Supporting Coastal Communities in a Changing Climate; Lessons Learned from Super Storm Sandy

L. DeWayne Cecil, Ph.D.

Global Science and Technology, Inc.

Climate Data Record Program

National Climatic Data Center, Asheville, NC

Hurricane Sandy and Beyond

Engineering, Ecology, and Policy Pathways in an Era of Climate Change

A Discussion Among the Science and Stakeholder Communities

December 3, 2012

Roosevelt House – Hunter College, CUNY

Objectives and Rationale of the Stakeholder Meeting

- **The impact and aftermath of Hurricane Sandy has raised questions about how we can reduce our vulnerability to future storms as well as enhance our resilience and adaptation to climate change.**

- **The immediate discussion of rebuilding makes clear that there are issues of *scientific uncertainty*, engineering, planning and policy, economics, and equity to be resolved.**

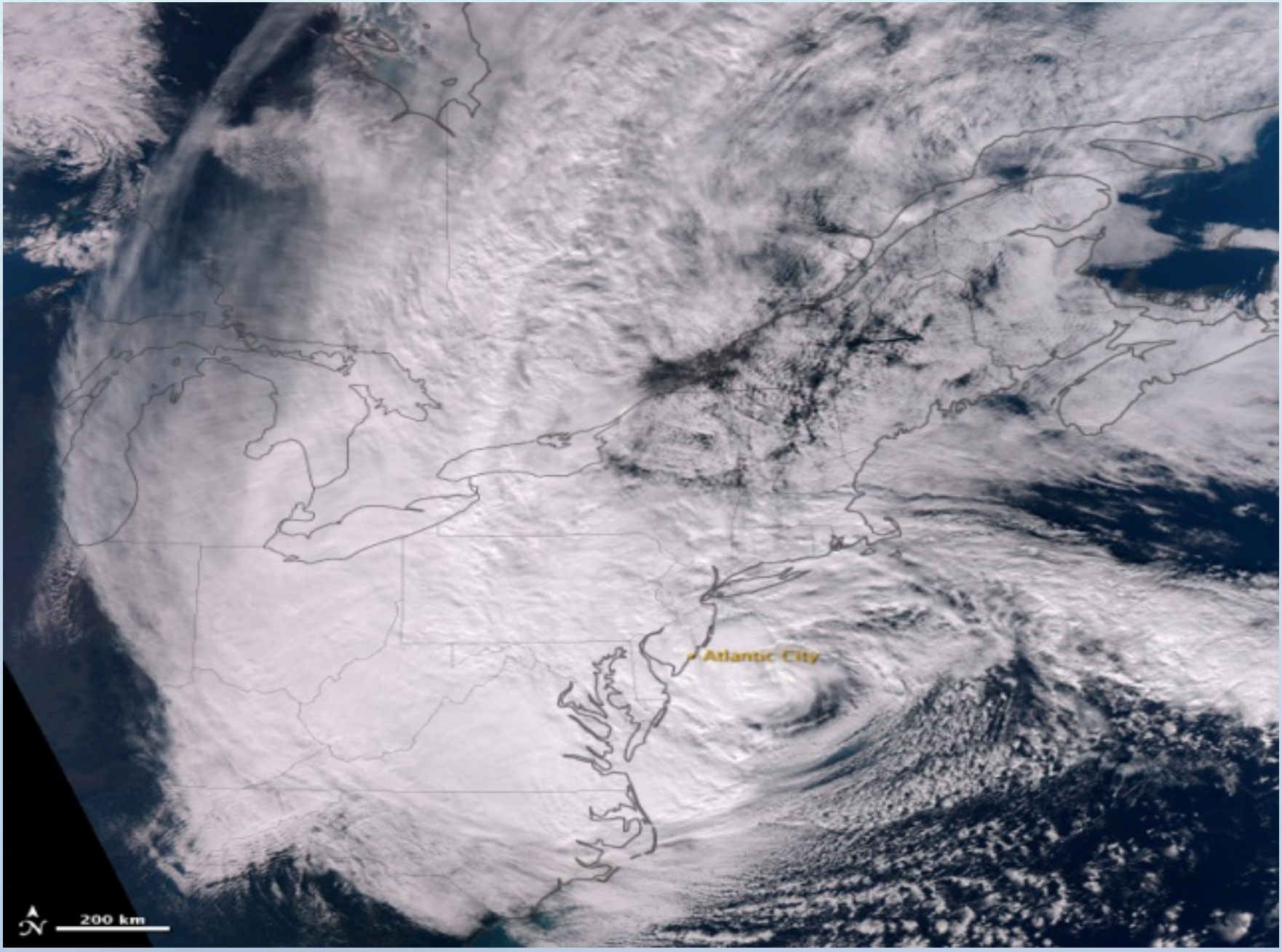
In order to help address these issues the panel and subsequent discussion will focus on the following questions:

- **What did Hurricane Sandy tell us about extreme storm events and future climate in our region? What is still not known?**
- **What did Hurricane Sandy tell us about our vulnerabilities to future extreme events?**
- **What are the key opportunities and challenges of potential adaptation strategies?**

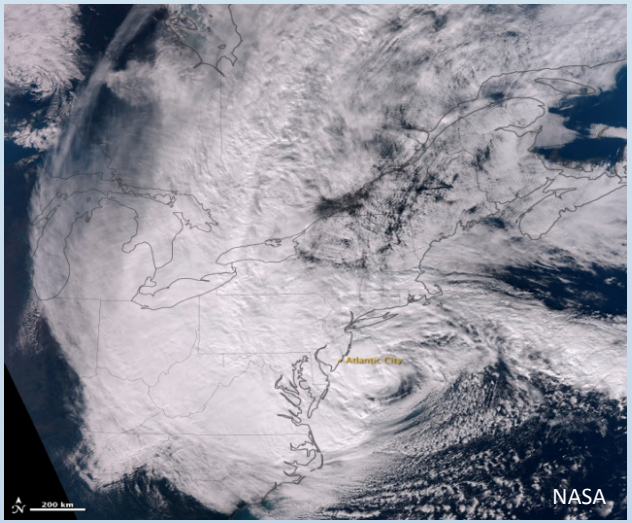
Sponsors and Hosts in New York City Post-Sandy Discussions

- **Sponsored by**
  - **The Roosevelt House Public Policy Institute at Hunter College**
  - **City University of New York, Institute for Sustainable Cities (CISC)**

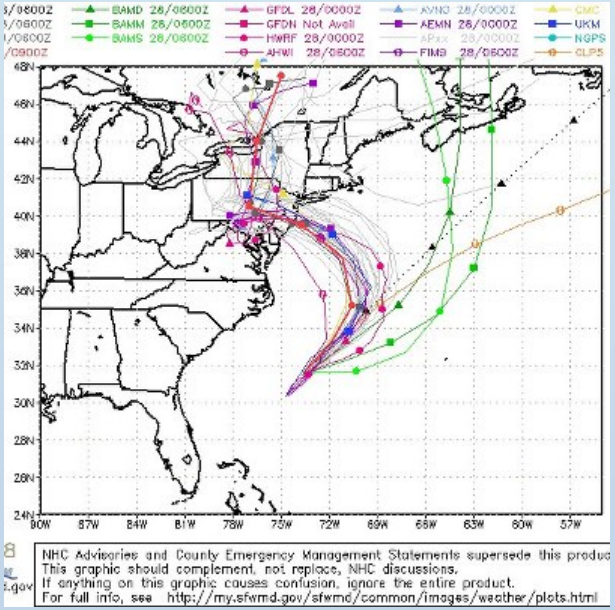
- **Hosted by**
  - **Urban Climate Change Research Network**
  - **Consortium for Climate Risk in the Urban Northeast**
  - **CUNY Institute for Sustainable Cities**


Atlantic City
200 km
N

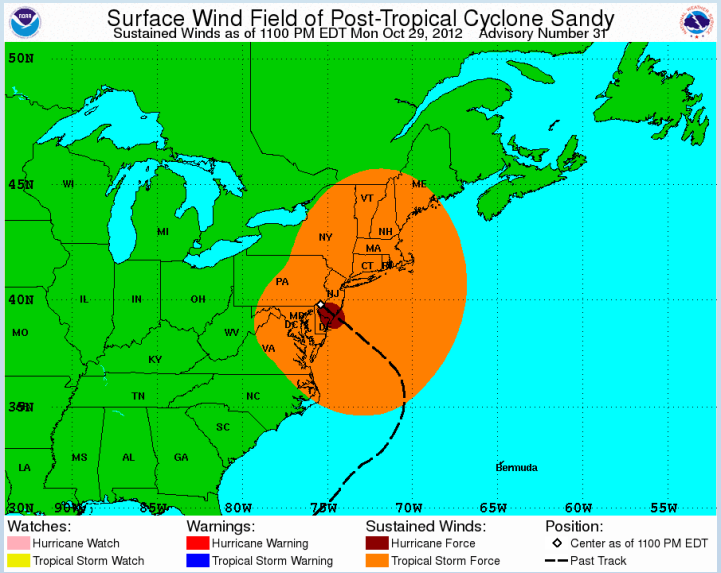
Hurricane Sandy – Role of Science Forecasting the Storm



