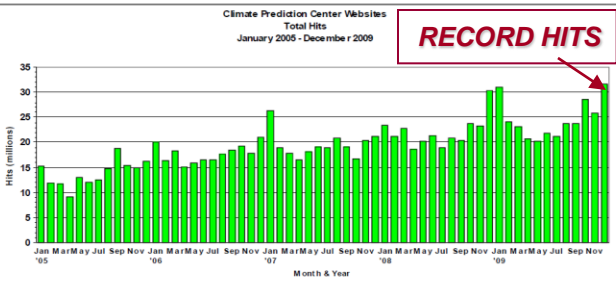
2. An increased chance for below average rainfall for southwestern continental Africa. Anomalous strong high pressure is expected to suppress rainfall across this region during the period. Persistent weak low-level jet flow supports upward rainfall in this region. [Click here](#) to view details.

Note: *These products connect climate to people's lives. How should we expand and improve the current suite of products to meet users' needs?*



Internet Monthly Reports

- **CPC Internet Monthly Reports are used to manage our products and services**
 - To monitor product usage statistics and trends
 - To determine our top user communities
 - To determine our most popular products and pages

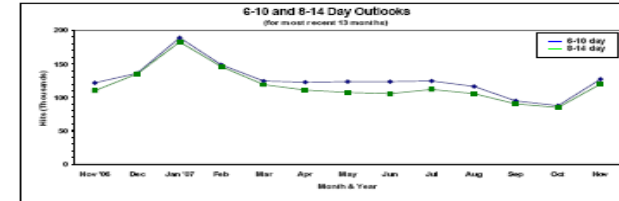


Users of CPC Website (cont.)

Top Ten Users of CPC Website November 2007					
Rank	Hostname	Visitor	Hits (Avg./Day)	% Total Hits	
1	12.177.145.170	Murray Trettle Inc.	8,652	1.27	
2	h216-165-191-196.216-165.unik.sds.net	Weather Central	7,397	1.09	
3	216.13.182.19	Allstream Corp.	6,208	0.91	
4	patbox.myweather.net	My Weather LLC	6,181	0.91	
5	aces-229.iquest.net	Iquest User	4,058	0.60	
6	66.5.120.20	Intelligence Inc.	3,829	0.56	
7	66.249.70.165	Google Inc.	3,517	0.52	
8	72.94.31.175	Verizon User	2,980	0.44	
9	66.180.175.99	Netsonic User	2,205	0.32	
10	148.134.37.1	Duke Power Company	2,062	0.30	

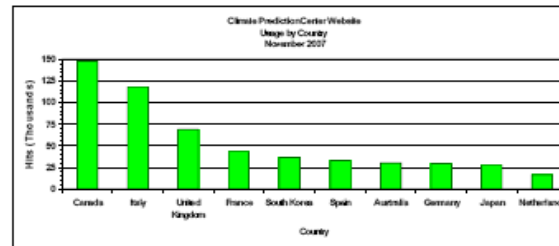
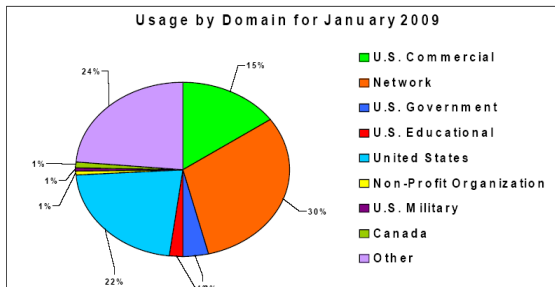
Trends of Most Popular Products & Pages

Outlooks and Forecasts



Users of CPC Website

Usage by Domain for January 2009



Top Products by Selected Categories

November 2007					
Category & Product	Total Hits	Avg. Hits/Day	Category & Product	Total Hits	Avg. Hits/Day
Outlooks & Forecasts			Miscellaneous		
6- to 10-Day Outlook	128,850	4,222	CPC Home Page	150,733	5,024
9- to 14-Day Outlook	119,752	3,992	Outlooks & Forecasts Home	45,825	1,521
30-Day Outlook	48,558	1,552	6-10 Day Outlook PNO	30,481	1,293
Expert Assessments			Stratosphere		
Hazards Assessment	58,890	1,963	UV Index (ind)	31,947	1,059
ENSO Evolution, Status, (ppt)	52,894	1,782	UV Alert	4,823	161
ENSO Diagnostic Discussion	31,011	1,034	UV Home	2,301	76
Monitoring & Data			Africa		
U.S. Daily Data (recent day)	33,957	699	African Desk Home	4,823	161
ENSO Home	18,506	617	Africa Severe Weather Forecast	1,123	37
El Niño/La Niña Home	10,777	359	FEWS Africa Home	940	28

