VIIRS DNB for Disaster Response

Science Advisory Committee Meeting

26 – 28 August, 2014

National Space Science and Technology Center, Huntsville, AL

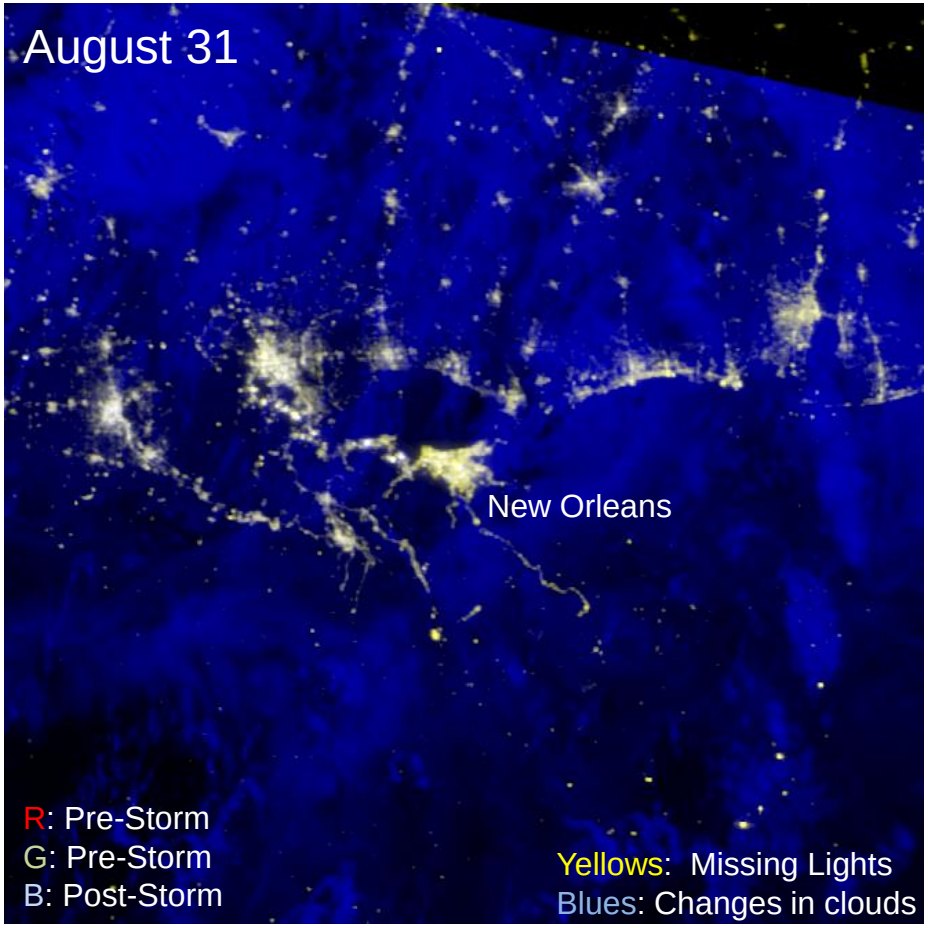
Disaster Response Activities

- In addition to using daytime, land surface observations for disaster support, the SPoRT Disasters Team has explored the use of the VIIRS day-night band (DNB) for disaster applications.
  - Since the DNB observes light associated with human activity and major settlements, changes in light can be useful in identifying power outages, loss of infrastructure, and other impacts.
- Activities have focused on specific events and R&D topics
  - Hurricane Isaac (2012)
  - Superstorm Sandy (2012, Molthan et al. 2013 in AGU Eos)
  - Moore, Oklahoma tornado (2013)
  - Super Typhoon Haiyan (2013)
  - Chilean Earthquake (2014, and in support of SERVIR collaborations)
- Efforts in using the VIIRS DNB for disaster response have been well-received by the NASA Administrator and acknowledged through both Center and Agency Group Achievement Awards

