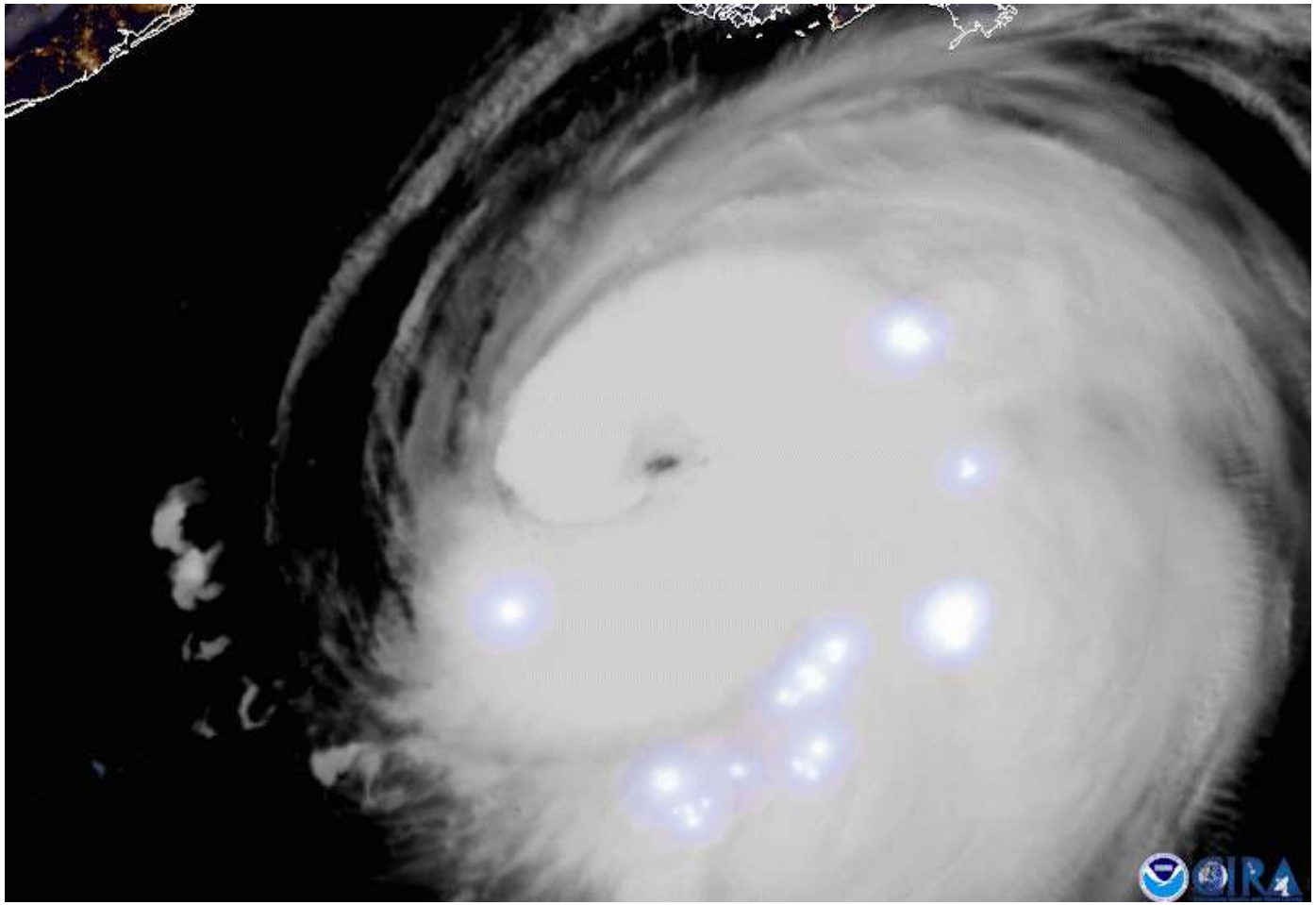
GOES-R and GEO-XO Program Update

Dan Lindsey, Program Scientist and Pam Sullivan, Program Director

September 8, 2020

GOES-16 and GOES-17 GLM



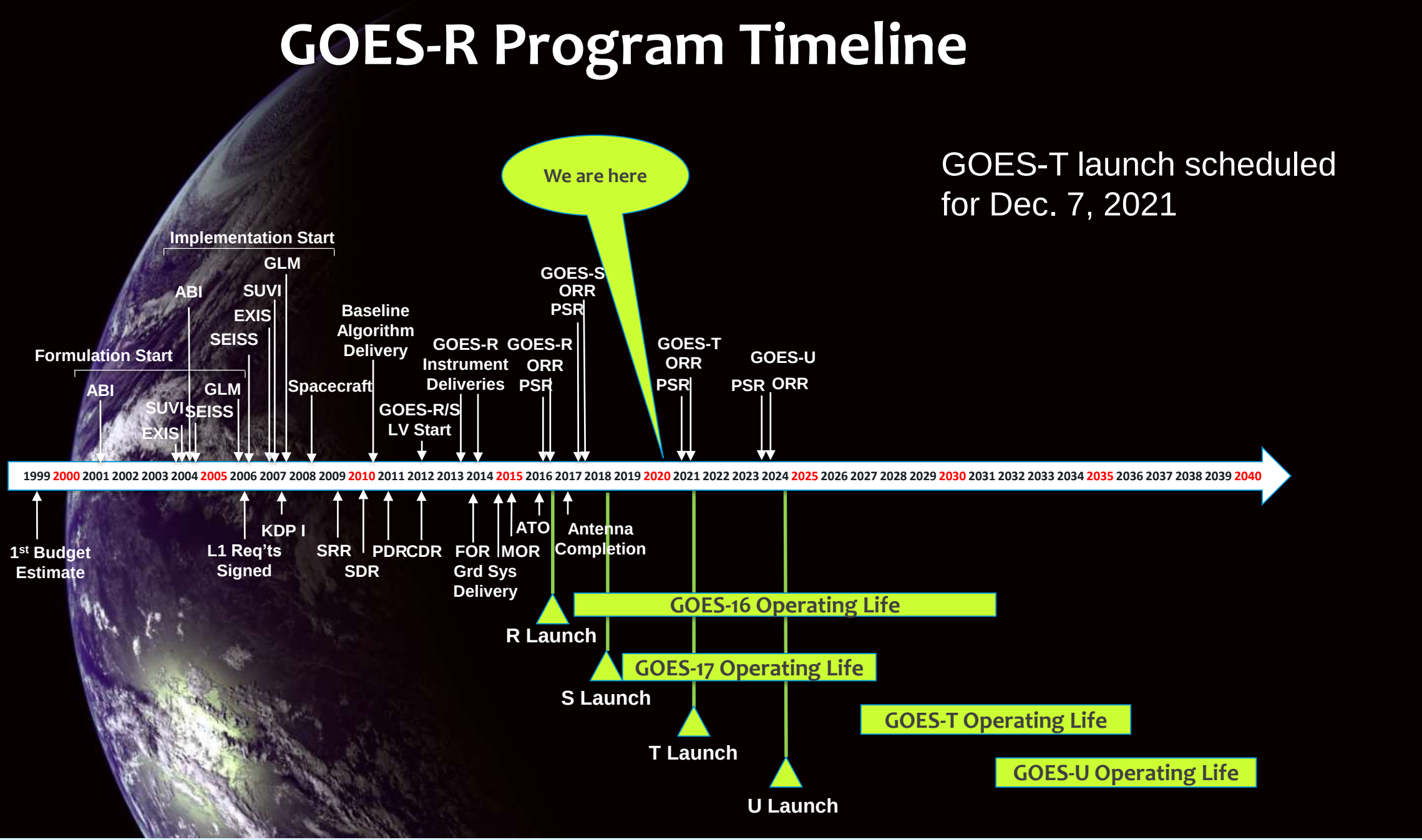
- Data are stable and providing reliable lightning information to users
- GLM has gotten a good bit of public exposure with some big weather events lately, including this animation from Hurricane Laura
- This animation got over 20,000 shares from various news outlets across Twitter and Facebook