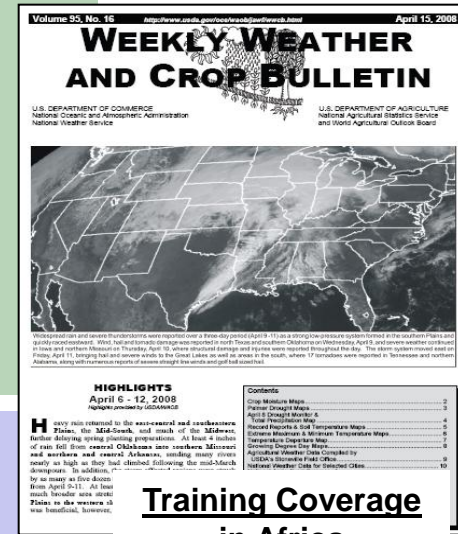


Selected Other Climate Services at CPC



• Joint Agriculture Weather Facility

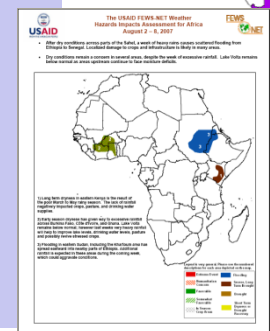
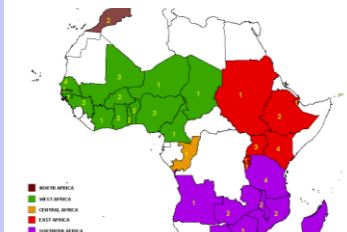
- *USDA – DOC partnership*
- *Weekly Weather and Crop Bulletin*
- *Briefings & Weather Summaries on global weather and crop conditions*



• CPC International Desks

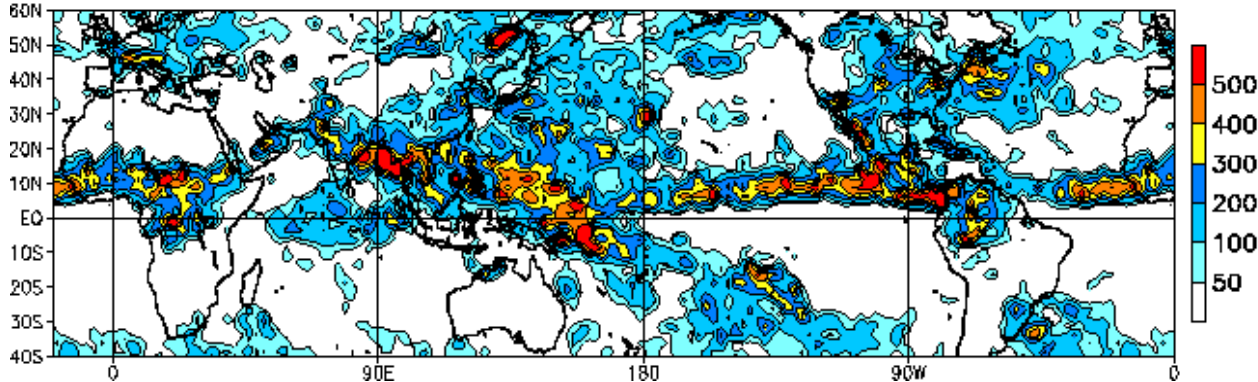
- *Professional development training to African Meteorologists*
- *WMO partnership for regional and global activities*
- *Lead Famine Early Warning System Hazard/Benefit Assessments: Africa, Central America, Afghanistan*
- *Indian Ocean tropical cyclone monitoring*
- *Contribute to USAID Asian Flood Network*

