Engineering Research Center for
Collaborative Adaptive Sensing of the Atmosphere

Off-The-Grid X-band Weather Radar Network for the West Coast of Puerto Rico

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CASA UPRM

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University of Oklahoma
Colorado State University
University of Puerto Rico Mayaguez

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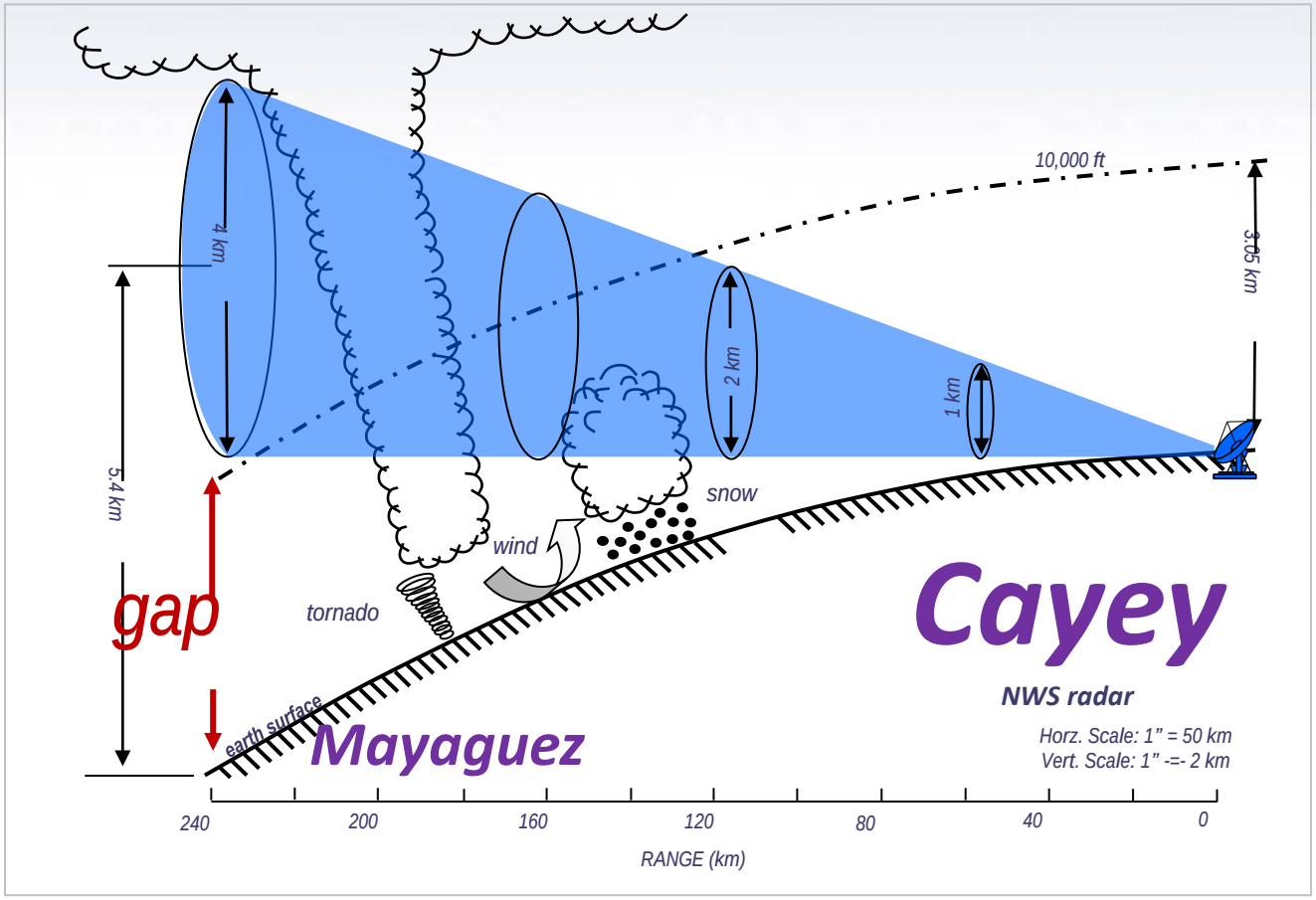
What is CASA?

- Collaborative Adaptive Sensing Atmosphere
- Multi-sector partnership
  - Academia
  - Industry
  - Government
- UPRM, UMASS, OU and CSU

The Problem



There's a GAP in the lower atmosphere which cannot be sampled due to the earth curvature and distance between the radar and target.

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Puerto Rico Test Bed

- Multi-level Research Team
- Low infrastructure, Low Cost
- Off-the-Grid Radars
- Mesh Network on West Coast Puerto Rico
- Weather Reflectivity Data
- Data Processing and Visualization

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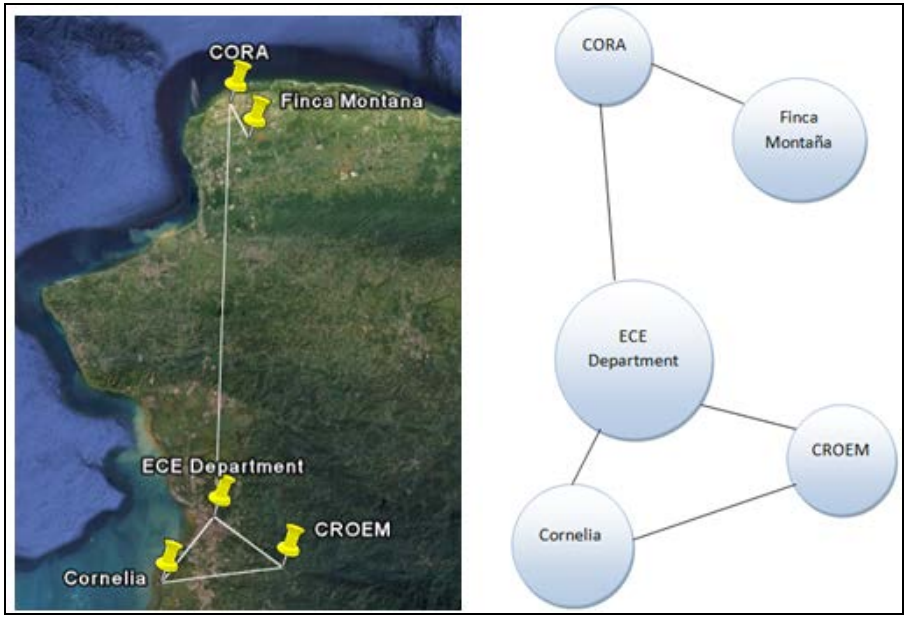
Radar Network