Lowest recorded central pressure north of Cape Hatteras, NC at 945 mb



Storm track forecasts



Exceptionally large wind field tropical storm force winds over ~500 miles from the center

Storm forecast well in advance

	KATRINA	SANDY
Strength at Landfall	Cat. 3 hurricane	Post Tropical Cyclone; ~Cat 1 hurricane
Barometric Pressure	902mb (fourth lowest Atlantic Storm)	945mb (lowest ever for a storm making landfall north of Cape Hatteras
Storm Surge	27.8ft at Pass Christian, Mississippi	14.1 ft at Battery; 11.2ft 1821 hurricane; 10.02ft Hurricane Dona 1960
Deaths	1,833 total	132 US; ~200 total
Housing Units Damaged or Destroyed	1.2 million (126,000 severely damaged or destroyed)	305,000 NY; 72,000 NJ (buildings); 3,000 CT(homes)
Costs	148 billion (2012 USD)	approaching 100 billion USD as of 1 December
Insured Losses	48.7 billion (2012 USD)	16-22 billion USD (estimate)
Homes without Power (peak)	~3 million - 8 states	8.51 million 16 states and Washington, DC
FEMA Assistance	738,318 applications approved	465,000 applications filed in NY and NJ as 27 November
People Displaced a Month after the Storm	Up to 600k families homeless	>10k in NYS; 10s of 1000s

Landfall

One Month On

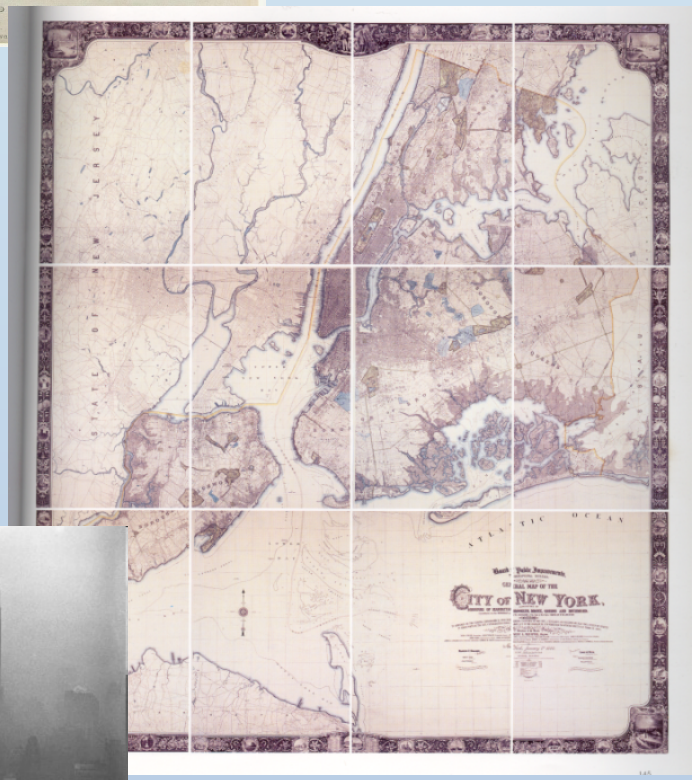
source: complied by Solecki from numerous sources including NY Times

What Does Sandy Mean for Us?

Meeting Urban Environment Crises in New York City

- **Water quality and supply - 1830s**
- **Open Space and Recreation -1850s**
- **Public Health and Sanitation – 1870s**
- **Mobility and Congestion – 1910s**
- **'Urban Renewal' /Loss of Community – 1950s**
- **Air Pollution – 1960s**
- ***Climate Change – 2010s***