GOES-16 and GOES-17 GLM

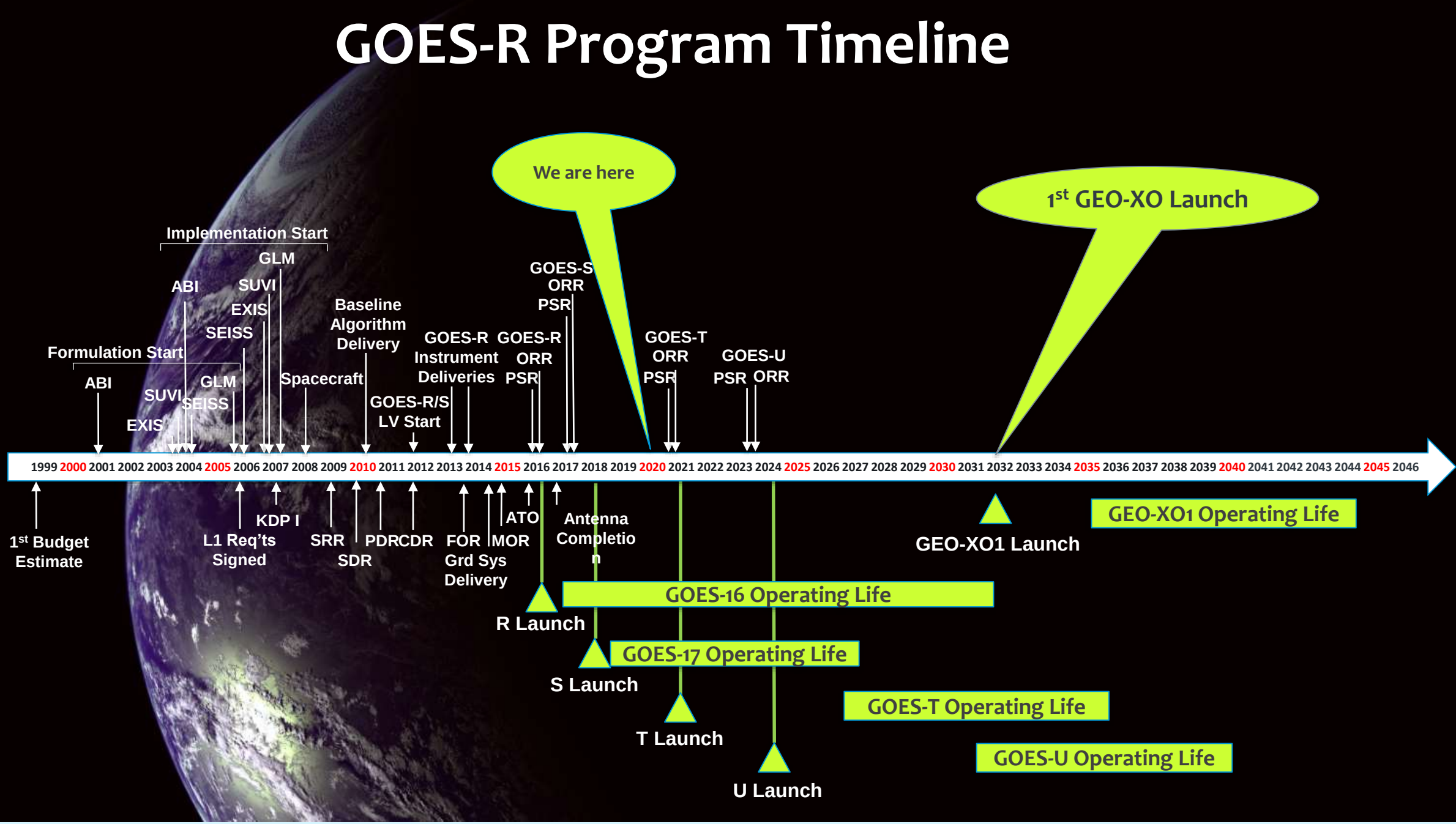
on Aug. 10

GOES-R Program Timeline

GOES-T launch scheduled for Dec. 7, 2021

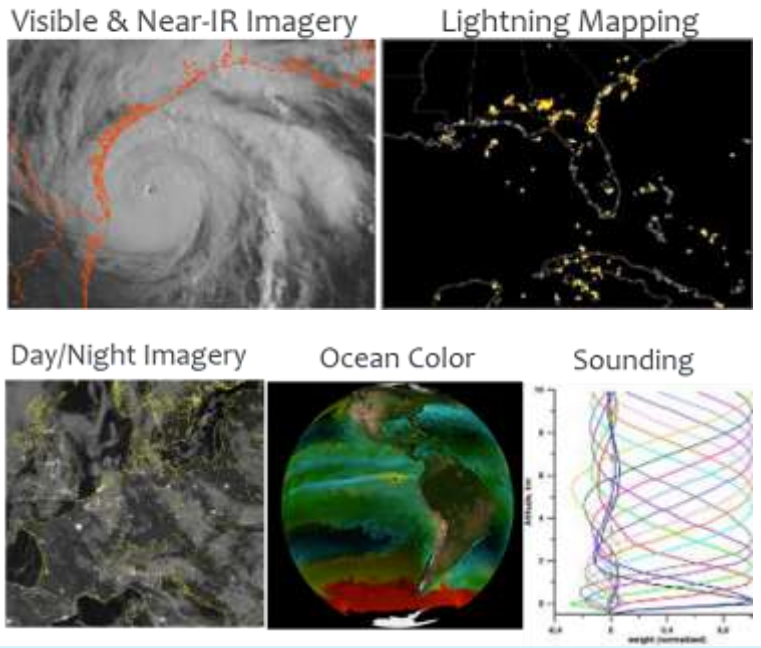


GOES-R Program Timeline



What is GEO-XO?

- *GEO-XO = Geostationary and Extended Orbits*
  - The mission to follow GOES-R and provide continuity for GEO observations
  - Considering expanding to include observations from "Tundra"
  - Anticipate providing services for Space Weather mission including L1 spacecraft
- GEO-XO includes all NOAA Earth-observing assets deployed above LEO:
  - Government spacecraft
  - Instruments or payloads hosted on commercial/partner spacecraft
  - Potential use of commercial services and observational data
- Operational in the 2030-2050 timeframe
  - Currently in pre-formulation:
    - Instrument and constellation studies underway
    - User needs assessment underway
    - Requirements definition underway
  - Approximate Program Schedule
    - Mission Concept Review, 2021