- Three Radars
- Wireless Links
- Servers
- Relay Stations

Network Node

- Weather Radar
- Processing Computer
- Wireless Link

X-Band Weather Radar

Radar Specifications:

- Furuno Marine Based
- Frequency = 9.41 GHz
- Peak Power = 4 kW / 25 kW
- Operational Range = 15 / 30 km
- Non Polarimetric
- Non Doppler

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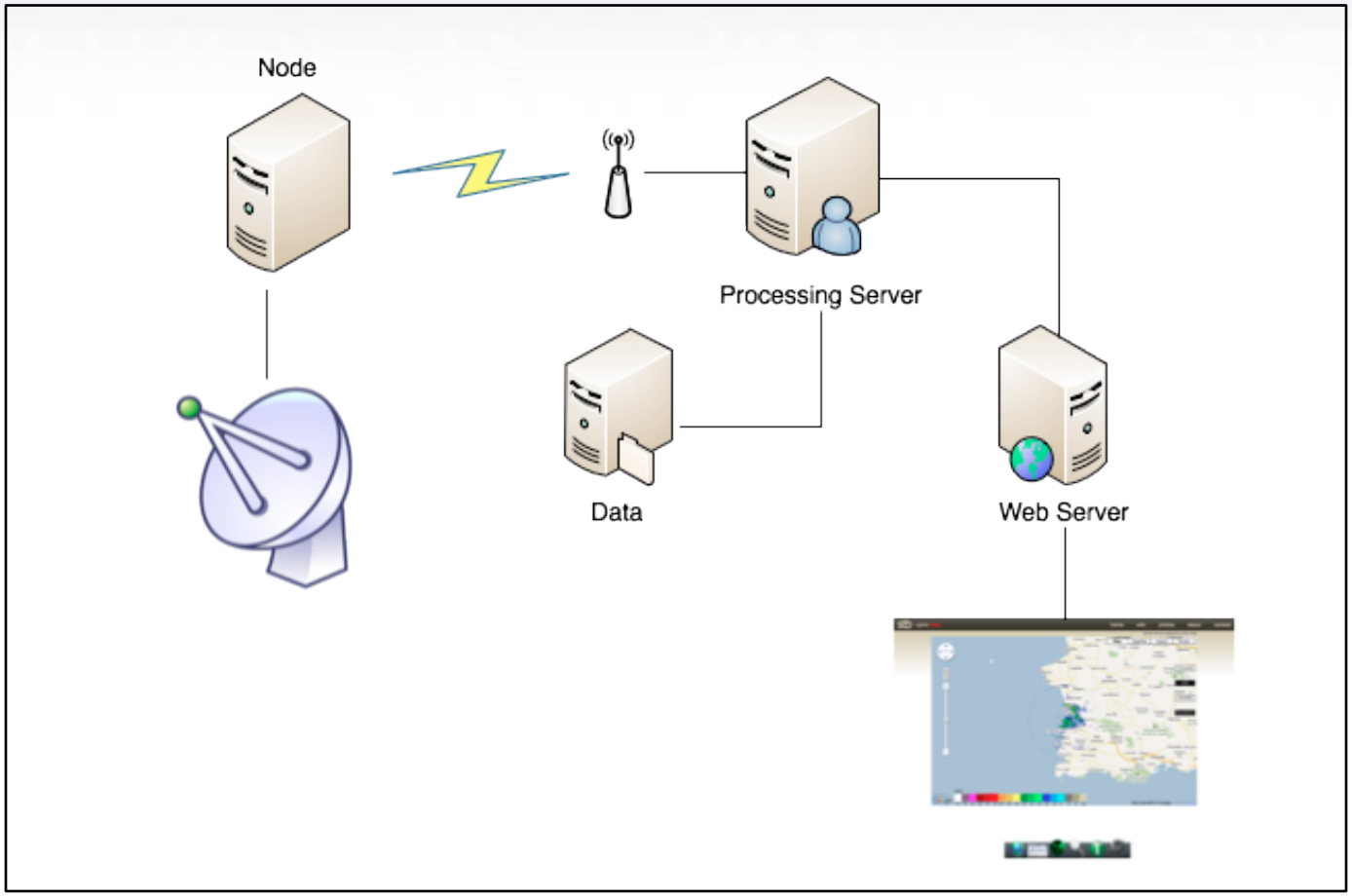
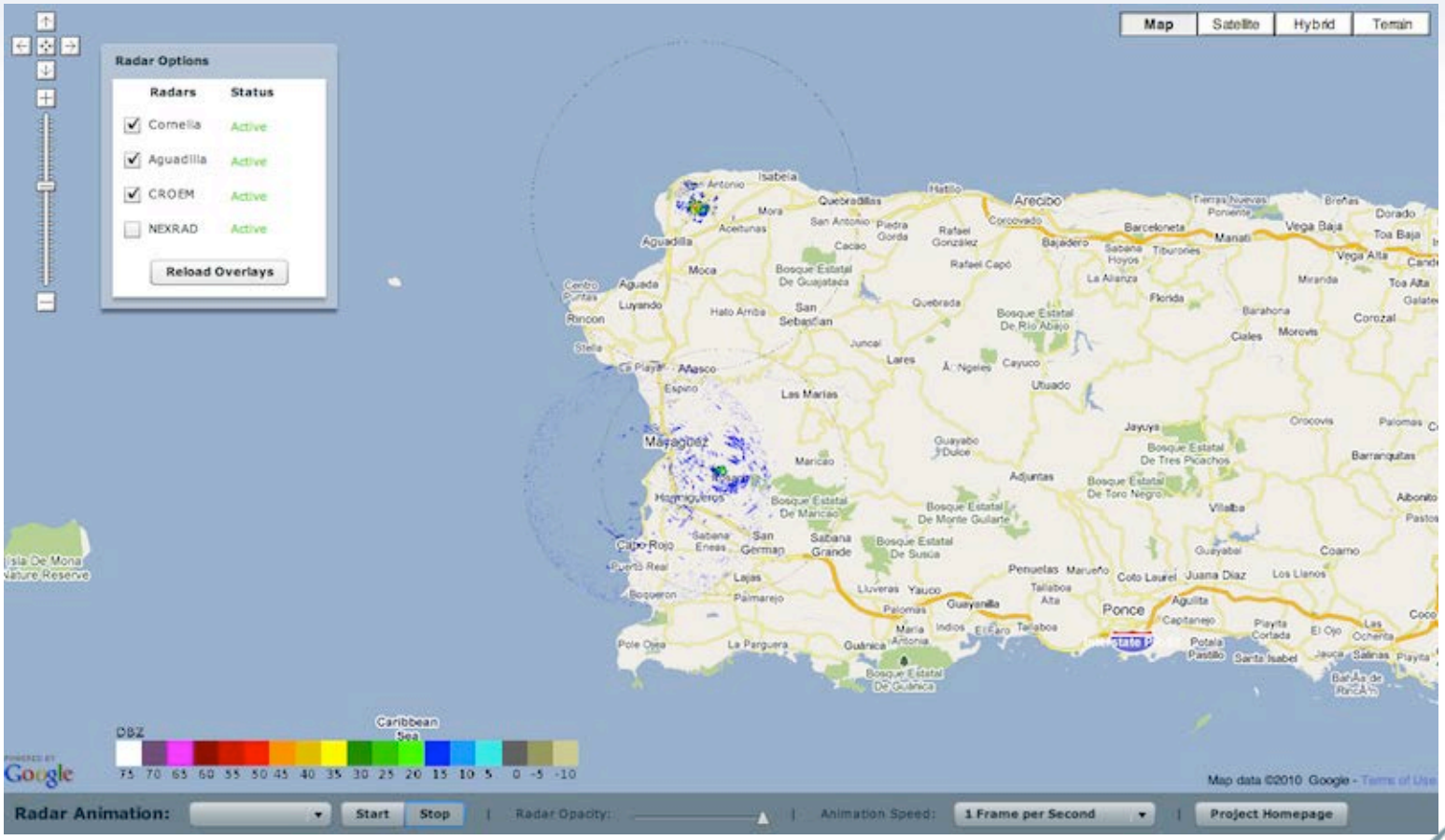
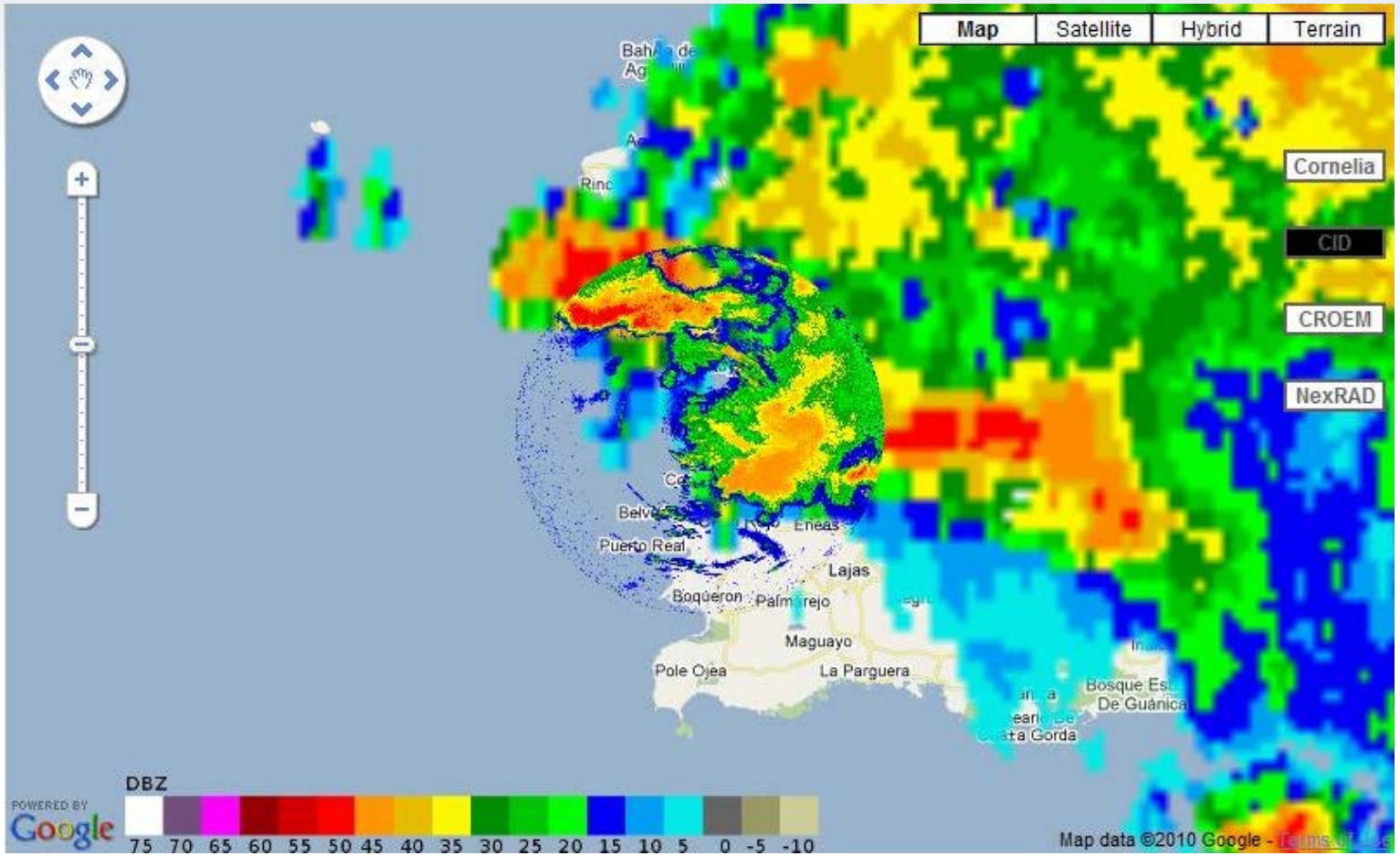
Network Behavior