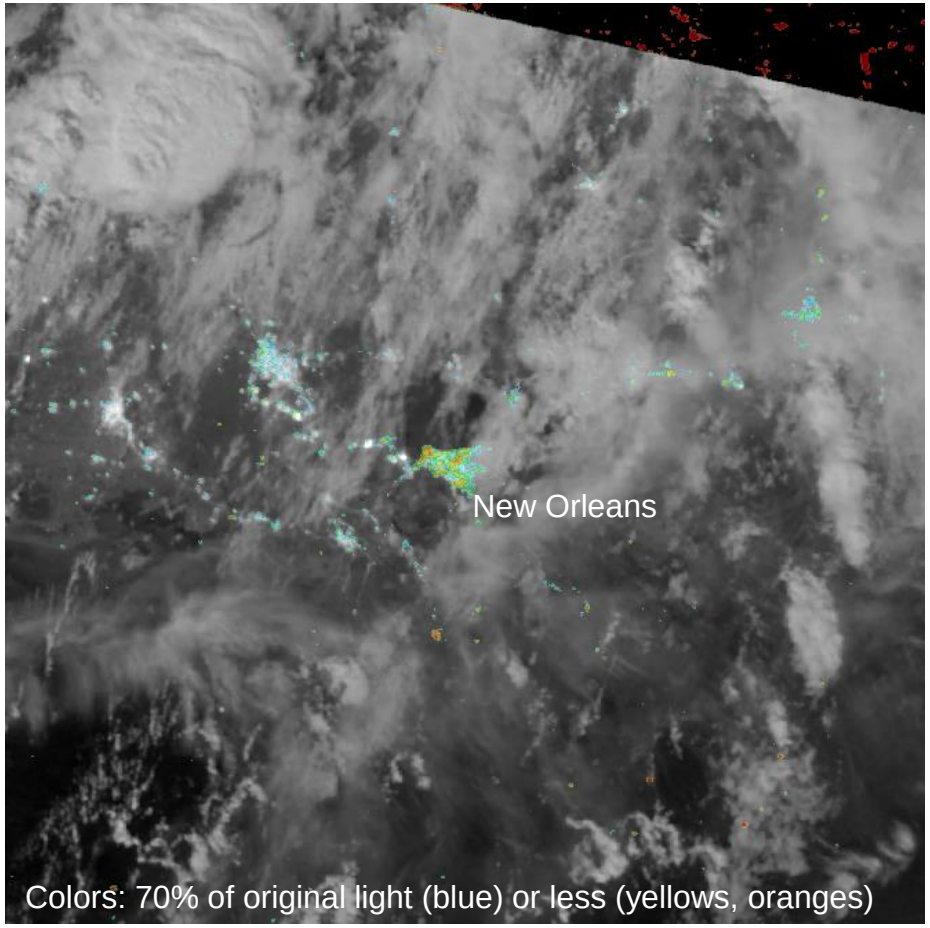
Use of the VIIRS DNB

- Since the VIIRS DNB observes light emitted from human activities, we focus on the loss or change in pre-event light in order to identify affected areas and recovery
- Two concepts have been explored to date:
  - False color RGB compositing to highlight changes in light
    - Using a composite where R and G are pre-event, and B as post-event, missing lights are highlighted in shades of yellow.
  - Differencing pre- and post-event to produce a "percent of normal light"
    - In a more quantitative approach, dividing current emissions by a reasonable pre-event baseline allows for monitoring current light conditions and trends toward normal during recovery efforts
- Disaster response can be further supported by identifying populations and infrastructure located within outage areas.

Concepts Applied to Hurricane Isaac



False color composite of pre- and post-storm VIIRS DNB imagery over New Orleans, immediately following Issac.



VIIRS DNB imagery (moonlit clouds, emitted light) following Isaac, superimposed with "percent of normal" light, based upon differencing of clear pre-storm imagery.