    - System Requirements Review, 2022
    - System Preliminary Design Review, 2025
    - 1st GEO Launch FY32



Data Continuity, and Potential New Observations

GEO-XO User Requirements Working Group (XORWG)

- Chartered by NESDIS for the purpose of recommending a set of prioritized observational requirements for GEO-XO Program

Lead: NESDIS/GEO Scientist
Co-Lead: NWS/Office of Observations

User Coordination, Data Services

- NESDIS/GEO-XO [User Eng Lead]*
- NESDIS/OSAAP [Reqts Process]
- 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 [Reqts Process]*
- NESDIS/OPPA/TPIO [User Surveys]*
- NESDIS/NCEI [User Outreach]*
- CIRA [Exploratory Research & Applications]*
- CIMSS [Exploratory Research & Applications]*
- CISESS [Exploratory Research & Applications]*

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

Numerical Weather Prediction

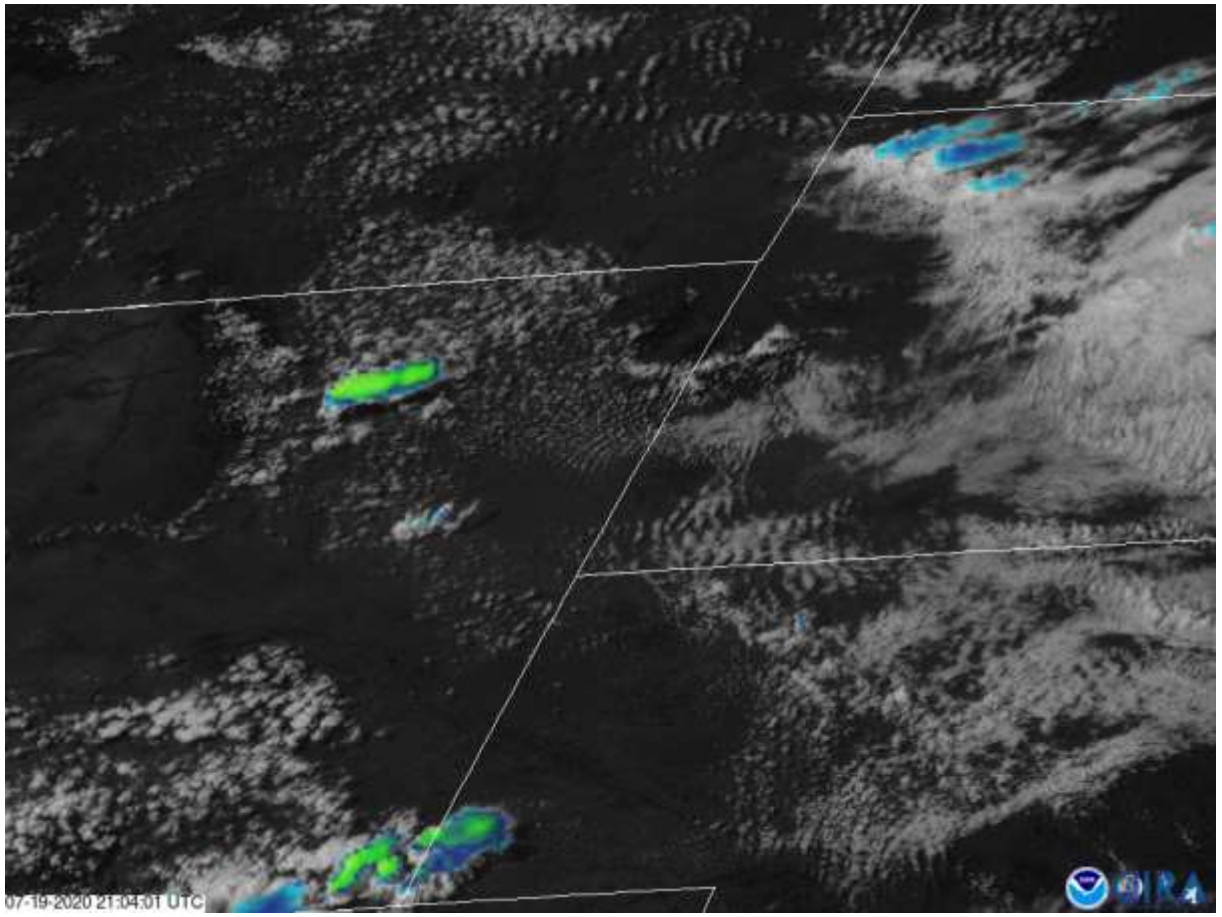
- NESDIS/STAR[Research & Analysis]
- NWS/NCEP [Data Assimilation]
- OAR [EPIC, Data Assimilation]