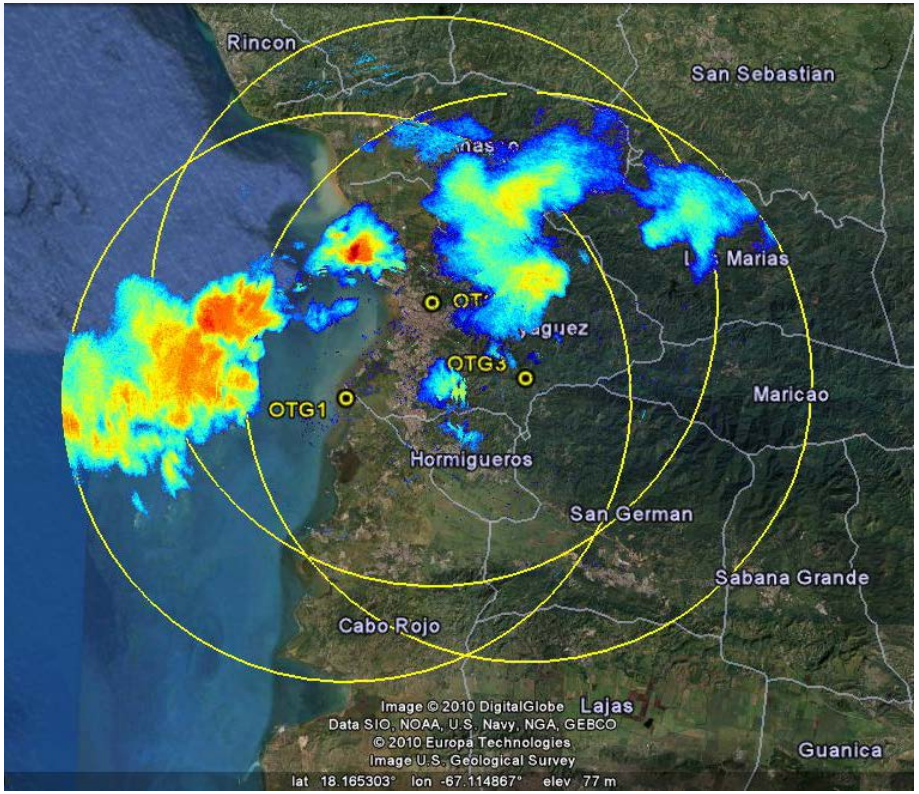
Monitoring Web App

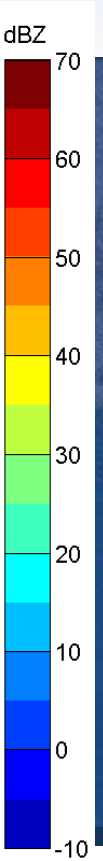


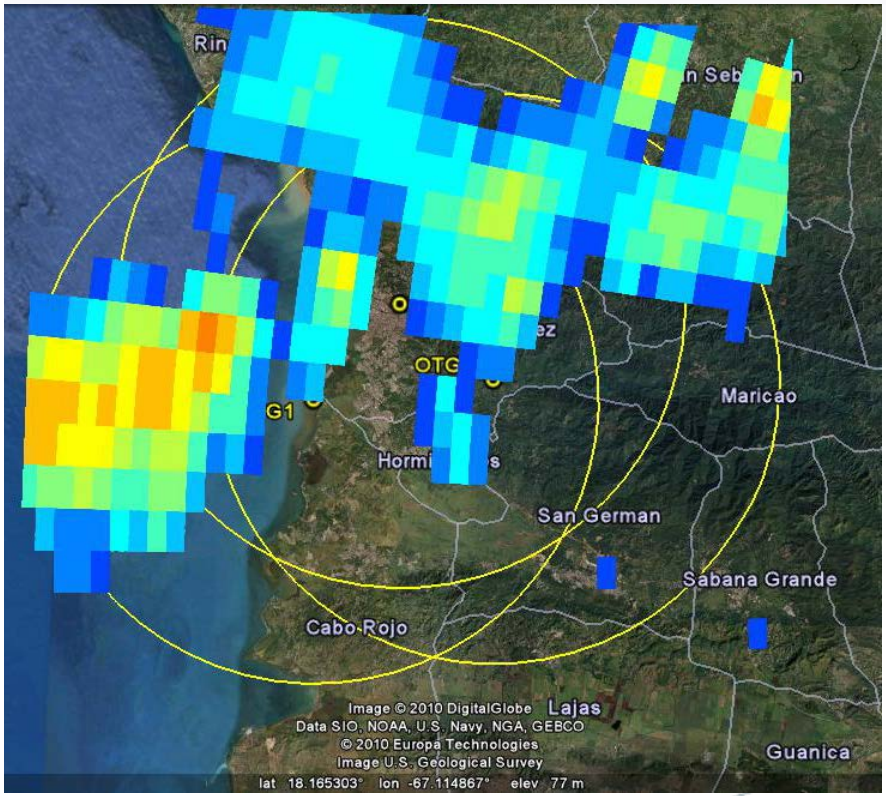
Results


Map
Satellite
Hybrid
Terrain
Cornelia
CID
CROEM
NexRAD
Puerto Real
Lajas
Boquerón
Maguayo
Pole Ojea
La Parguera
De Guánica
DBZ
75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 -5 -10
Map data ©2010 Google

August 29, 2010







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Advantages

- Low Cost
  - Almost 10 times cheaper than current