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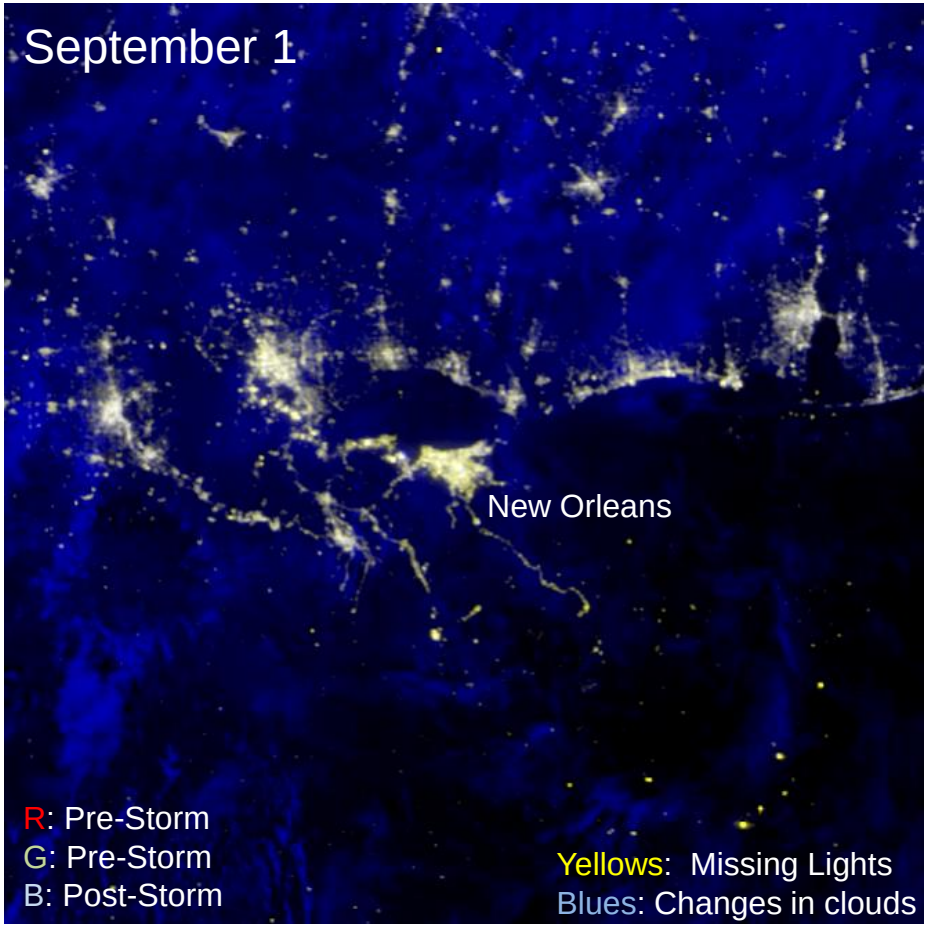
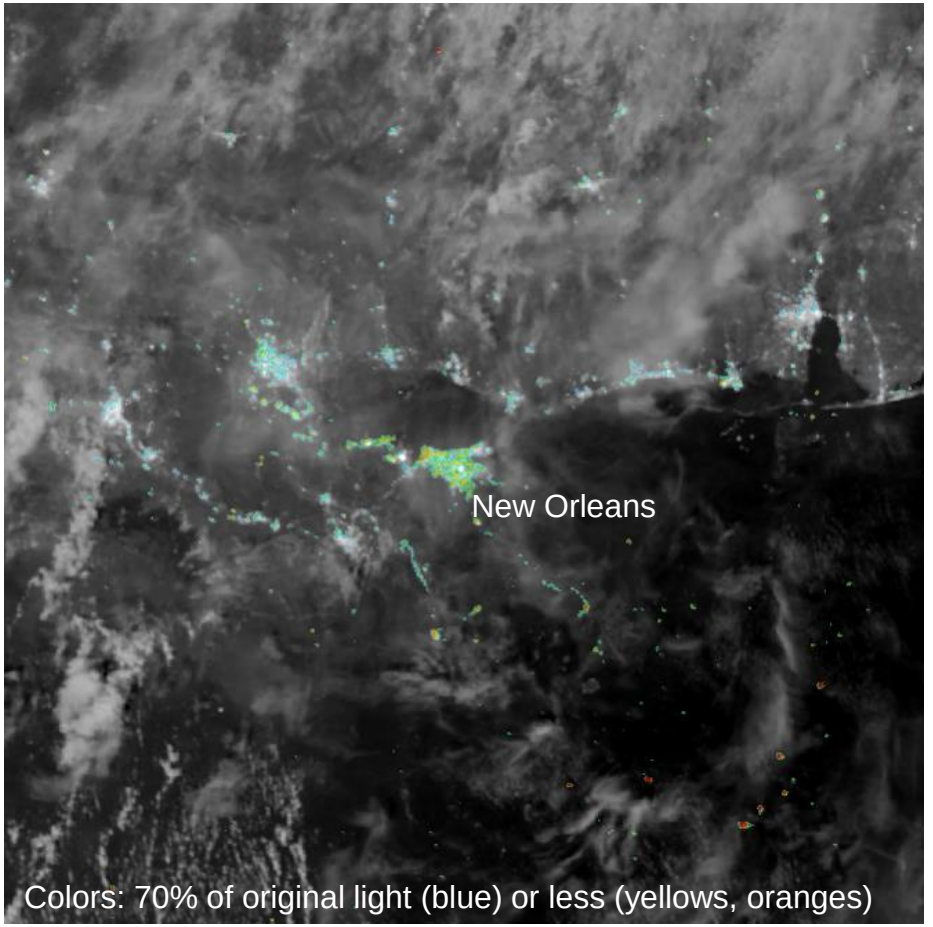
Concepts Applied to Hurricane Isaac



False color composite of pre- and post-storm VIIRS DNB imagery over New Orleans, as power recovery continued.



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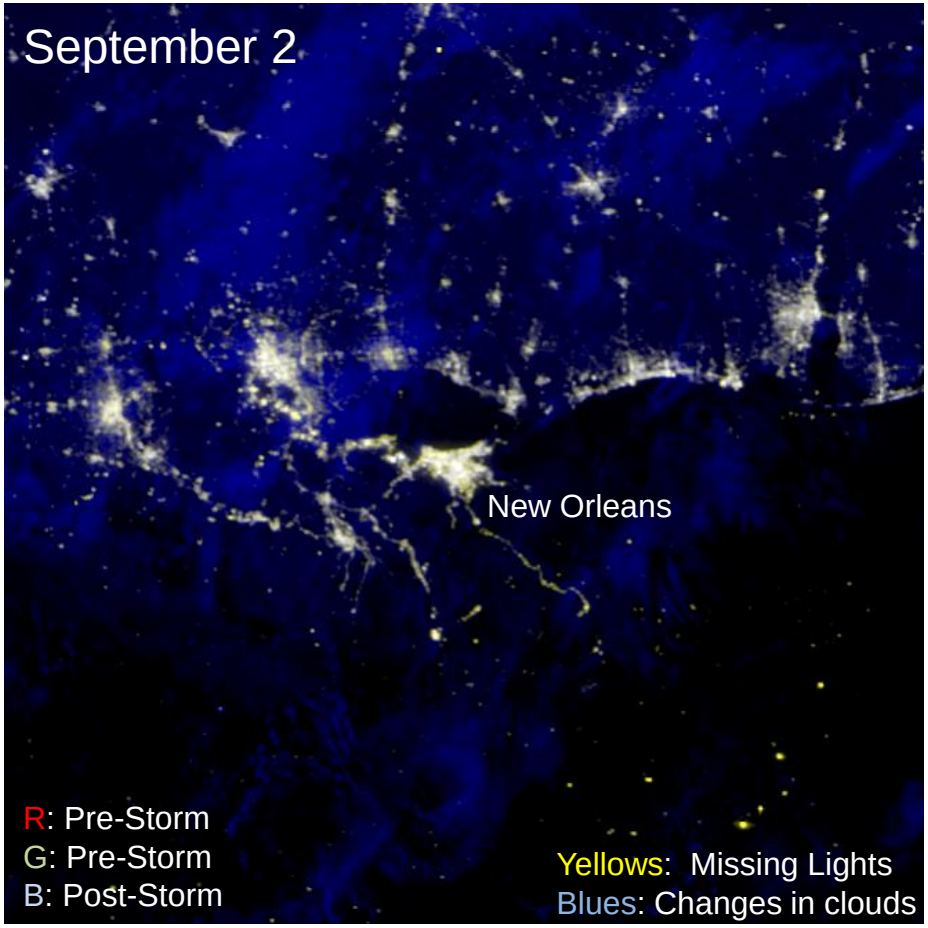