Training Coverage in Africa

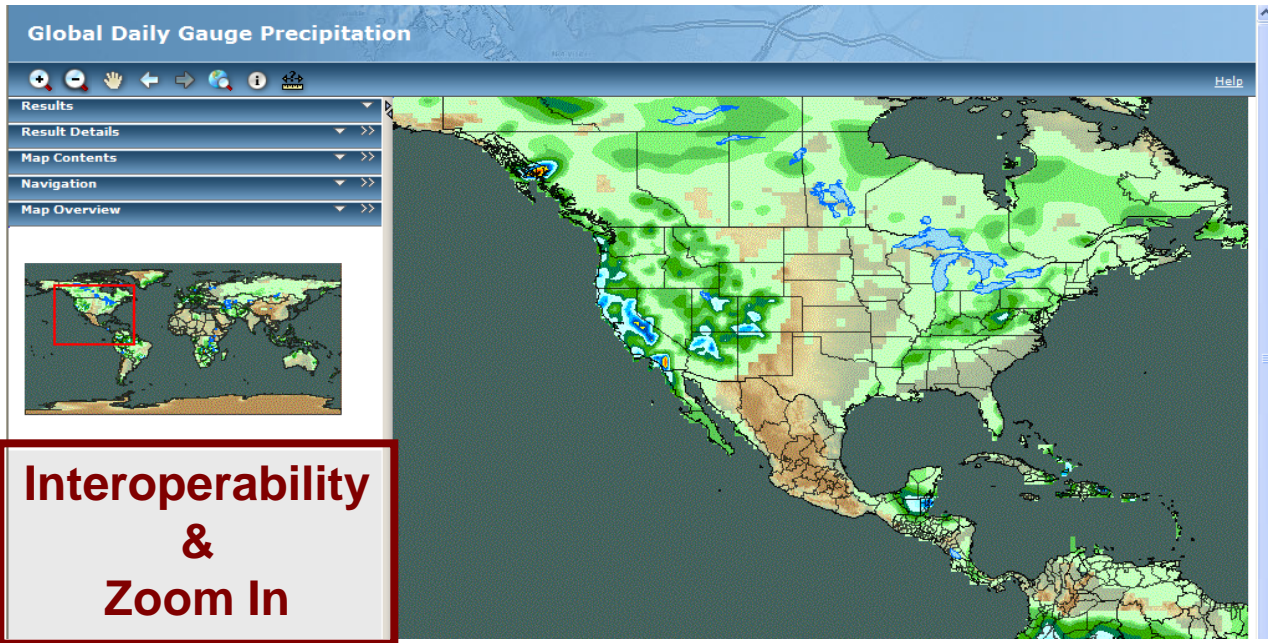




Conversion of CPC Products to GIS Format

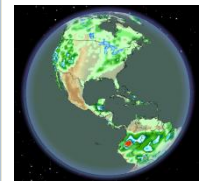


BEFORE



AFTER

**Interoperability
&
Zoom In**





CPC Web Site Redesign



- Redesign of CPC web site
 - Easier to navigate
 - Easier to manage
 - Public outreach materials (tutorials; fact sheets)

The screenshot displays the National Weather Service Climate Prediction Center website. The header includes the NOAA logo, the text "National Weather Service Climate Prediction Center", and navigation links such as Home, About the Center, Pressroom, Contact Us, and NOAA. A search bar is also present. Below the header is a navigation menu with categories: U.S. Temperature, U.S. Precipitation, Hazards, Drought, Hurricanes & Storm Tracks, Climate Phenomena, Circulation, International Climate, Data, and Resources. The main content area is titled "OUTLOOKS" and features a map of the United States with a color-coded temperature outlook for the 6-10 day period. The map shows a mix of blue (cooler) and red (warmer) areas. Below the map is a legend and a section titled "6 to 10 Day Outlooks" with a brief description. To the right of the map is a "HAZARDS" section with a list of recent events, including a cool mass moving into Western Washington and a flood warning for the Mississippi River. Below the hazards section is a "CLIMATE NEWS" section with articles on the Atlantic Hurricane Season, El Niño - Southern Oscillation (ENSO), and Georgia Floods Widespread. At the bottom of the main content area is an "ABOUT THE CENTER" section with a sub-section for "Stratospheric Ozone" and a list of "Announcements" with dates and titles. The footer contains the NOAA logo, copyright information, and various links including Home, Career Opportunities, Privacy Policy, Disclaimer, Credits, Freedom of Information Act (FOIA), and Contact Us.



