



NOAA

GEO Requirements and Value Assessments

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September 30, 2020





GEO-XO User Requirements Working Group (XORWG)



- Tasked with providing recommendations for GEO-XO Level 1 Requirements by Nov. 2020
- Level 1 requirements include the set of instruments in a specified constellation, and some instrument details including baseline and desired upgrades in spectral bands and spatial resolution
- The XORWG is accomplishing this task via:
 - Instrument value assessments (details coming in a few minutes), including OSSEs
 - Collecting user input from workshops & surveys (briefed by Vanessa Escobar yesterday) and listening sessions at conferences/meetings, like this one!
 - Results from Broad Area Announcement (BAA) studies
 - Program Studies
 - Economic value assessments
- Using a method similar to that used by NSOSA which assesses instrument value relative to the NOAA Mission Service Areas, along with output from ASPEN, to help in the recommended prioritization



XORWG Membership



Lead: GOES-R/GEO-XO Program Scientist
Co-Lead: NWS/Office of Observations

User Coordination, Data Services

- NESDIS/OSAAP [Reqs Process]
- NESDIS/GEO-XO [User Eng Lead]*
- NESDIS/OSPO [Data Ops/Distribution]*
- NESDIS/NCEI [Data Archive/Steward.]*
- OFCM [US Gov't Users & Applications]*
- NESDIS/IIA [Internat'l Users & Apps]*
- NASA/GOES-R Sci [GOES-R Sys & R2O]*
- NOAA/SSD [Economic Analysis]*
- GEO-XO Systems Engr [Reqs Process]*
- NESDIS/OPPA/TPIO [User Surveys]*
- NESDIS/NCEI [User Outreach]*
- CIRA [Exploratory Research & Applications]*
- CIMSS [Exploratory Research & Applications]*
- CISESS [Exploratory Research & Applications]*



Numerical Weather Prediction

- NESDIS/STAR [Research & Analysis]
- NWS/NCEP [Data Assimilation]
- OAR [EPIC, Data Assimilation]

Weather & Earth Observations

- NESDIS/GOES-R [GOES Users/System]
- NWS [NWS Users & Applications]
- NOS [NOS Users & Applications]
- NMFS [NMFS Users & Applications]
- NESDIS/STAR [Research & Analysis, Algorithms]
- OAR [Research & Applications]

*Associate members will assist in the facilitation of the WG process but will be non-voting members





Instrument Value Assessments



1) Imagery in Tundra (summarized next)

2) Day Night Band (nighttime visible) observations (summarized next)

3) Lightning Mapper – Scott Rudlosky (NESDIS/STAR)

4) IR Hyperspectral Sounder – Ed Grigsby (NASA/GOES-R) and Joel McCorkel (NASA/GOES-R)

5) Ocean Color in GEO – Shelly Tomlinson (NOS) and Mike Ford (NMFS)

6) Atmospheric Composition in GEO – Greg Frost (OAR) and Monika Kopacz (OAR)