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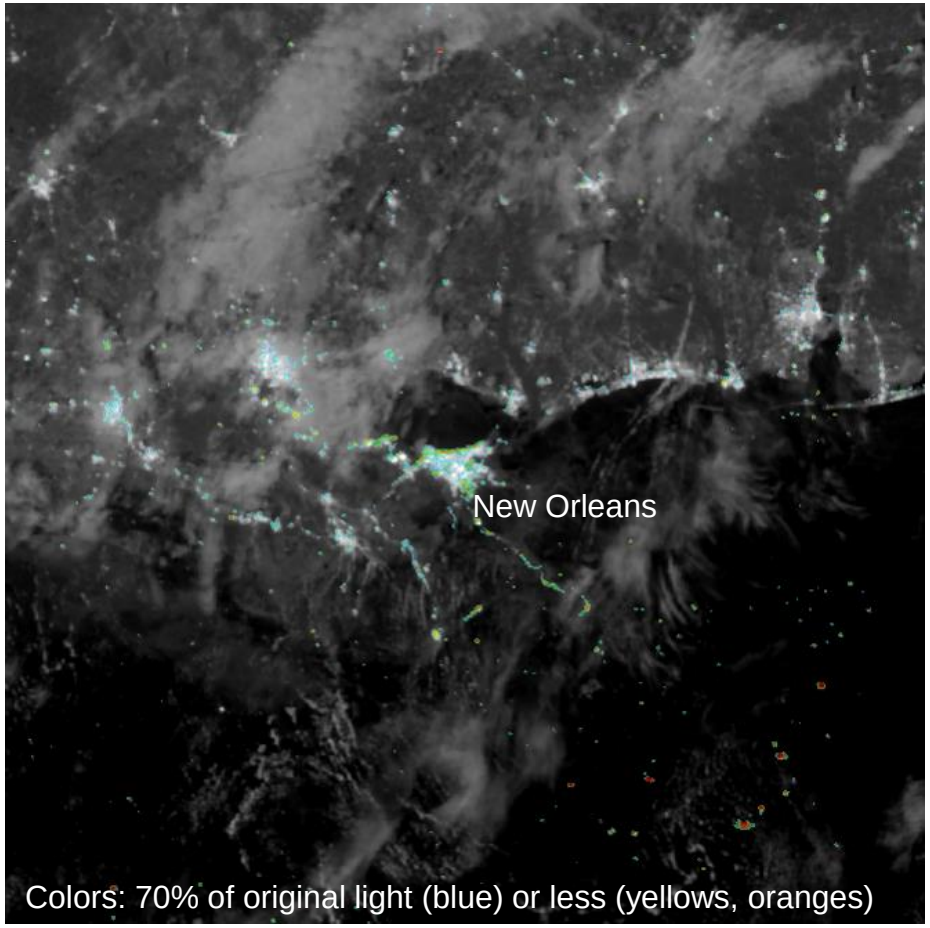