NCSS Climate Portal: Data & Services



Explore: [ClimateWatch Magazine](#)

[Data & Services](#)

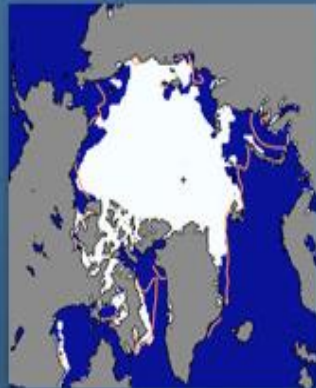
[Understanding Climate](#)

[Education](#)



NOAA is developing a comprehensive, **Climate Portal** that provides **ready access** to all NOAA climate data, products, and services. Many CPC Products; 4 CPC Staff

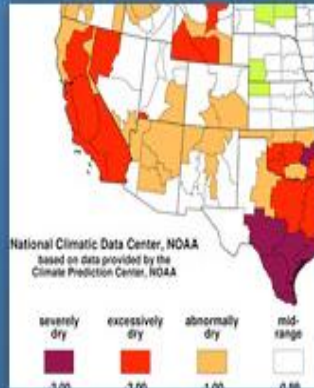
[Past & Present Climate](#) ▶



Climate at a Glance

Read and explore summaries and digests of recent climate-related phenomena from NOAA's distributed climate service community.

[Outlooks](#) ▶



Looking Ahead

Discover explorations short-term evaluations of how climate phenomena are likely to unfold in coming days, weeks, and months.

[US & Global Regions](#) ▶



Explore NOAA by Region

Explore the climate services and products NOAA experts prepare for specific regions of our nation and the world.

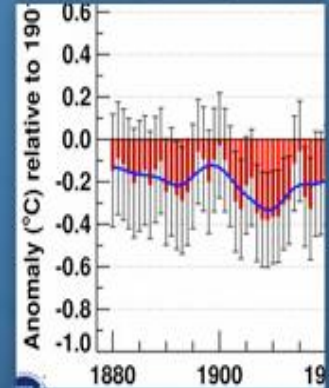
[Serving Society](#) ▶



Utilizing Climate Data

Climate information is essential for business and community planning. These resources focus on needs of specific sectors of society.

[Data Library](#) ▶



Visualizing & Explore

NOAA is a leading provider of access to data from research projects, stations, and satellites to the nation and the world.



Outlook Verification Tools



http://www.cpc.ncep.noaa.gov/products/predictions/long_range/tools/briefing/seas_veri.grid.php

The screenshot displays the National Weather Service Climate Prediction Center website. The header includes the NOAA logo and the text "National Weather Service Climate Prediction Center". Below the header is a navigation menu with "Site Map", "News", and "Organization". A search bar is present with the text "Search All NWS Search" and a "Go" button. The main content area is titled "Latest Seasonal Verifications" and includes the following information:

- Valid: Dec-Jan-Feb 2008-09
- Updated: March 17, 2009
- Download Skill Score Archive
 - [Temperature](#)
 - [Precipitation](#)
 - [Click here for skill score explanation](#)

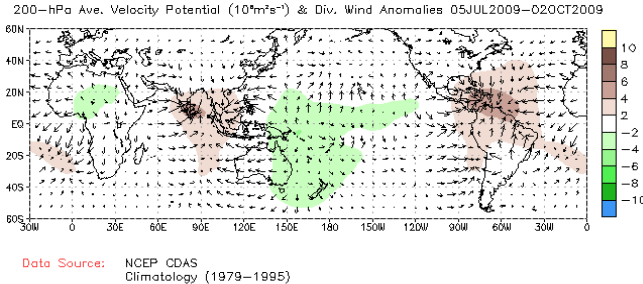
Below this, there are four sections, each with a map of the United States and associated data:

- Temperature Forecast Heidke Skill Scores:** Non-Equal Chance(non EC) forecasts: 19.70, All forecasts: 8.41, % coverage not Equal Chance forecasts: 42.67
- Precipitation Forecast Heidke Skill Scores:** Non-Equal Chance(non EC) forecasts: 37.31, All forecasts: 10.79, % coverage not Equal Chance forecasts: 28.88
- Temperature (Forecast):** Download Forecast Data Archive (CAT, PROB ABOVE PROB BELOW), [How To Read Temperature Forecasts](#)
- Precipitation (Forecast):** Download Forecast Data Archive (CAT, PROB ABOVE PROB BELOW), [How To Read Precipitation Forecasts](#)
- Temperature (Observations):** Download Observational Data Archive (Temperature Observations), [How To Read Observations](#)
- Precipitation (Observations):** Download Observational Data Archive (Precipitation Observations), [How To Read Observations](#)

- **CPC provides real-time gridded verification of its seasonal outlooks**
 - downloadable archive
 - observations
 - performance metrics
- **Current/planned extension:**
 - monthly outlooks
 - regional extended range
 - performance metrics



Monitoring & Prediction of Monsoon Systems Worldwide



Monitor:

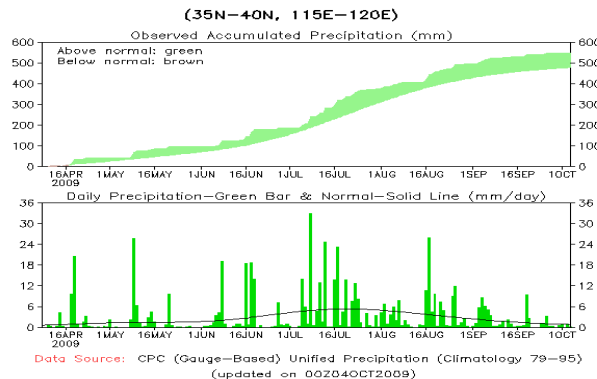
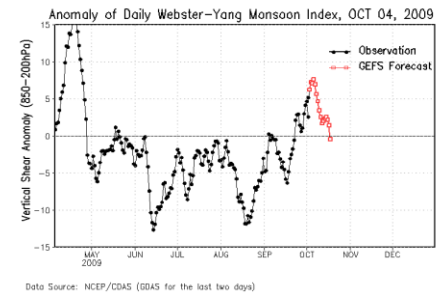
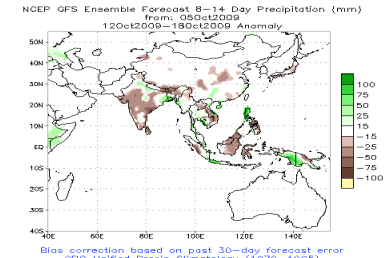
Atmospheric, oceanic & land surface conditions across time scales

Predict:

Week-1, week-2, monthly and seasonal rainfall

Lifecycle: onset, maintenance and demise

Monsoon indices



Assess:

Hazards (droughts and floods)

Seasonal Intensity

Variability (linkages to ENSO, MJO, etc)