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]

GEO-XO Instruments and orbits under consideration

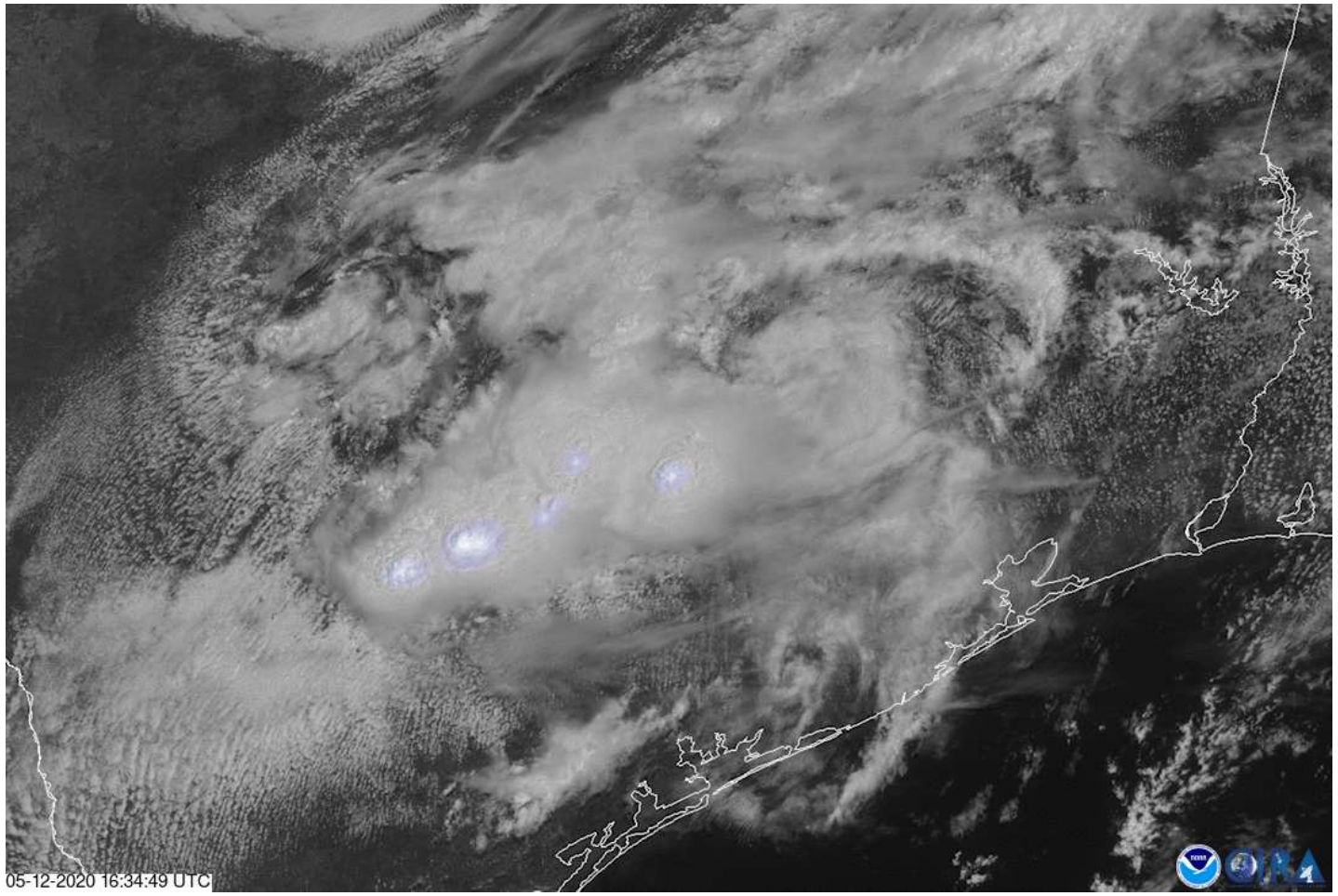
1. Imager in Geostationary Orbit
    - Continuing in the GOES-East and –West positions
    - Likely at least ABI quality with some potential upgrades being studied, including:



- Improved resolution to the 3.9 µm channel to allow for earlier detection of smaller fires
- Improved resolution to the 0.64 µm VIS band which might help with pre-storm mesoanalysis
- Additional spectral channels such as a 0.9 µm band to help with low-level water vapor and a green band for *true* true color