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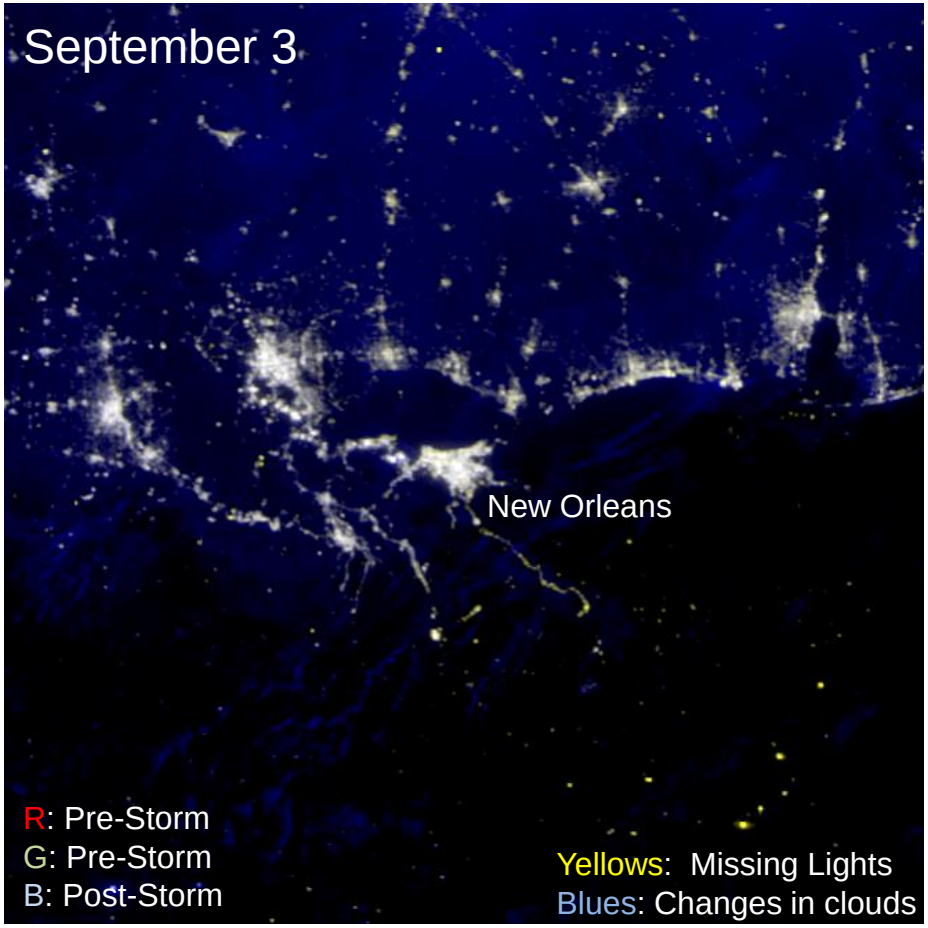

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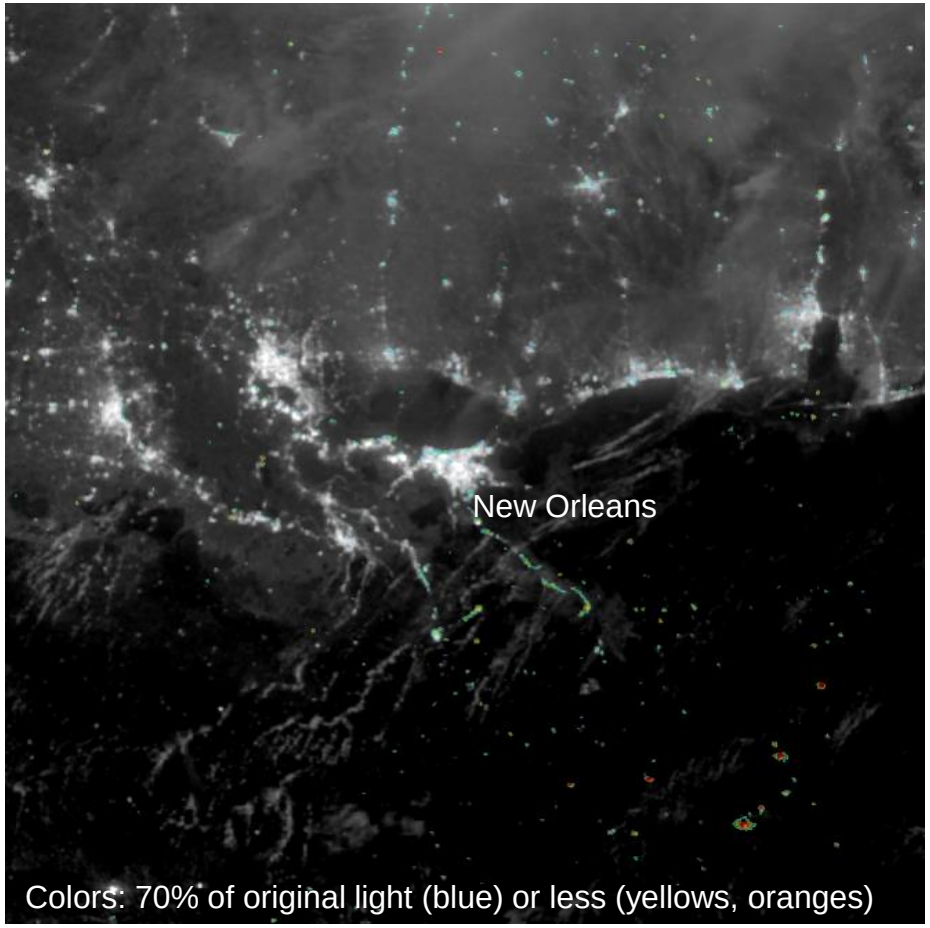

VIIRS DNB imagery (moonlit clouds, emitted light) following Isaac, superimposed with "percent of normal" light, based upon differencing of clear pre-storm imagery.

