Workshop Report

NASA-Rio-UCCRN Training Workshop: Sea Level Rise, Urban Heat Island and Green Infrastructure, and Water Quality

November 14-16, 2016

NASA Goddard Institute for Space Studies

New York, NY
Title  NASA-Rio Partnership Training Workshop: Sea Level Rise, Urban Heat Island and Green Infrastructure, and Water Quality

Date  November 14-16, 2016

Location  NASA Goddard Institute for Space Studies, New York, NY, USA

Co-Organizers  Dalia Kirschbaum, NASA GSFC
               Cynthia Rosenzweig, NASA GISS/UCCRN
               Somayya Ali Ibrahim, Columbia University/UCCRN
               Daniel Bader, Columbia University/UCCRN
               Felipe Mandarino, Instituto Pereira Passos

Sponsors

[Images of NASA, UCCRN, and RIO Prefeitura logos]
Participants

NASA Goddard Space Flight Center

Dalia Kirschbaum, NASA GSFC
Lachlan Mckinna, NASA GSFC
Margaret Hurwitz, NASA GSFC

NASA Goddard Institute for Space Studies/Columbia University

Cynthia Rosenzweig, NASA GISS/UCCRN
Daniel Bader, Columbia University/UCCRN
Somayya Ali Ibrahim, Columbia University/UCCRN
Vivien Gornitz, Columbia University/UCCRN
Stuart Gaffin, Columbia University/UCCRN
Klaus Jacob, Columbia University/UCCRN

Rio de Janeiro

Felipe Mandarino, Instituto Pereira Passos
Leonardo de Carvalho Valentim da Silva, Instituto Pereira Passos
Bruno Fontoura Costa, Instituto Pereira Passos
Brasiliano Vito Fico, Municipal Environmental Secretariat
Ricardo d’Orsi, GEO-RIO
Sérgio Antônio da Silva Almeida, Civil House Secretariat
Alexander de Araújo Lima, Civil Defence
Alexandre Cardeman, Rio Operations Center
Paulo Luiz da Fonseca, Rio Águas Foundation
Nelson Lima, Rio Águas Foundation
Vivien Green, Federal University of Rio de Janeiro

Guest Speakers

Gavin Schmidt, Director, NASA GISS
Katherine Greig, Deputy Director for Planning, NYC Mayor’s Office of Recover and Resiliency
Alan Cohn, Climate Program Director, NYC Department of Environmental Protection
Laura Jay, Manager, Land Use Planning Network, C40 Cities Climate Leadership Group

Alex Gittelson, School of International and Public Affairs, Columbia University
NASA-Rio-UCCRN Training Partnership Workshop: 
Sea Level Rise, Urban Heat Islands, and Water Quality

Agenda

November 14 – 16, 2016

NASA Goddard Institute for Space Studies (GISS)
2880 Broadway, New York, NY

Monday, 14 November 2016
3rd Floor Codan Conference Room (324)

8:00 – 9:00  Badge check-in and coffee

9:00 – 9:45  Welcome and Introductions of the group
Gavin Schmidt (GISS Director)
Cynthia Rosenzweig (Local Host)
NASA-Rio Partnership Goals and Status (Dalia and Felipe)
Introduction of participants

9:45 – 10:15  NASA Overview: Dalia Kirschbaum

10:15-10:45  City of Rio Overview: Felipe Mandarino

10:45-11:15  NYC Overview and UCCRN Overview:
Cynthia Rosenzweig and Somayya Ali Ibrahim

11:15-12:00  Discussion and definition of Training Objectives:
Led by Dalia, Cynthia, Felipe

12:00 – 13:30  LUNCH

13:30 – 14:30  Thematic Overview Presentations (20 minutes each)
Sea Level Rise: Vivien Gornitz
Urban Heat Island and Green Infrastructure: Stuart Gaffin
Water Quality: Lachlan McKinna

14:30-16:30  Science Policy Interface Roundtable Discussion
Moderators: Cynthia Rosenzweig and Somayya Ali Ibrahim
Goal: Hear from policy makers about how they use science to make decisions
Participants:
Laura Jay, C40
Katherine Greig, City of New York
Alan Cohn, NYC DEP
Ricardo D’Orsi, Rio de Janeiro City Hall
Gavin Schmidt, NASA GISS

16:30 – 17:00 Wrap Up and Plans for Day 2

17:45-19:30 Dinner (Pisticci, 125 La Salle St, New York, NY 10027
http://www.pisticcinc.com/#pisticci-home)