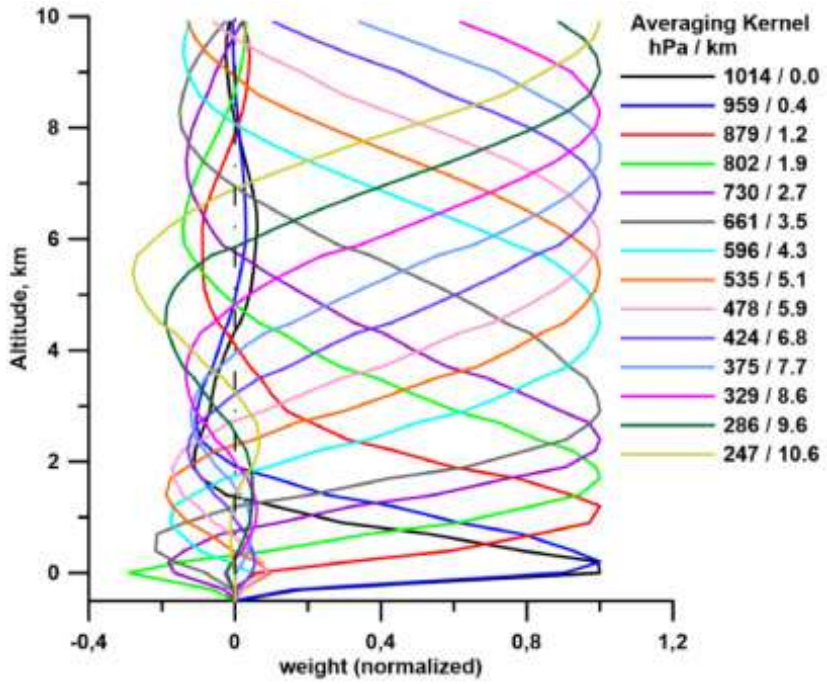
GEO-XO Instruments and orbits under consideration

2. Lightning Mapper in Geostationary Orbit
    - May be a GLM-like instrument or potentially upgraded lightning mapper with higher spatial resolution



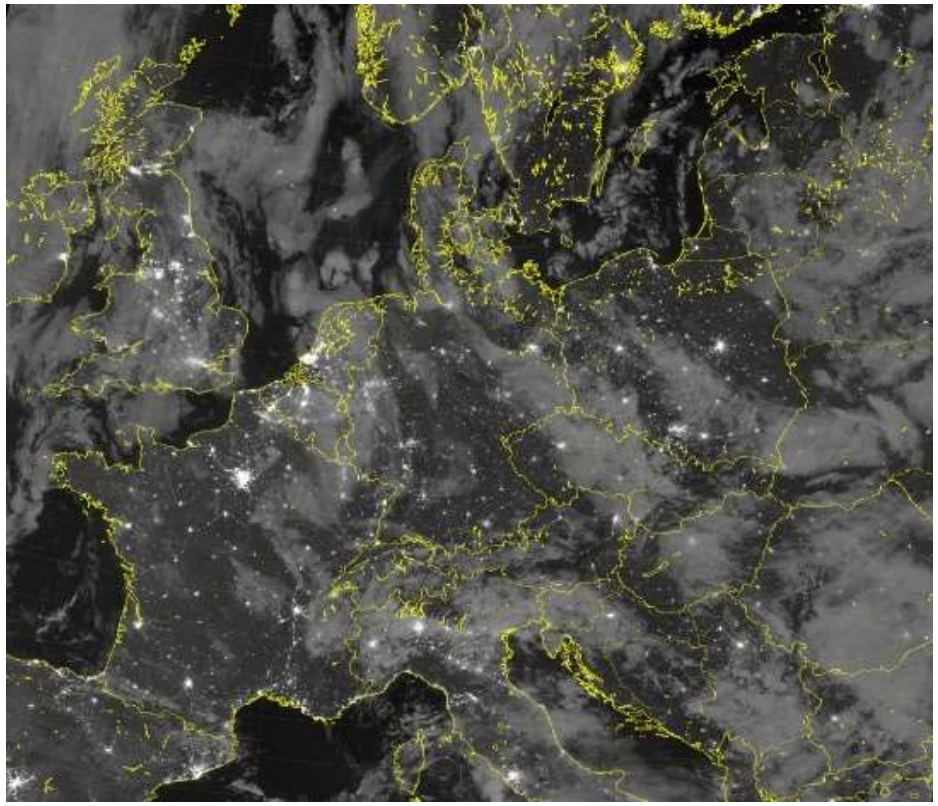
GEO-XO Instruments and orbits under consideration

3. Hyperspectral IR Sounder in Geostationary Orbit
   - Variations on sounder designs being studied now
   - Would likely have hundreds to thousands of channels, improving vertical resolution of temp/WV profile retrievals
   - Some OSSE studies underway to estimate benefit to NWP



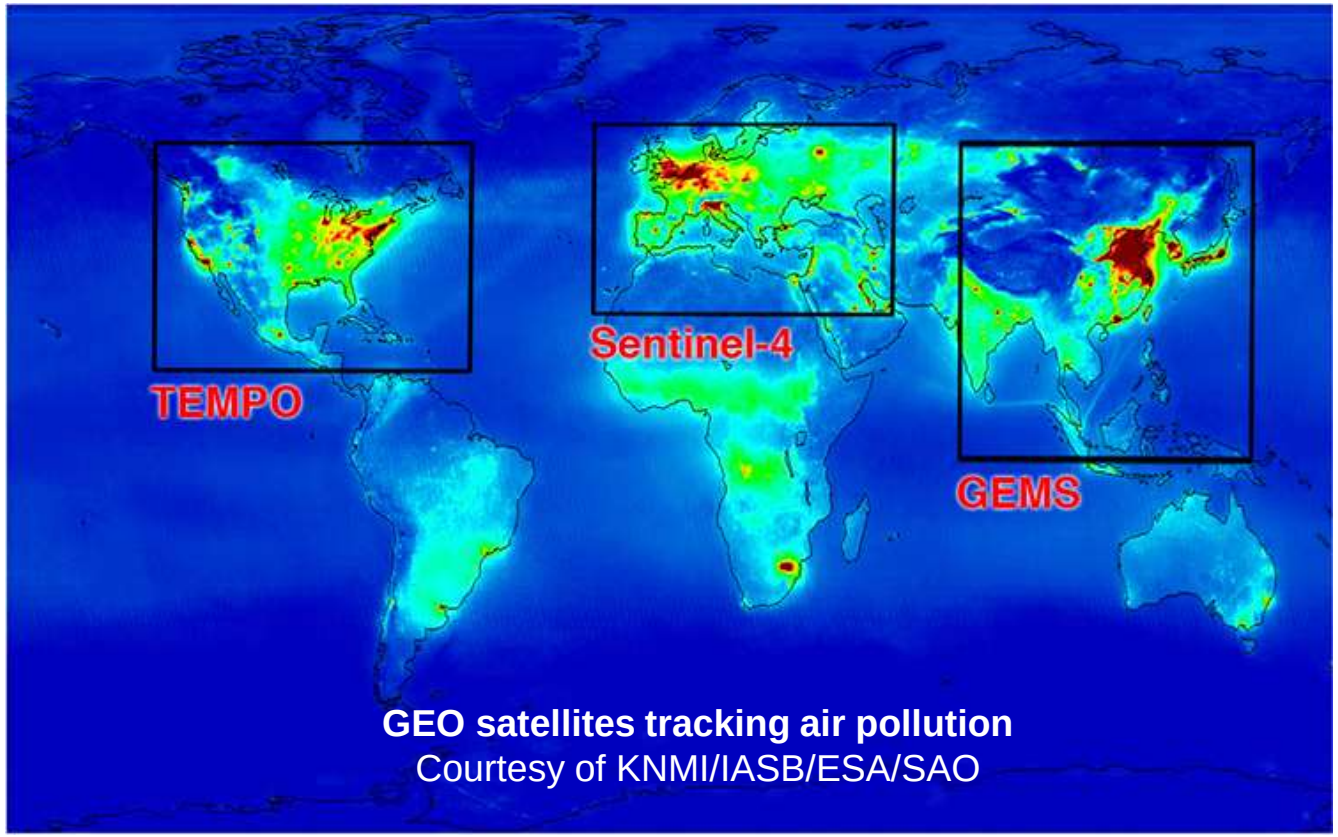
GEO-XO Instruments and orbits under consideration