Climate Prediction Advances





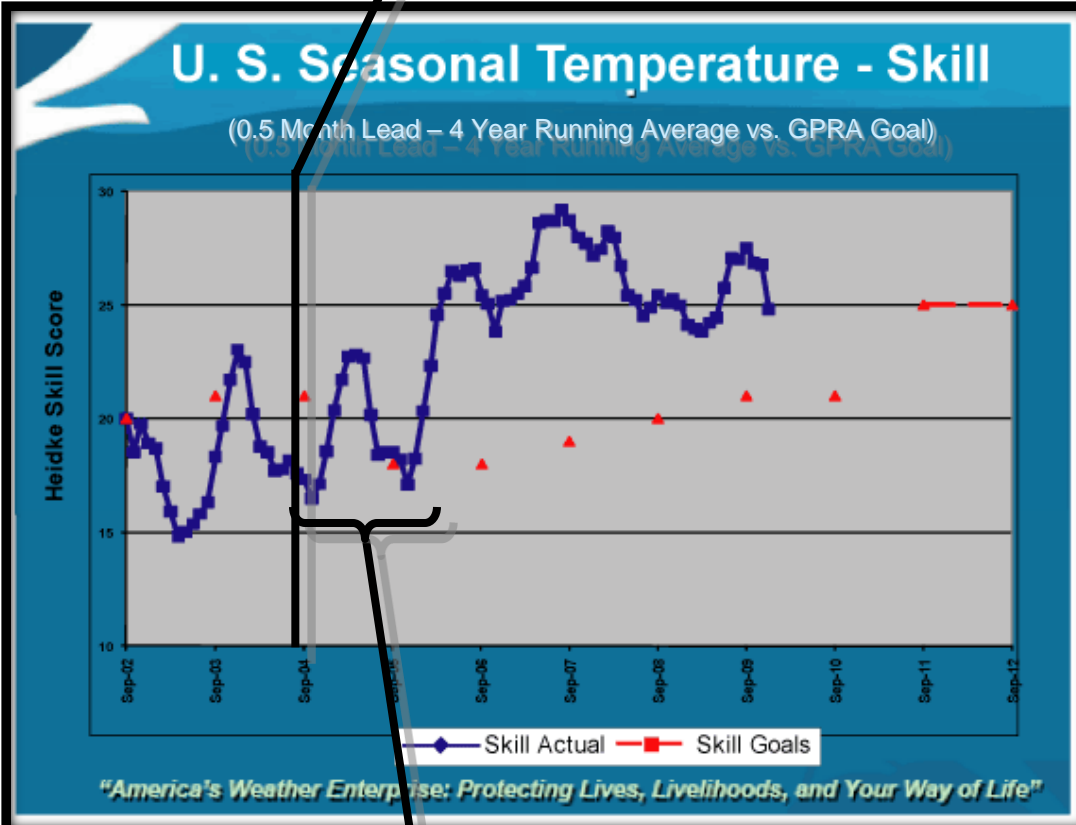
Climate Prediction Advances at NCEP



Climate Forecast System (CFS)
Dynamic, fully-coupled operational model

CFS & improvements to CFS through CTB contributed to improved skill of CPC official outlooks by 20% or more (O'Lenic et al 07)

CFS (v1.0) implemented



CTB Spun up



Climate Prediction Advances at NCEP



Climate Test Bed Mission

- *To accelerate the transition of scientific advances from the climate research community to improved NOAA climate forecast products and services*

Research to Operations (R2O)

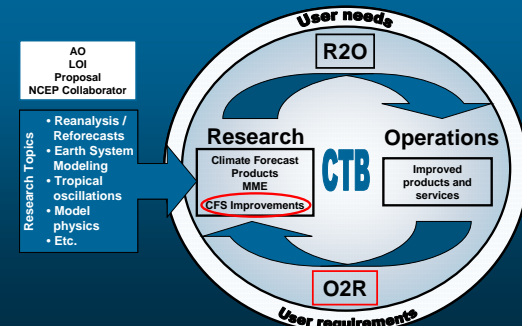
Operations to Research (O2R)

• Focus Areas

- *CFS Improvements – transition of research advances from external community*
- *Multi Model Ensemble (MME) Prediction Systems*
 - *National / International*
 - *GFDL / NCEP Postdocs*
- *Climate Forecast Products*
 - *Establishing user needs*
 - *Develop and improve products and services in coordination with external community*