Tuesday, 15 November 2016

8:30 – 9:00 Check-in and coffee

9:00-9:30 Introduction to Training Sessions

9:30 – 12:30 Concurrent Training Sessions (Rooms 324, 720, 316):
Sea Level Rise - Vivien Gornitz, Dan Bader, Klaus Jacob, Somayya Ali Ibrahim
Urban Heat Island and Green Infrastructure - Stuart Gaffin
Water Quality - Lachlan McKinna

12:30 – 13:30 LUNCH

13:30 – 16:30 Concurrent Training Sessions (Sea Level Rise, Urban Heat Island and Green Infrastructure, Water Quality)

16:30 – 17:30 Report Back, Discussion, and Wrap-Up

Wednesday, 16 November 2016

8:00 – 12:00 Field Trip to Hurricane Sandy Locations in Southern Manhattan: Dan Bader to lead

12:00 – 13:30 Return to GISS and LUNCH

13:30 - 16:00 Break into concurrent training sessions for summary and wrap-up

16:00 – 17:00 Concurrent Training Session Wrap-up and reporting

17:30-18:30 3rd Educational Webinar focusing on Water Quality and Sea Level Rise: Felipe Mandarino, Cynthia Rosenzweig, and Sergio Signorini participating. Access to this webinar is at: https://gsfc610.adobeconnect.com/riowebinar3/.

ADJOURN
NASA and the City of Rio de Janeiro are partnering to better anticipate natural hazards and adapt to climate change. In November 2016, ten scientists, engineers and officials from the Rio City Hall visited NASA GISS and received specialized training in sea level rise, urban heat islands and water quality.

**Workshop Background**

In December 2015, NASA entered into a formal partnership with the City of Rio de Janeiro for sharing Earth-observing data and methods, to support innovative efforts to better understand, anticipate, and monitor natural hazards, including drought, flooding, and landslides, in and around the city. Signed between NASA’s Earth Science Division and Rio’s Mayor’s Office, the agreement will leverage the unique attributes of NASA’s satellite data systems and Rio de Janeiro’s monitoring and crisis management capabilities to improve hazard monitoring and disaster response.

NASA provides satellite imagery and data from its fleet of Earth-observing satellites that is openly available to the public. Products derived from these sources are of potential value to diagnose potential hazards within the region. The City of Rio de Janeiro will provide in situ data and evaluate the routine application of Earth-observing data for monitoring efforts, decision support, and action.

NASA’s Earth Science Division is partnering with the Mayor’s Office which oversees several research and operational agencies that play a role in natural hazard mitigation and response. The Instituto Pereira Passos is the statistical and cartographic research arm of the municipal government, and handles Rio de Janeiro’s statistical data. The Centro de Operações, essentially Rio de Janeiro’s smart city hub, integrates over 30 agencies to anticipate, reduce, and respond immediately to threats like flooding, fires, and traffic accidents. The Fundação Geo-Rio acts as a geological research organization that has significant expertise in landslides. Together, these agencies provide a comprehensive set of tools and resources that help the city respond in innovative ways to a variety of natural disasters.

For the coordination of the efforts from the Rio-NASA Partnership, Mayor Paes of Rio de Janeiro created a Steering Committee, which is led by Pereira Passos Institute (IPP) and has as members the following Rio City Hall organizations: Rio Operations Center - COR; Municipal Environmental Secretariat - SMAC; RIOÁGUAS Foundation; GEORIO Foundation; Municipal Civil Defense; Planetarium Foundation; Municipal Education Secretariat - SME; Mayor’s Office - International Affairs Coordination.

In April 7th, 2016, one technician from Rio made a visit to NASA’s Goddard Space Flight Center (GSFC), located in Greenbelt, MD. The visit was a great opportunity to move forward in the actions of the partnership during a meeting with NASA specialists in climate change impacts, precipitation measurement, air quality, ocean color, fire detection, flood modeling and others subjects.
The City of Rio de Janeiro has also developed a partnership with the Urban Climate Change Research Network (UCCRN), which co-led the workshop. Based at the Columbia University Earth Institute in New York City, the UCCRN consists of more than 750 researchers and practitioners around the world, with regional hubs across the world including its Latin American Hub in Rio de Janeiro, launched in October 2015, which will help to spread the knowledge gained to other cities in Brazil and Latin America. The Hub is a partnership between the Oswaldo Cruz Institute (FIOCRUZ), the Federal University of Rio de Janeiro (UFRJ), the City of Rio de Janeiro, Columbia Global Center Latin America, and Rio Resiliente.