4. “Day Night Band” in Geostationary Orbit
    - Would be similar to the VIIRS DNB, except with GEO latency and looping capability
    - Useful for nighttime detection of low clouds, smoke, and other capabilities unique to visible imagery



GEO-XO Instruments and orbits under consideration

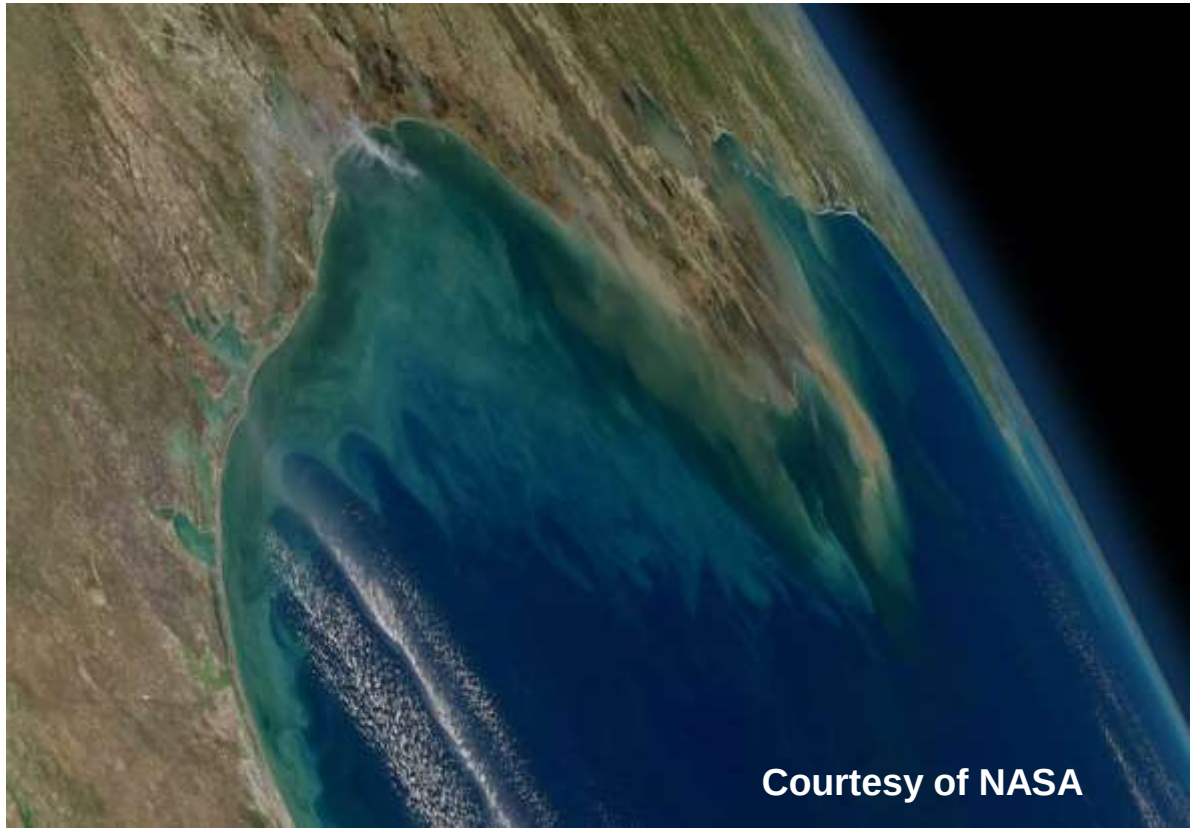
5. Atmospheric Composition in Geostationary Orbit
    - Perhaps similar to the NASA TEMPO instrument (a UV/VIS spectrometer) scheduled for launch in a few years
    - Would allow for diurnal monitoring of atmospheric constituents