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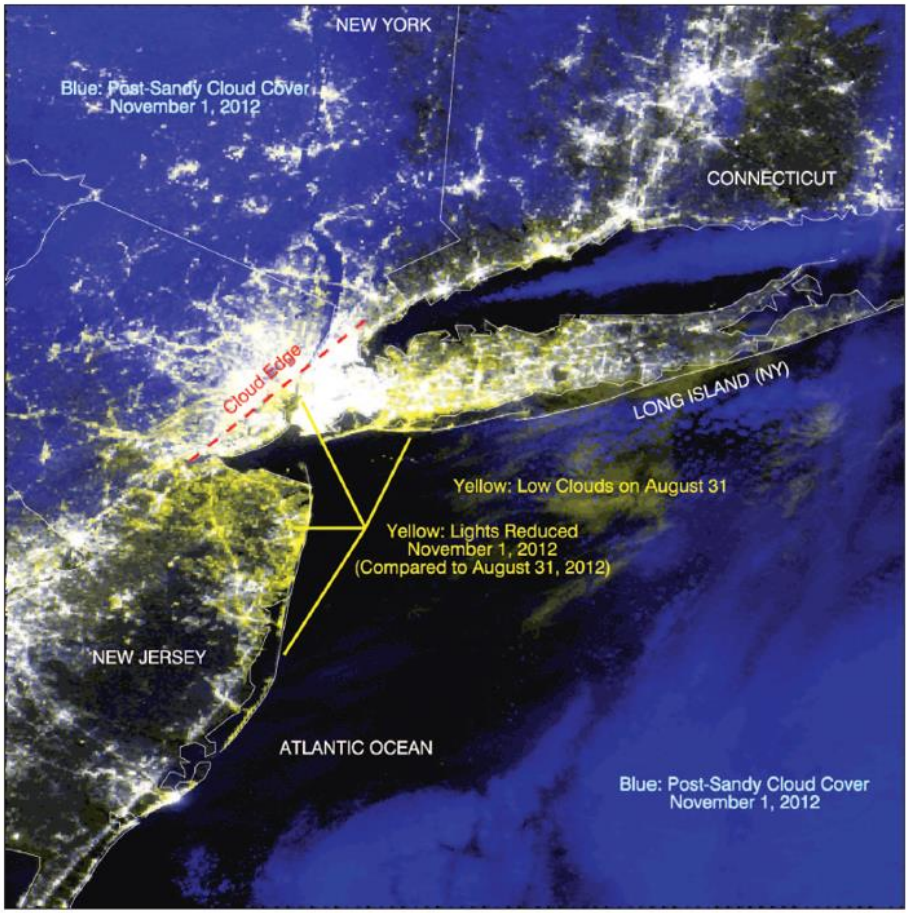
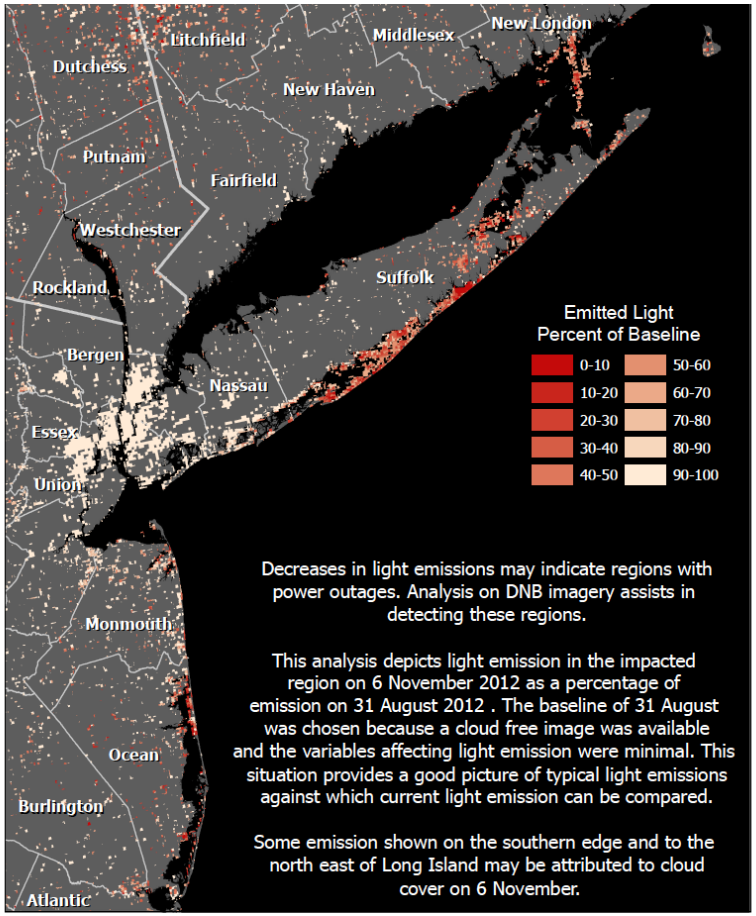
Concepts Applied to Superstorm Sandy