The UCCRN team hopes to replicate these collaborative workshops with other Hub cities in the network such as Paris, Durban, Canberra, Philadelphia, and Shanghai.

**Workshop Summary**

The main aim of the workshop was for representatives from Rio and New York City to learn from each other’s experience. Rio’s sophisticated Operations Center continuously monitors weather, traffic and other city operations, coordinates communications with the public and media, and provides crisis management facilities. New York City is working to strengthen its climate resilience e.g., by building new coastal defenses at Jamaica Bay.

Many of the Rio and New York participants were members of UCCRN, an effort to coordinate researchers and city leaders on climate change impacts and adaptation at the city level. Somayya Ali Ibrahim (Columbia University/UCCRN) and Cynthia Rosenzweig (NASA GISS) described the recent launch of the UCCRN Latin American Hub in Rio de Janeiro, in partnership with local universities and the City of Rio.

A Science-Policy Roundtable, with participants from Rio City Hall, City of New York, NASA GISS, and C40, focused on the value of climate data to support cities’ climate resilience efforts. NASA data products and climate projections are particularly valued because they are well-vetted and openly available. However, for local decision-making (such as monitoring the water supply or responding to a power outage), these products must be paired with high-resolution in situ measurements.

The second day of the workshop consisted of concurrent training sessions. There were four main Thematic Areas of the workshop:

**Theme 1:** Intense rainfall, landslides, and flooding

**Theme 2:** Climate change impacts

**Theme 3:** Water and air quality monitoring

**Theme 4:** Education and outreach
Stuart Gaffin and Alex Gittelson (Columbia University/UCCRN) summarized their research on the effects of different surfaces on air temperature (e.g., pavement vs. tree-covered areas), and the impacts of green infrastructure on the urban environment. Vivien Gornitz (Columbia University/UCCRN) noted that, in the New York area, sea level is rising by approximately 3mm/year, reflecting a combination of the warming surface climate and long-term glacial adjustment. Sea level is measured by both high-frequency tide gauges and by radar altimeters such as that aboard NASA’s Jason-2 satellite. Rising sea level has consequences for cities: accelerated coastal erosion, saltwater intrusion and more frequent ‘nuisance’ street flooding. Lachlan McKinna (NASA GSFC) explained the challenges of studying ocean ecology with remote sensing i.e., just 10% of the satellite signal comes from the ocean. Several planned missions, such as PACE and SABIA-Mar, are expected to provide high-quality measurements, particularly in coastal zones.

Participants gathered at Battery Park in New York City to appreciate the impacts of Hurricane Sandy and the projected increases in sea level on this area of Lower Manhattan.

On the last day of the workshop, Dan Bader (Columbia University/UCCRN) led the group on a field trip to Hurricane Sandy-affected areas of lower Manhattan. Participants saw the 2012 high-water mark of the
storm surge generated by Hurricane Sandy, well above the boardwalk at Battery Park. Seeing the affected areas further encouraged participants from New York and Rio to continue their cities’ preparations for sea level rise and extreme weather events. The event culminated with a Facebook Live stream highlighting the NASA-Rio partnership, which featured Dalia Kirschbaum (NASA GSFC), Cynthia Rosenzweig (NASA GISS), Felipe Mandarino (Instituto Pereira Passos), and Daniel Bader (Columbia University/UCCRN).

Strong partnership and continued communication between NASA, UCCRN and Rio de Janeiro’s City Hall will facilitate the use of NASA data products and climate simulations in Rio’s sea level rise projections, landslide risk prevention and water quality monitoring, and advance Rio and New York City’s climate resilience. The hope is to replicate this experience in other UCCRN cities around the world.

_Dalia Kirschbaum and Felipe Mandarino give an overview of the NASA-Rio partnership._
Cynthia Rosenzweig details the history of climate change reporting and adaptation in New York City.

Felipe Mandarino and Klaus Jacob discuss the ‘AlertaRio’ system.

**Key Takeaways from Workshop**

For each of the key focus areas of the workshop, the ripest opportunity to complete immediately following the workshop, next steps, and a potential application to cities globally (via UCCRN) were identified.
1. **Sea level rise**

Low hanging fruit – For the city of Rio de Janeiro, regional sea level rise projections will be developed. These projects will include all 6 components, advancing the initial projections that were developed. The two terms to be added will be the ‘fingerprint’ (taken form the literature) and land subsidence (taken from Peltier). Where possible, Integration with federal policies/information will be explored.