- Low infrastructure
  - Low maintenance cost
- Off the Grid
- Better for uneven terrains
- Improved resolution

Limitations

- Non polarimetric
- Non Doppler
  - Unable read velocity
- Range
  - 30km vs up to 460km
- Power
  - 25kW vs 1MW

Future Work

- Doppler Off-The-Grid radar
- Improve system performance
- Lower current cost
- Better Merging algorithms
- More Radars….

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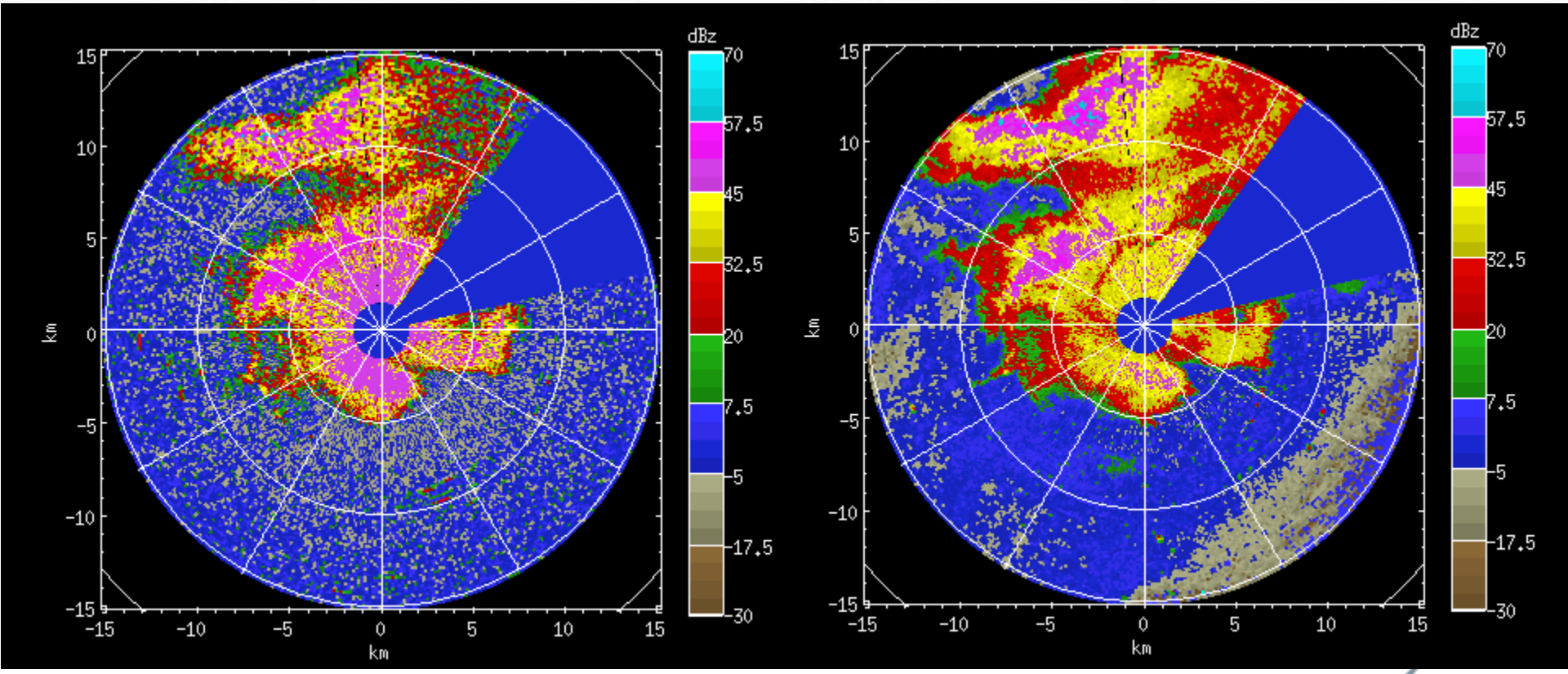
PR Test Bed Team

Questions

- ???