GEO satellites tracking air pollution
Courtesy of KNMI/IASB/ESA/SAO

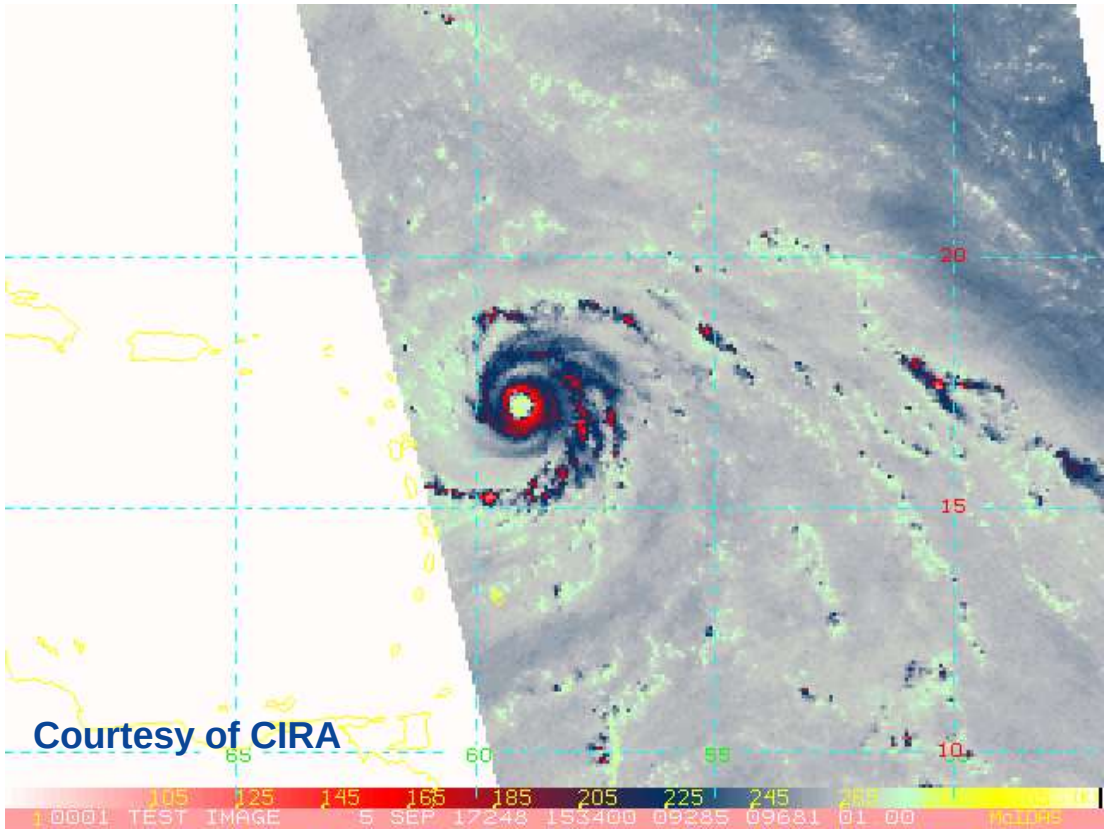
GEO-XO Instruments and orbits under consideration

6. Ocean Color in Geostationary Orbit
    - Perhaps similar to the NASA GLIMR instrument, to launch in the latter half of the 2020s
    - Would allow for diurnal monitoring of ocean color



GEO-XO Instruments and orbits under consideration

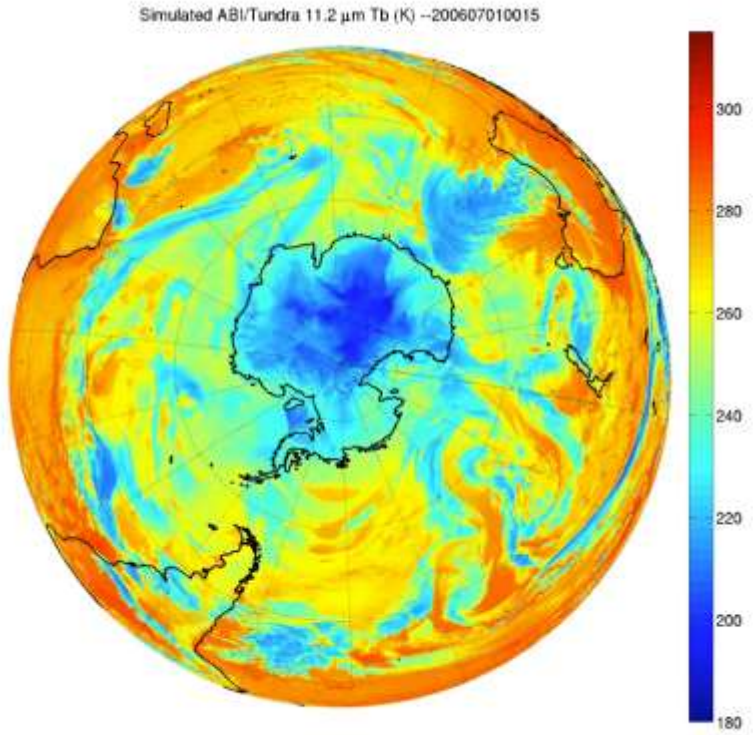
7. Microwave in Geostationary Orbit
    - Looking at both microwave sounder and imager
    - Due to required antenna size, lowest frequency observations not feasible
    - Limitations in spatial resolution relative to LEO



GEO-XO Instruments and orbits under consideration

8. Tundra Orbit

- Looking at an ABI-like imager and/or an Atmospheric Composition instrument in this orbit
- Would allow for improved observations over the Arctic