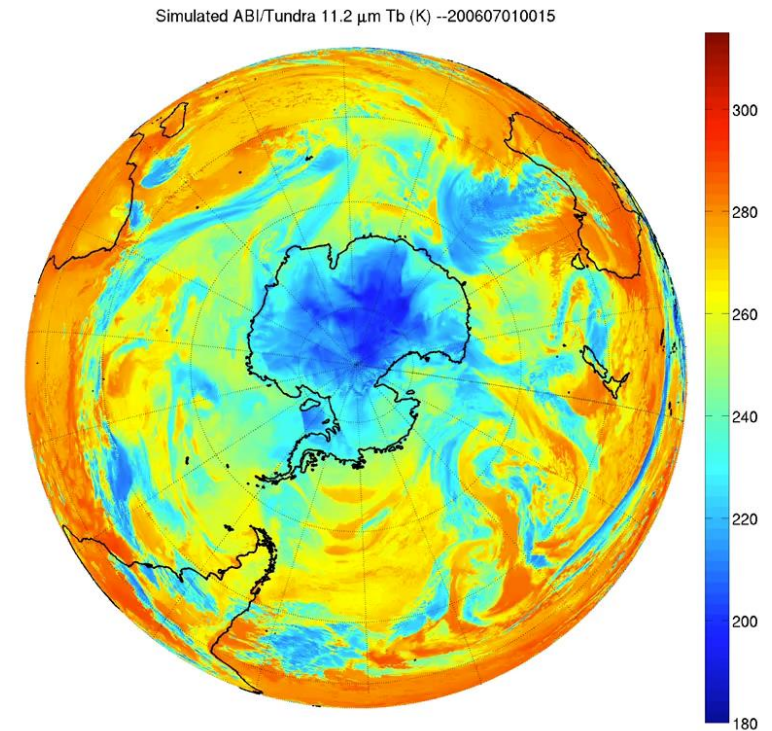


Imagery in a Tundra Orbit – Value Assessment



More frequent VIS and IR observations over the Arctic will lead to:

- Better cloud tracking for derivation of polar winds, which can be assimilated and improve NWP
- Improved detection and tracking of sea ice; this is important for shipping and commerce, and may become increasingly important in the future as Arctic sea ice declines
- Better detection and tracking of high latitude volcanic ash, such as in the Alaska Aleutian Island chain
- Improved analysis of high latitude severe weather, including polar lows
- Better detection of fog and low clouds in the Arctic



Special thanks to Jeff Key, Darin Figurskey, Gene Petrescu, Joe Siekiewicz, and Kevin Berberich for helping with this analysis

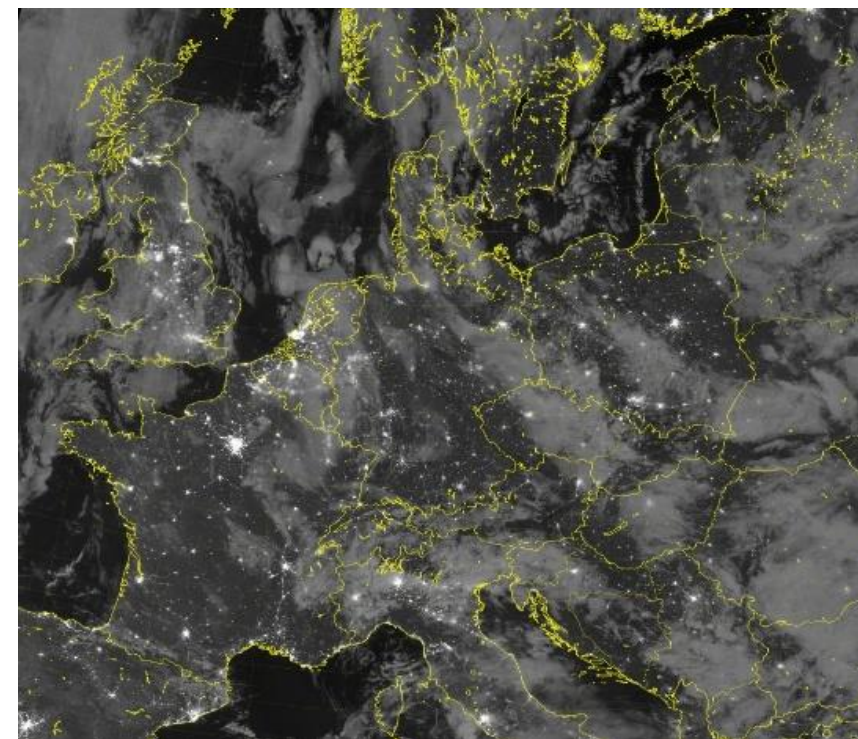
Courtesy of CIMSS



Nighttime Visible Imagery – Value Assessment



- The Day Night Band on the VIIRS instrument of SNPP and NOAA-20 has shown what new observations are possible at night
- However, it has 2 big limitations limiting its operational utility: 1) latency, and 2) no ability to loop images
- A Day Night Band-like capability in Geostationary orbit provides lots of potential operational value, including:
 - Improved analysis of tropical cyclones, especially center fixing (more on this next)
 - Better detection of low clouds and fog, particularly in the tropics
 - Would introduce the ability to detect and track smoke at night
 - Improved qualitative assessment of severe weather (boundaries, overshooting tops, etc.)