Live Demo

OTG vs CSU-CHILL



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Note the improved resolution of UPRM Radar
Sebastian
Stella
Perchas
La Playa
Añasco
Espino
Hacienda Morales
Hacienda San Pedro
Eugenio Maria De Hostos Airport
Hacienda Lamberti
Las Marías
La Soledad
Hacienda Juanita
Hacienda Buena Vista
Hacienda Esperanza
Maricao
Rosario
Campamento Buena Vista
Hormigueros
Hacienda Corcega
Bosque Estatal De Maricao
Delicias
Margarita
Belvedere
Cabo Rojo
Sabana Grande
San German
Puerto Real
Interstate PR-2
Pr-114
Pr-100
Pr-102
Google
5 mi
5 km
Map data ©2010 Google, Europa Technologies
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75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 -5 -10
DBZ


Note the improved Resolution of one UPRM Radar
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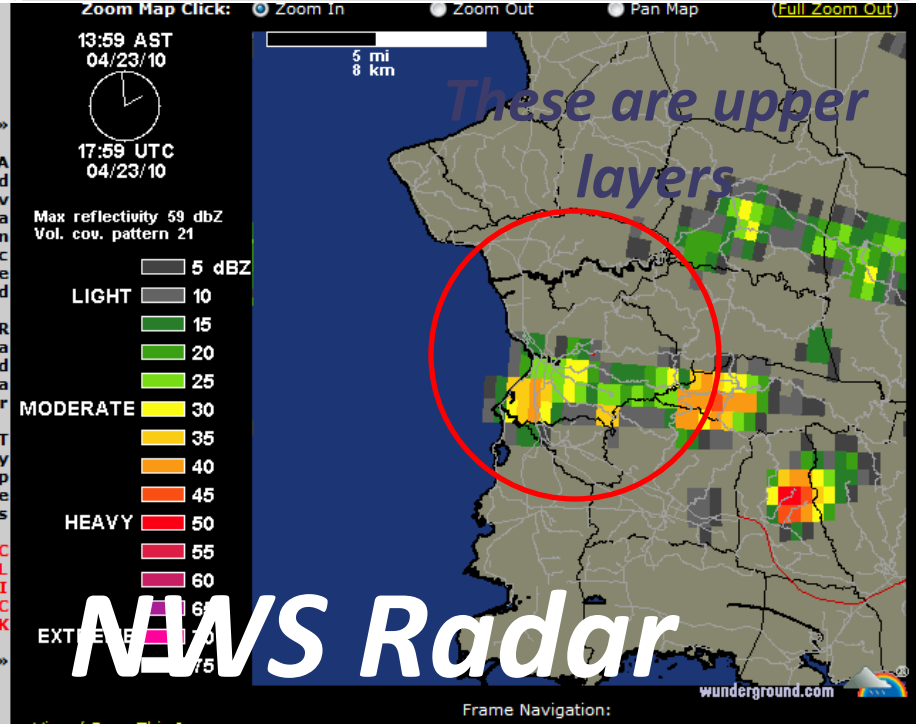
Zoom Map Click: Zoom In Zoom Out Pan Map (Full Zoom Out)
13:59 AST
04/23/10
17:59 UTC
04/23/10