Looking south over Central Park in 1861



New York City Environs - 1900

Smog - November 1953

Hurricane Sandy and Climate Change Science

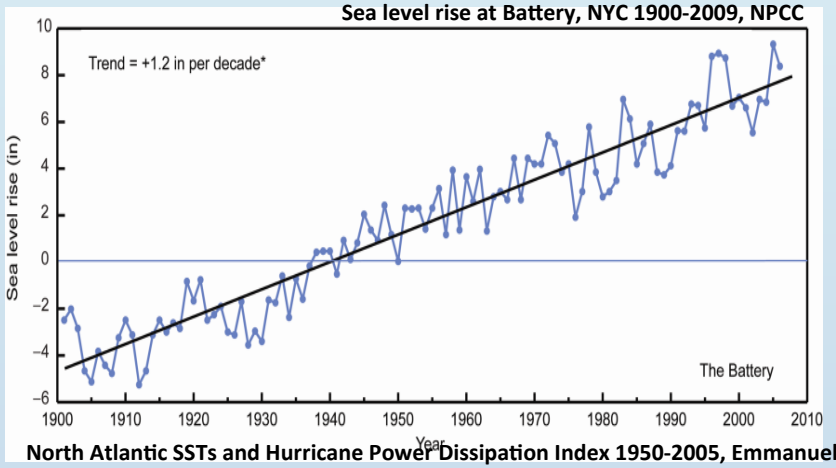
- ~1 ft of sea level rise in past 100 years in New York metropolitan region, due to local land subsidence, global thermal expansion of ocean water, melting of land-based ice, and local surface elevation

- Hurricane Sandy is defined as a 1 in multi-century event in current climate – Coastal flooding projected to occur more frequently and to greater extent in future due to sea-level rise alone

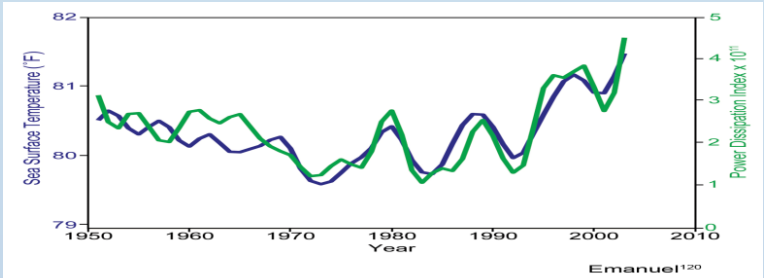
- Intensity of severe hurricanes appears to be on rise and may increase in future***

- Melting sea-ice may be changing pattern of jet stream, making westward-turning storm tracks more likely***

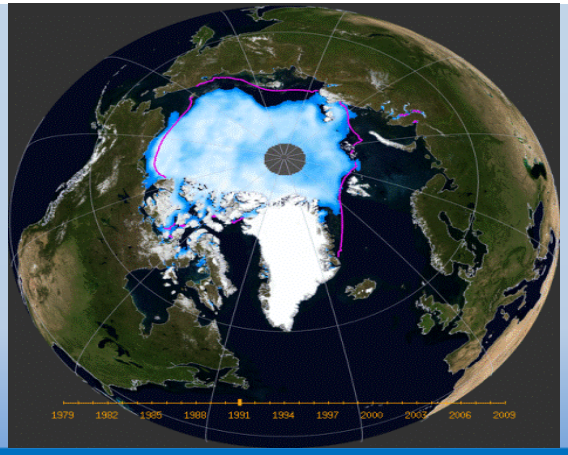
Sea level rise at Battery, NYC 1900-2009, NPCC



North Atlantic SSTs and Hurricane Power Dissipation Index 1950-2005, Emmanuel



Observed sea surface temperature (blue) and the Power Dissipation Index (green), which combines frequency, intensity and duration for North Atlantic hurricanes.120 Hurricane rainfall and wind speeds are likely to increase in response to human-caused warming. Analyses of model simulations suggest that for each 1.8°F increase in tropical sea surface temperatures, rainfall rates will increase by 6 to 18 percent.[68]