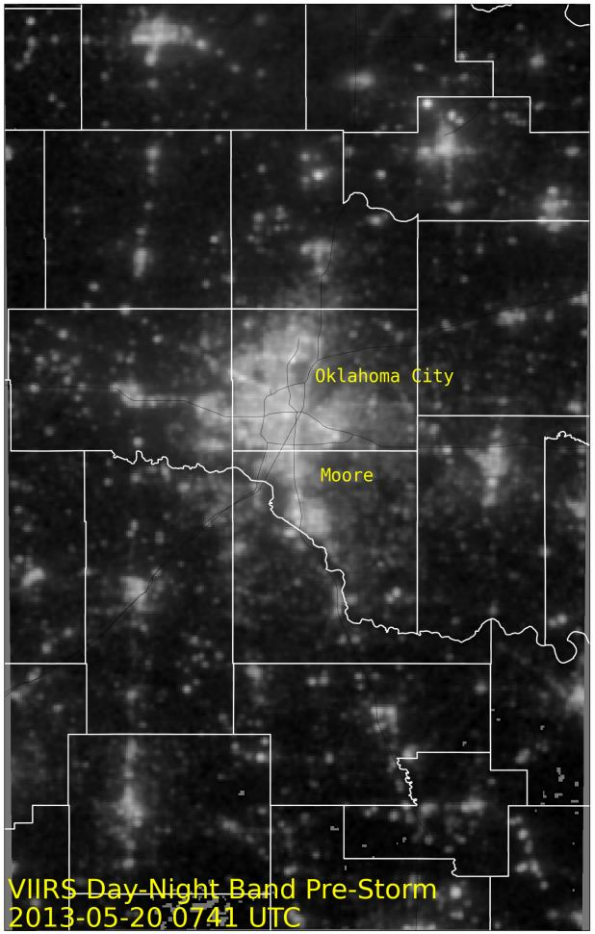


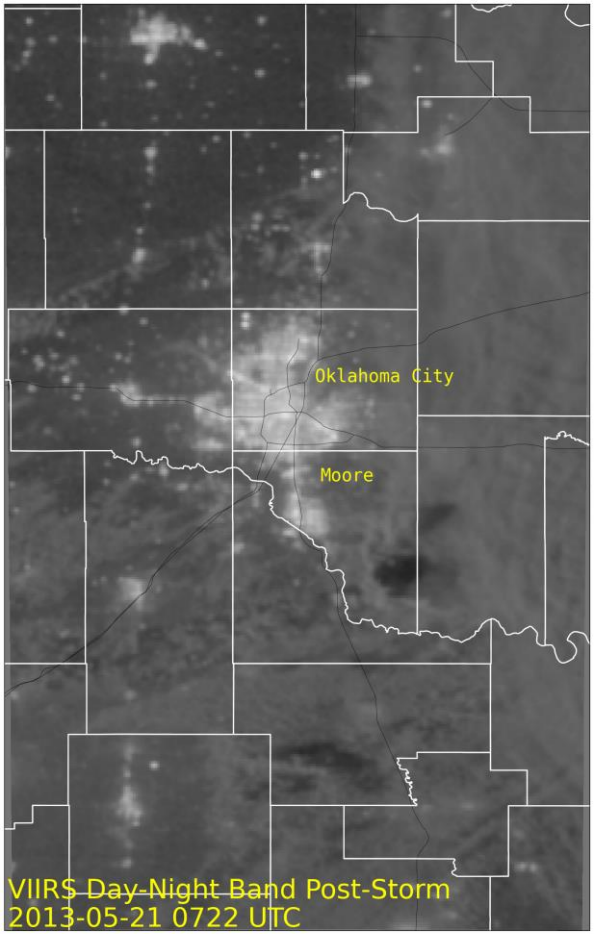
False color composite of pre- and post-storm VIIRS DNB imagery over New York and New Jersey following Superstorm Sandy (reproduced from Molthan et al. 2013)

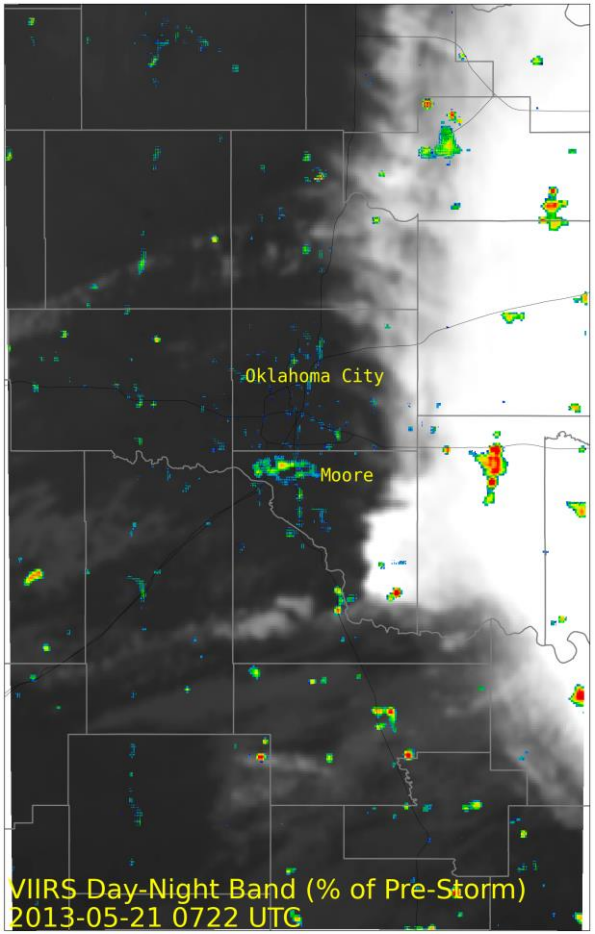


SPoRT provided U.S. Northern Command with daily VIIRS DNB and guidance on deriving "percent of baseline" light emissions used by DoD in recovery efforts.