• Model Test Facility

- *Provide CFS and related datasets to community*





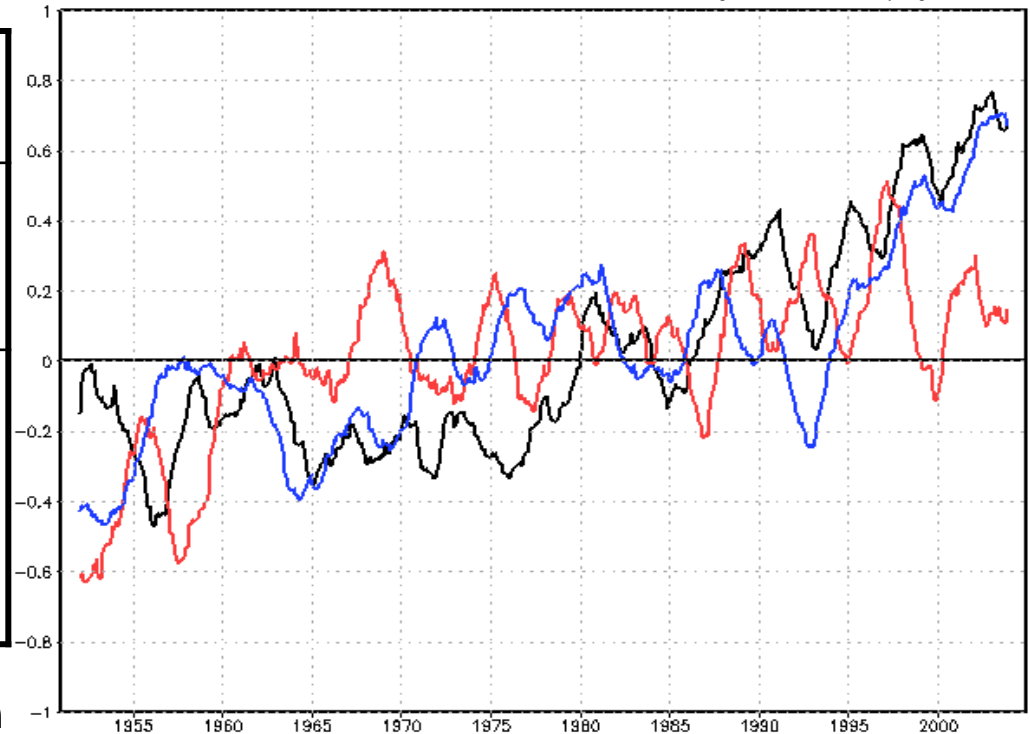
Climate Prediction Advances at NCEP



- Investigation of ISI-Decadal linkages
 - CFS capability to recreate decadal temperature profile

— OBS	CPC Analysis (Fan and van den Dool, 2008)
— CTRL	CMIP run with 1988 CO ₂ settings (no variations in CO ₂ , current operations)
— CO ₂	Ensemble mean of 3 NCEP CFS runs in CMIP mode <ul style="list-style-type: none">– realistic CO₂ and aerosols in both troposphere and stratosphere

Glb Mean LAND ONLY 2m-Temp Anom (C)

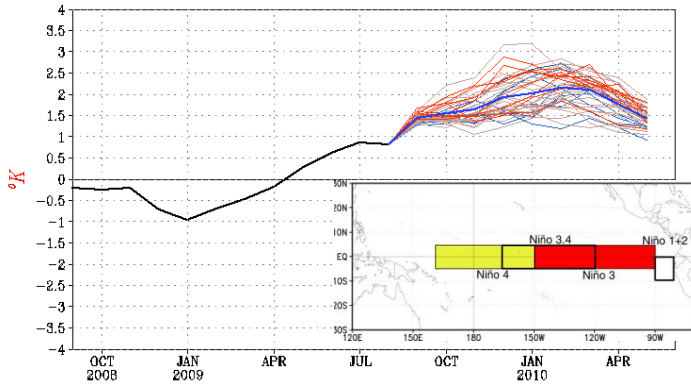


Processing: 25-month running mean applied to the time series of anomalies (deviations from their own climatologies)

Testing with CMIP Runs
(variable CO₂)

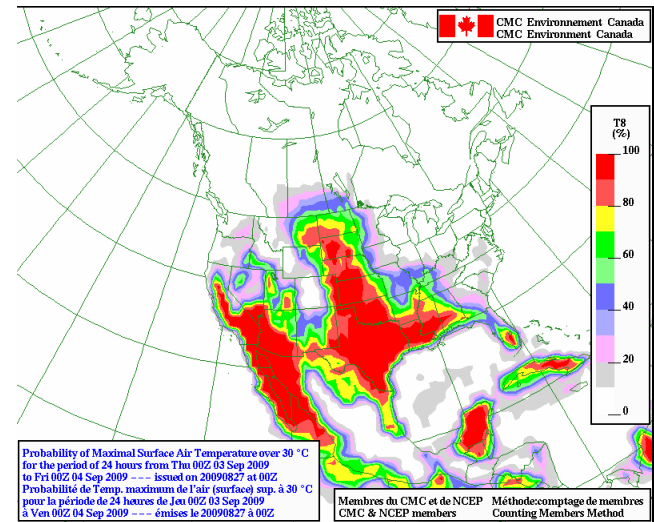
Impending Domination of Ensemble Based Model Systems