UCCRN Template – Using NASA altimetry data time series (Jason 3, TOPEX), observed sea level rise trends can be computed for cities globally. NASA MODIS Data snapshot including keystone species will be developed.

Next steps – Once the sea level rise projections are completed, we will conduct a review of the best science available for flood modeling, in particular hydrodynamic modeling for coastal storm surge. This will entail searching and analyzing datasets and models that could provide the City with one (or more) tools to evaluate future flood risk.

*NASA Jason-2 satellite radar altimeter monitoring for sea level rise. Source: NASA*
2. Urban heat island

Low hanging fruit – Urban heat island maps for Rio were developed using NASA Earth Science Data (Landsat 8). Additional map products will be developed. A web application featuring these products is already released by IPP at http://arcg.is/2hdM05w.

UCCRN Template – Map products showing surface temperatures, other climate variables, and land surface characteristics using NASA remote sensing products (Land cover change, NDVI) can be developed for cities globally. This would include snapshot images and data time series.

Next steps – For the future, providing atmospheric correction for thermal bands from Landsat is a goal. The information from the remote sensing products can be utilized for better understanding of the impacts of heat waves on public health.

*NASA Landsat data map showing surface temperatures and the Urban Heat Island in New York City*
3. Coastal water quality

Low hanging fruit – Initial work will focus on data processing and workflow for Landsat8, advancing software expertise, and exploring the compatibility of operating systems. The goal is to create a procedure inside SEADAS to monitor water quality in the coastal ecosystems of Rio de Janeiro.

UCCRN Template – A selection of key indicators including, Chlorophyll A, total suspended matter sediment, turbidity, sea surface temperature, can be obtained from MODIS Terra Truecolor. With these data, an image for a snapshot of a coastal urban area with key challenges highlighted can be developed. This would be relevant to cities globally.

Next steps – As the work continues, efforts will focus on Investigating the possibility of estimating coliform concentration levels from Landsat proxy, with additional data from a drone based aerial survey. The goal is to use, evaluate, and improve the algorithm created for Rio using local monitoring data for calibration and validation.

MODIS Aqua Total Suspended Matter for Guanabara Bay, Brazil, 30 June 2015 @250m
Landsat-8 Chlorophyll-a for Guanabara Bay, Brazil, 19 March 2016 @30m
4. Landslides and flooding

Low hanging fruit – The first step that is already underway is to evaluate the usage of the existing landslide forecast model in RIO’s operations center (COR). After, the goal is to Introduce PMM’s Global Landslide Nowcast in the decision framework of AlertaRio (City’s meteorology office that is responsible for sending landslides alerts and sirens activation).

UCCRN Template – Using the GPM landslide catalog (snapshot where landslides have occurred recently) based on intense precipitation, vulnerabilities of cities globally can be assessed. For heavy precipitation, a global inland flooding model can be evaluated.

Next steps – Following up, the next step is to adapt the landslide model to read local data and improve spatial resolution, evaluate existing flood model and its potential to be integrated into the Operations Center routine, interactions with Columbia engineers working on landslides and flooding innovations.

Action Items

- Continue developing processes and partnerships
- Link data to responsible institutions
- Provide open access to the products developed under this partnership
- Strengthen communication and relationships for administration transitions
- Document and provide feedback for use of data for decision making
- Explore framework for data sharing
- Share best practices on institutional frameworks for development of climate resiliency
- Develop long-term sustainability for human resources, data, models, analysis for climate resilience
- Continue to build the NASA-RIO-UCCRN Partnership

Next Steps

- Schedule next workshop in Rio (2017)
- Continue to integrate education and outreach and work with data visualization products
- Identify new topics and experts
- Reach out to new partners (e.g., INPE, IBGE, AEB, CONAE)
- Work with UCCRN on templates
- Schedule monthly teleconferences
For more information on the Partnership:

www.nasa.gov/feature/goddard/2016/nasa-helps-cities-address-climate-risks

www.nasa.gov/feature/goddard/2016/nasa-to-aid-disaster-preparedness-in-rio-de-janeiro

Urban Climate Change Research Network (UCCRN):

www.uccrn.org

Pereira Passos Institute:

www.armazemdedados.rio.rj.gov.br/