VIIRS DNB Differencing for Moore, OK

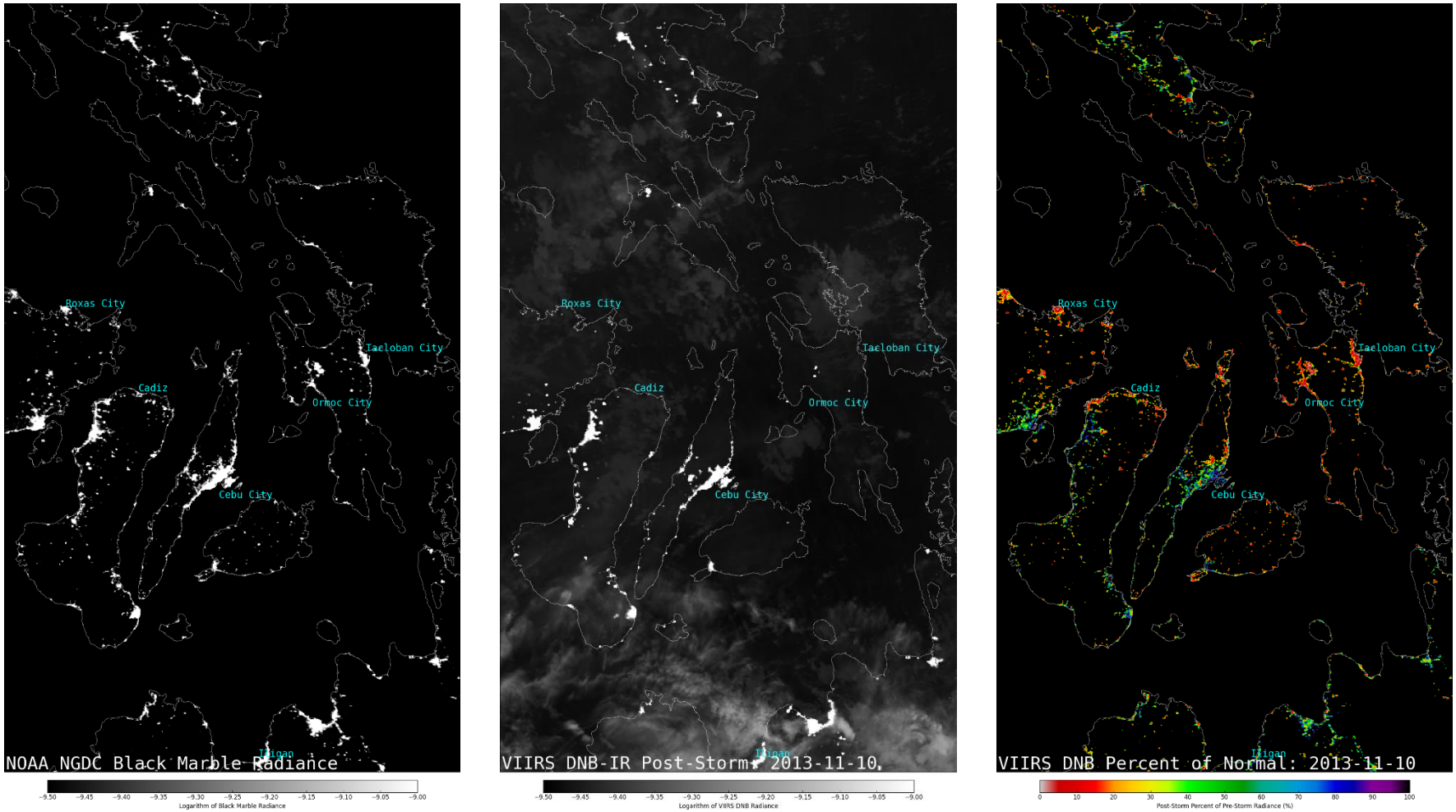






Immediately pre-event, post-event, and difference imagery (with IR clouds) by applying the VIIRS DNB over Moore, OK following the May 2013 tornado. The DNB was likely the first sensor to observe the damaged area.

Outages from Typhoon Haiyan



NOAA/NGDC Black Marble global lights, post-typhoon lights and cloud cover, and difference imagery over the Philippines following Super Typhoon Haiyan. The Black Marble serves as pre-event "normal" light.

Summary and Future Work

- Observations of emitted light by the VIIRS DNB offer unique capabilities to support disaster response and recovery assessment.
- The team continues to explore new techniques for identifying outage areas, estimating affected populations and infrastructure, and monitoring recovery.
- Goals include near real-time production of outage imagery as an additional product for DAT usage and other partner applications.