Forecast Niño 3.4 SST Anomalies from CFS



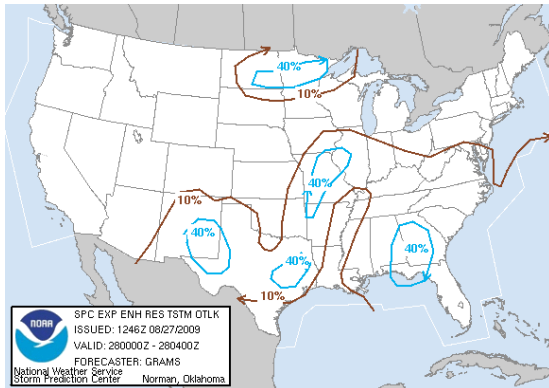
- **Climate:** Climate Multi-Model Ensemble
 - NCEP Climate Forecast System + GFDL Climate Model

- **Medium Range Weather:** North American Ensemble Forecast System (NAEFS)
 - GFS + MSC + Navy FNMOC NOGAPS



Probability of Temperature over 30C over 24 hour period
(7 day forecast valid Sept 3-4, 2009)

Experimental Enhanced Resolution Thunderstorm Outlooks



- **Mesoscale:** Short Range Ensemble Forecasts
 - WRF/ARW + WRF/NMM + RSM

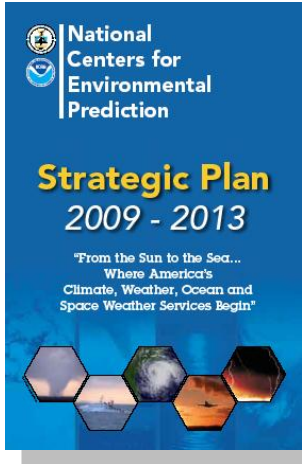


Future Opportunities





Looking Ahead: Next 5 Years

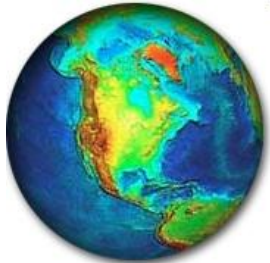


- **NCEP (FY09-13), NWS (2010-2025) & NOAA (FY10-14) Strategic Plans**
 - *CPC 5-Year Implementation and Operations Plan (FY09-13)*

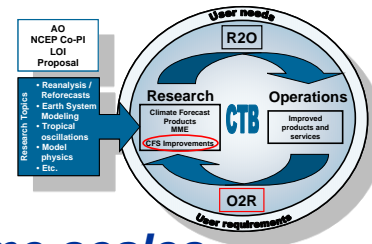
- **Move to NOAA Center for Weather and Climate Prediction**
 - *Opportunities for collaboration*



- **Emergence of NOAA Climate Science and Services**
 - *Informing decisions and managing risks*



- **Climate Prediction**
 - *Enhance Intraseasonal-to-Interannual climate forecasts*
 - *Increasing emphasis on multi-model ensembles across time scales*
 - *Enhance transition activities (Climate Test Bed; Model Test Facility)*



- **Improve Interactions with Broader Science and Service Community**



Looking Ahead: Major Thrusts of CPC 5-Year (FY09-13) Implementation Plan



- Develop process for CPC requirements through user input (*Customers and Partners*).
- Improve operational climate outlook, monitoring and assessment products (e.g. objective verification; outlooks for week 3 - week 4) (*Products and Services*)
- Improve delivery of climate products and services and measure success to users (conversion to GIS; Climate Portal; customer surveys) (*Information Systems*)
- Through CTB, accelerate the transition of science and technology advances to improved operational climate models and forecasts (*Science and Technology*)
- Increase collaborative products and services (*Business Process*)



Summary

CPC

- **Delivers a suite of “operational” climate prediction, monitoring, and assessment products**
- **Accelerates advances in climate prediction and fills gaps in the “seamless suite” of climate products**
- **Works across NOAA and with other organizations on expanded responsibilities for climate; interdisciplinary approaches are the key to success**
- **Plays a unique and critical role in NOAA climate science and services**