Special thanks to Chauncy Schultz, William Churchill, and Mark DeMaria for helping with this analysis

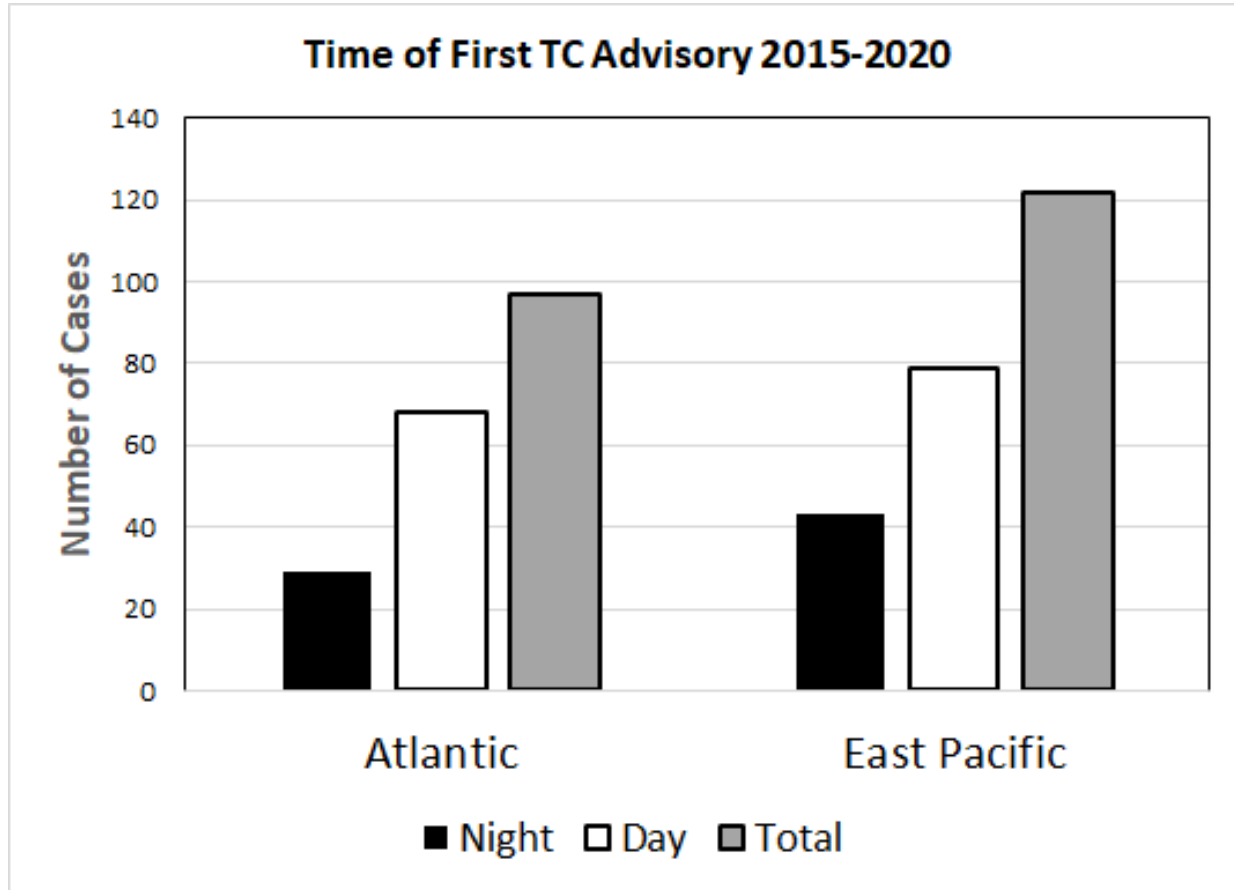


Nighttime Visible Imagery – Value for the National Hurricane Center



Mark Demaria, NWS/NHC

- Visible imagery very useful for identifying closed centers
 - NHC often requests meso-sectors for invests near sunrise to get earlier vis data
- Is there a daytime bias in the NHC genesis forecasts?
- Examine time of first NHC advisory for 2015-Aug 2020 TCs
 - 97 Atlantic cases, 122 eastern North Pacific cases
 - Calculate local solar time of TC center at the first advisory
 - Categorize each case as day or night formation



$P < 0.01\%$ differences due to random chance based on cumulative binomial distribution



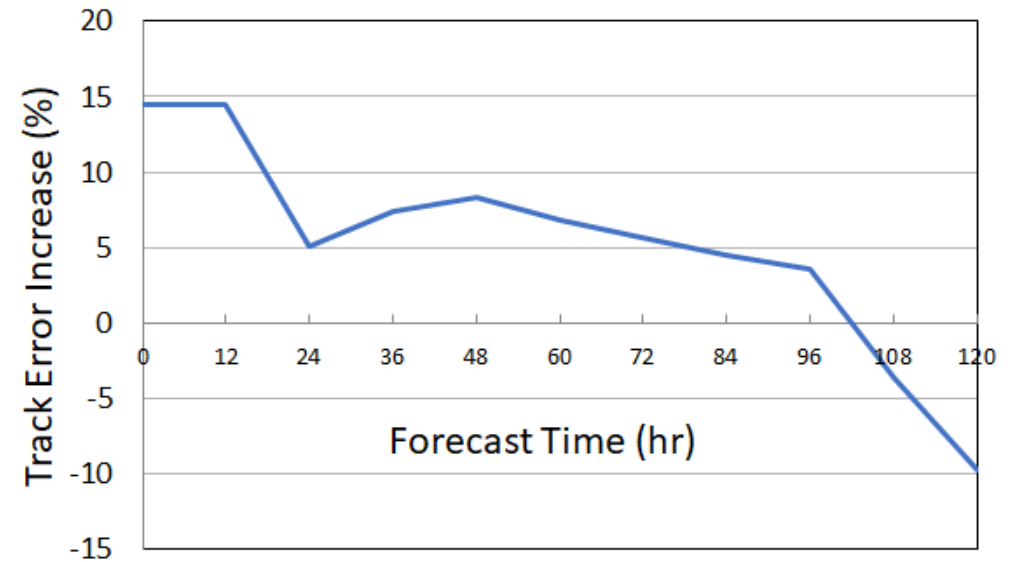
Nighttime Visible Imagery – Value for the National Hurricane Center



Mark Demaria, NWS/NHC

Value Summary for NHC

- NHC's first advisory has significant daytime bias
- Lead time of genesis could be increased by ~6 hr for up to 3 tropical cyclones per year in both AL and EP
 - ~1 U.S. landfalling TC forms and makes landfall within the watch/warning time frame
 - ~1 U.S. TC forms within 5 days of landfall
- Initial position errors are ~15% larger at night
- Track forecasts through 96 hr for weak TCs initialized at night also impacted



NHC Track Forecast Error Differences
Weak TCs Starting at Night (06 UTC) Versus
Day (18 UTC) 2015-2019 Atlantic Cases



GEO-XO Requirements Working Group – Path Forward



Near-term

- Help translate user needs into potential instrument requirements (Oct. 2020)
- Deliver initial Level 1 requirements recommendations (Nov. 2020)
- Provide input to instrument Phase A requirements (Nov. 2020)
- Support path to the Mission Concept Review (Mar. 2021)

Longer-term

- Continue collecting user input to help inform data delivery plans, ground system design, products, etc. (now through 2030+)
- Update level 1 requirements recommendations for the System Requirements Review (2022)
- Further refine level 1 requirements for KDP-C/Milestone 3 (2025)