Max reflectivity 59 dbZ
Vol. cov. pattern 21
5 dBZ
LIGHT
10
15
20
25
MODERATE
30
35
40
45
HEAVY
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55
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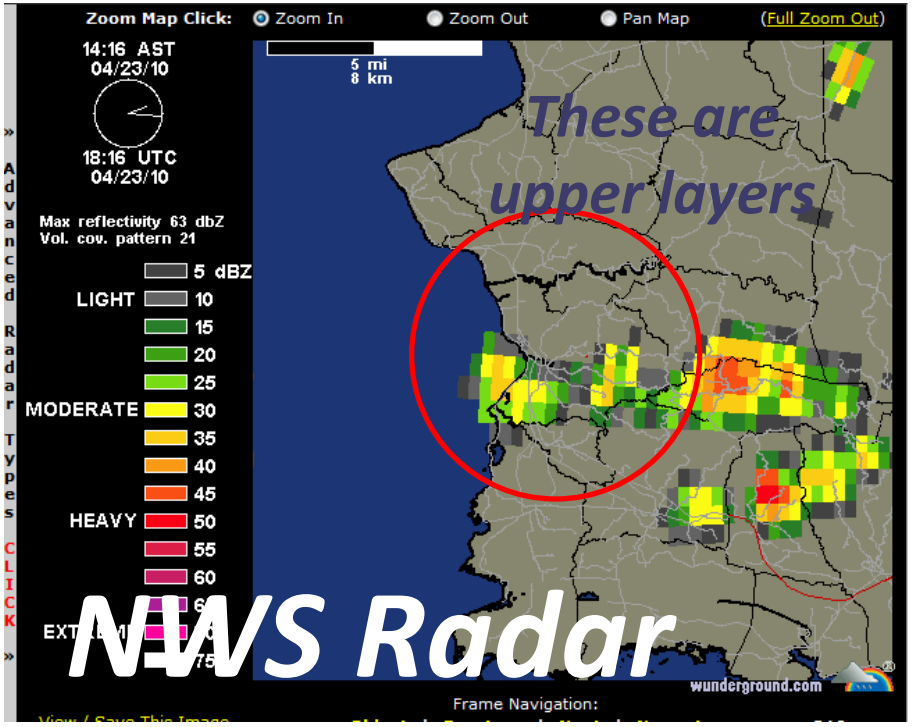
5 mi
8 km
These are upper layers
NWS Radar
wunderground.com
Frame Navigation: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04/23/10
18:16 UTC
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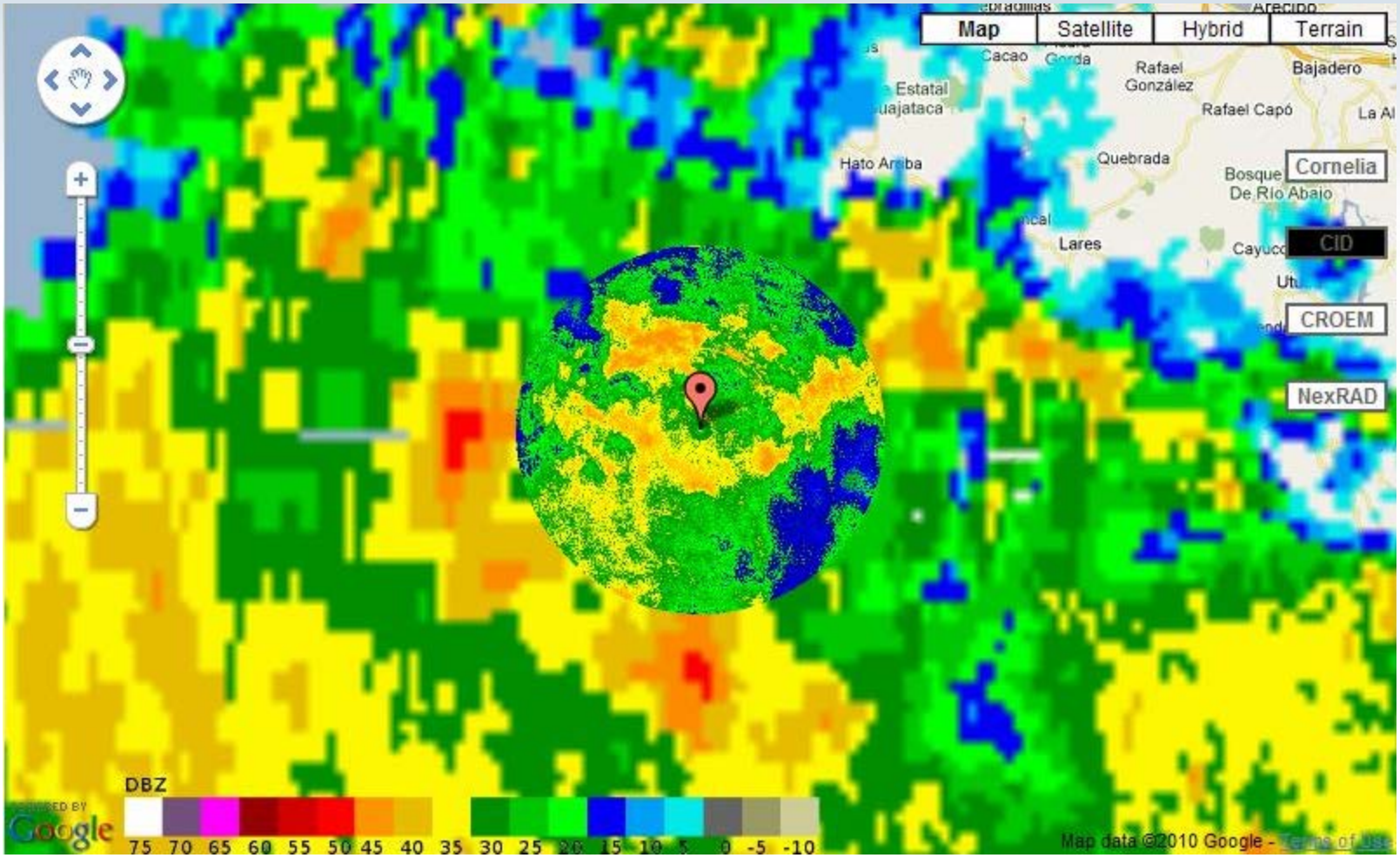
Some Results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Cacao
Rafael González
Bajadero
Rafael Capó
Hato Arriba
Quebrada
Bosque De Río Abajo
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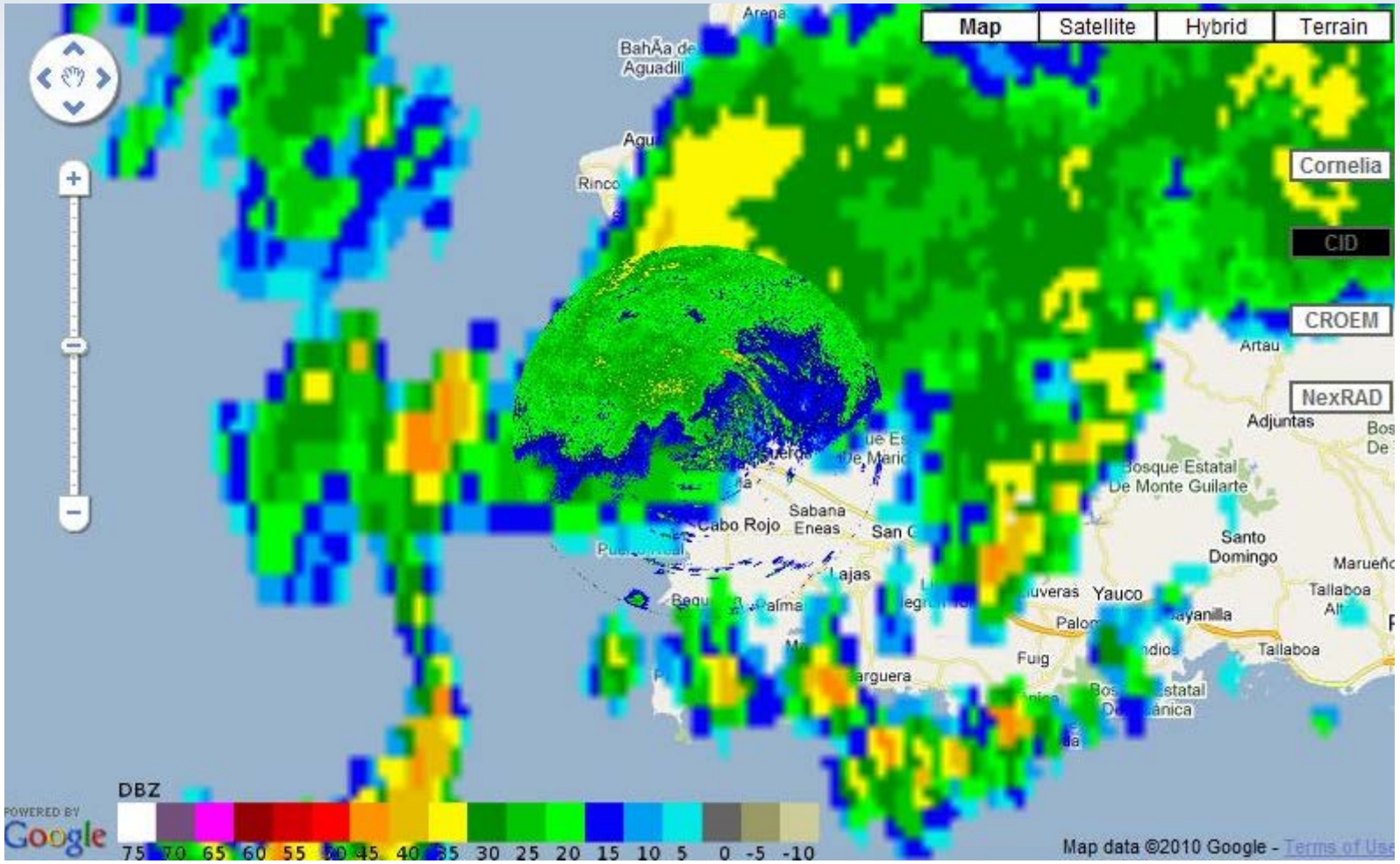
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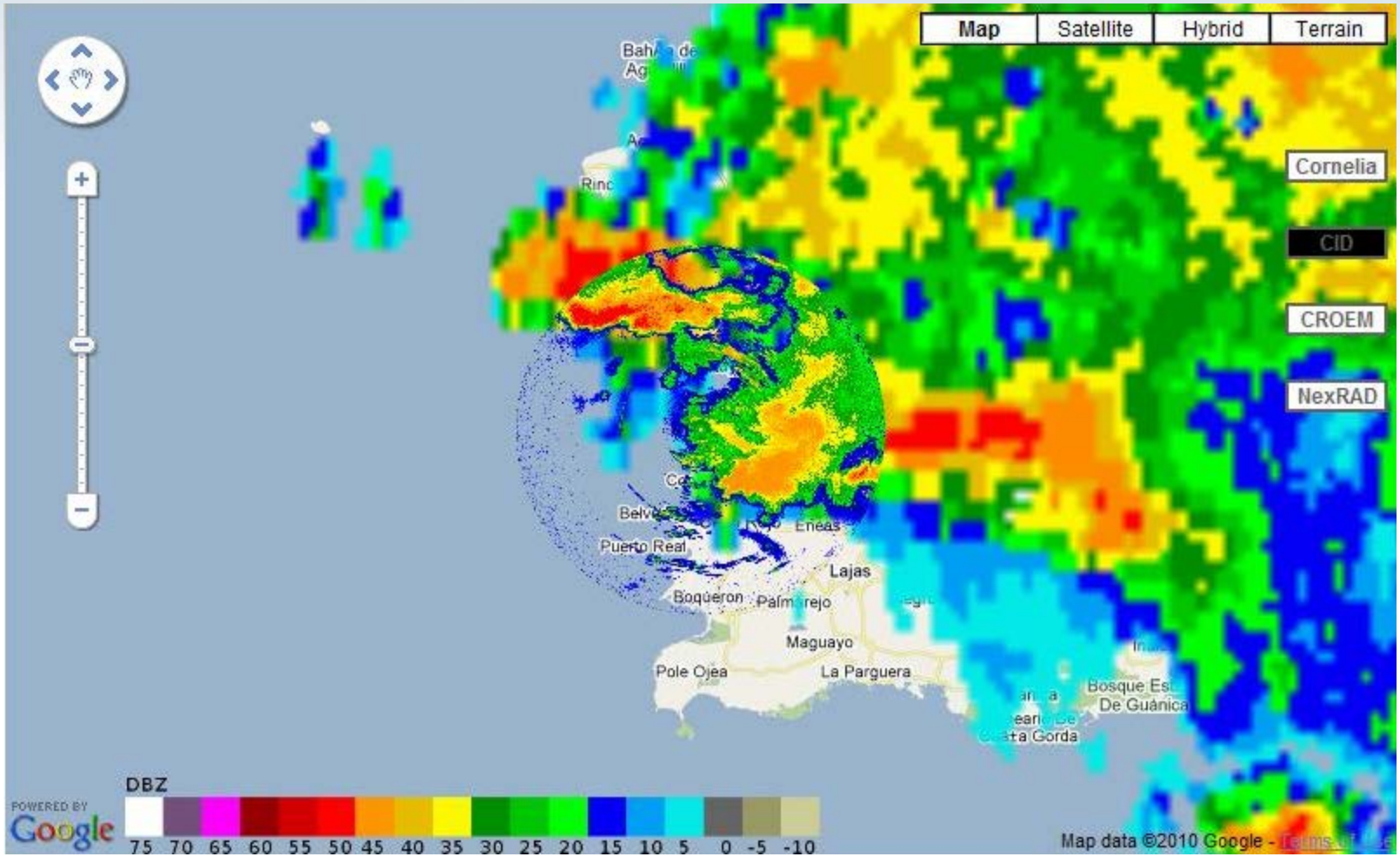
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DBZ
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Map data ©2010 Google

Remarks

- Nodes localization are:

1. Cornelia Hill
2. CROEM
3. Aguadilla (Finca montaña)

- Measurements have been taken when the Nexrad has been down
- Helped to discuss the high gusts during the Central American games celebrated this last summer (2010)
- Reflectivity product is available
- Professors from hydrology have been able to make validation studies using rain rate vs. their weather station grid

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Remarks

• Current network can compliment the measurements taken by the Nexrad radar

•Temporal resolution is at 3 min compared to the 5 min used by Nexrad

•Range resolution used is of 15 m compared to the 150 m of Nexrad

•The portal serves as a tool for the western coast community

•Clutter removal as a network and Doppler implementation is currently under research for better product

•Data merge will enhance the current reflectivity plots

http://stb.ece.uprm.edu/v2/index.html

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