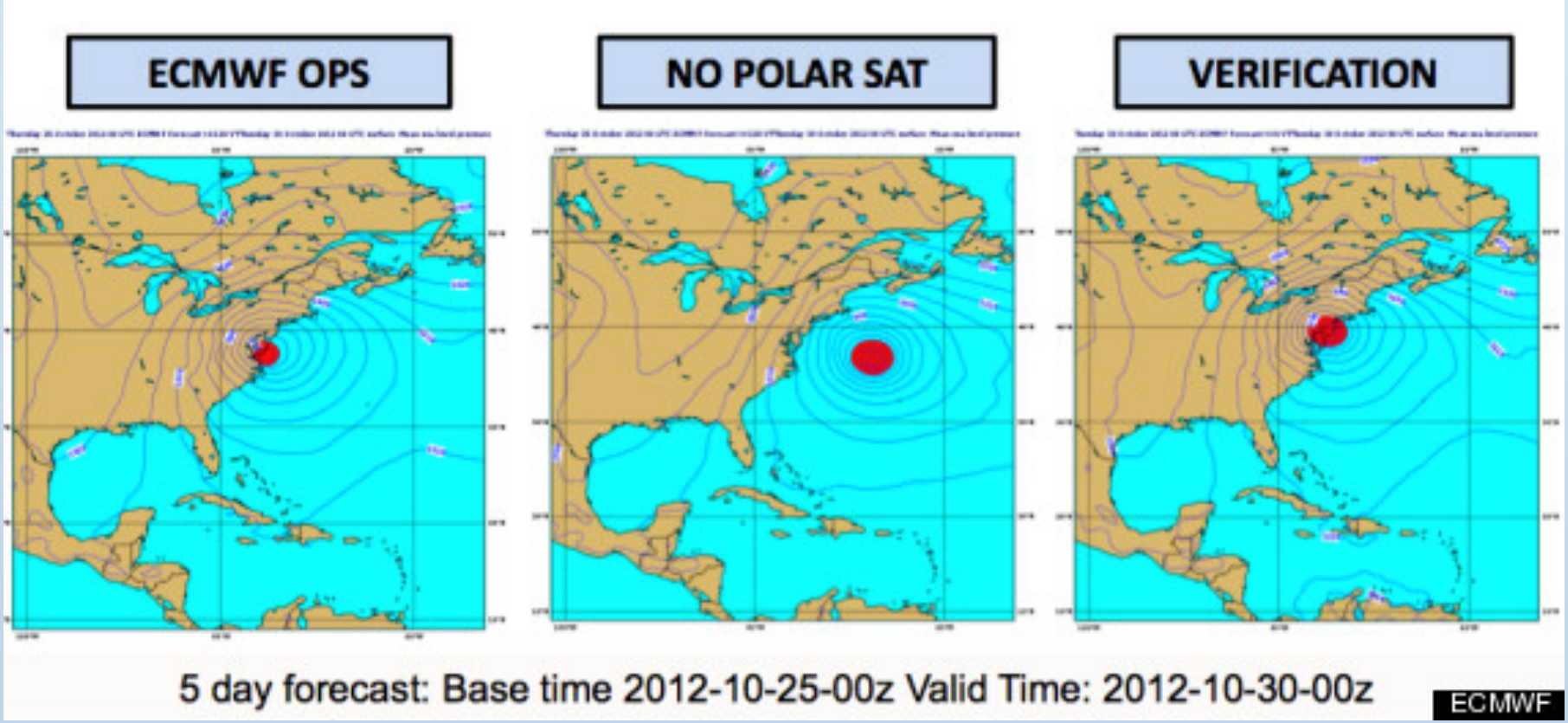
Median Minimum Sea Ice Extent 1979-2009

***Areas of active research

NCDC's Climate Data Record Program Participation

- Briefed staff at the Consortium for Climate Risk in the Urban Northeast RISA at Columbia University, December 2012
- Met with staff at the Northeast Regional Climate Center at Cornell University in January, 2013
- Briefed them on the Operational CDRs and other products at NCDC (GHCN for example)
- Provided links to the CDR datasets (and the National Mesonet Dataset)

Utility of Satellite Information for Storm and Extreme Event Projections



Use of satellite data at the ECMWF, Tony McNalley

Thank You

Contact info:
DeWayne.Cecil@noaa.gov

General Comments on Recovery So Far

- **Rebuilding funds are small and piecemeal at the moment; big money is being sought**
  - **New York State is seeking $42 billion in federal aid, including about $9 billion for projects to head off damage in future storms. New Jersey is seeking nearly $37 billion in aid, including $7.4 billion for future projects.**
- **Bringing experts and expertise to the issue**
  - **Each state connecting with national experts and appointing state-level advisors — e.g. James Lee Witt Associates in NJ; Thad Allan of Hurricane Katrina and Rita to work with NYS committee.**
- **Keeping folks in their homes; getting businesses back up**
  - **Work with local municipalities to discuss buy-out of most impacted neighborhoods and properties – Federal approach; 10,000s with homes literally destroyed or uninhabitable.**
- **Most devastated areas are highly geographically concentrated**
  - **including many low-to-moderate income neighborhoods near the shore; Possible tax reduction for damaged housing units and other benefits to highly impacted property owners.**
- **Early explanations of impact as part of the narrative of recovery**
  - **e.g., in New Jersey, importance of sand dunes – and now, some home owners can't get a permit for those who refused beach renourishment; links to climate change made immediately**
- **All options still on the table**
  - **Climate change needs to be recognized from the beginning of these recovery efforts – it will be near impossible to add it in later.**