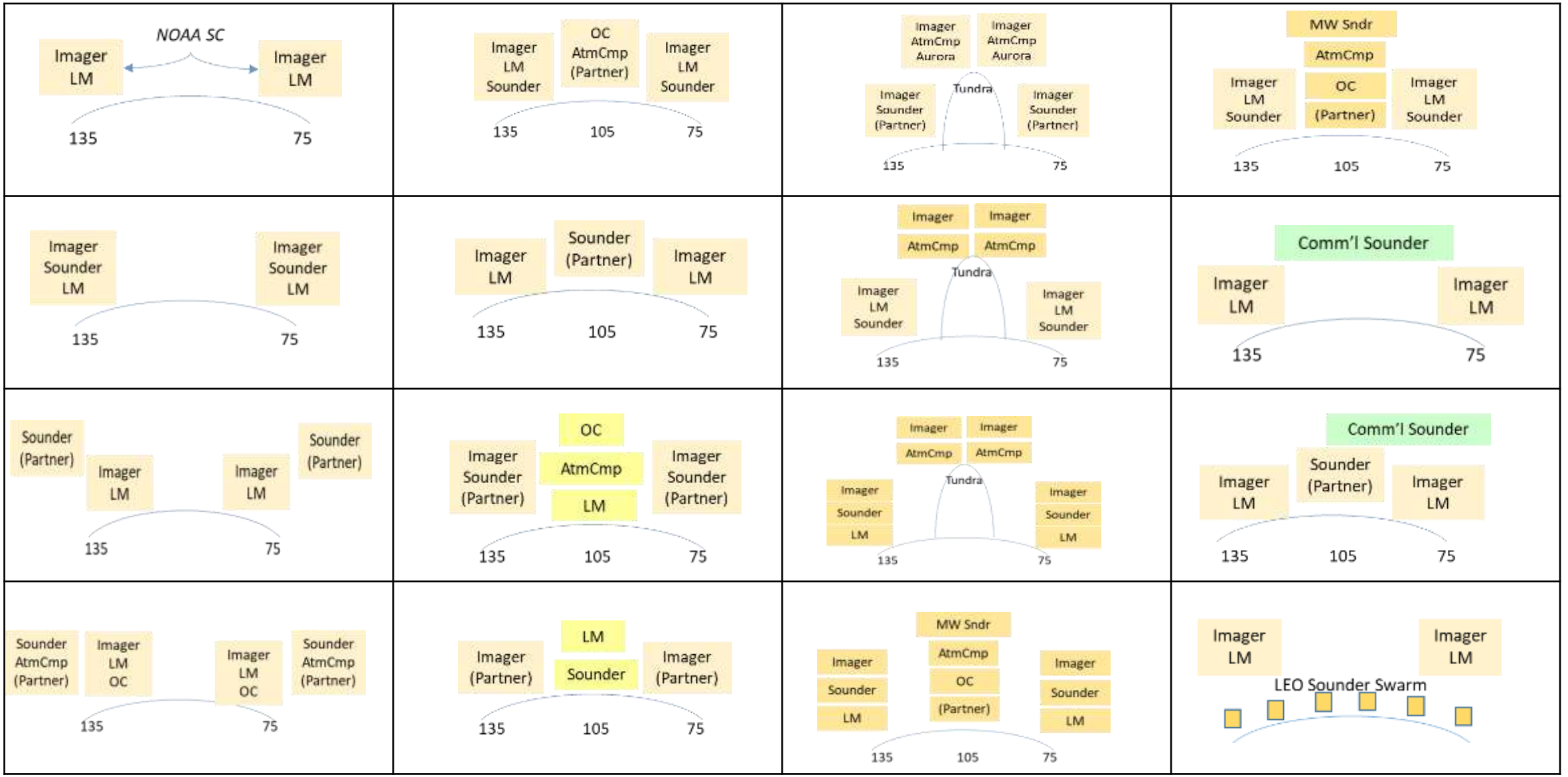


Courtesy of Zhenglong Li[1], Jun Li[1], Timothy J Schmit[2*], Fredrick W. Nagle[1], Mathew Gunshor[1]

Sample of Constellations under Study

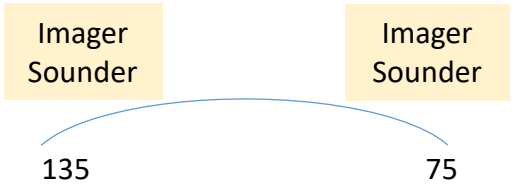
Key:

NOAA Satellite	Hosted Payloads
NOAA SmallSat	Commercial Data



Narrowed constellation options (not necessarily the final list)

51.



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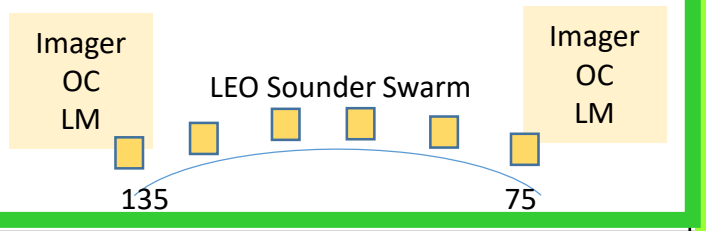

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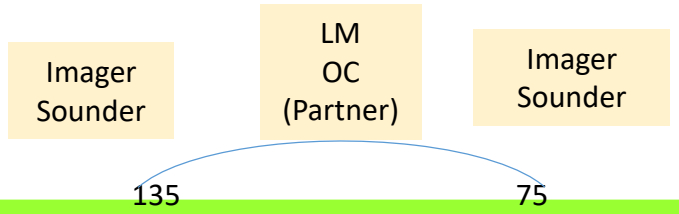

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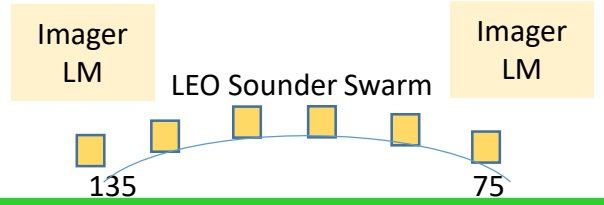

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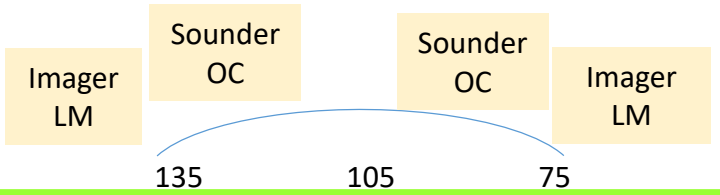

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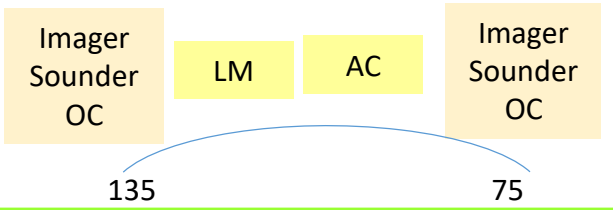

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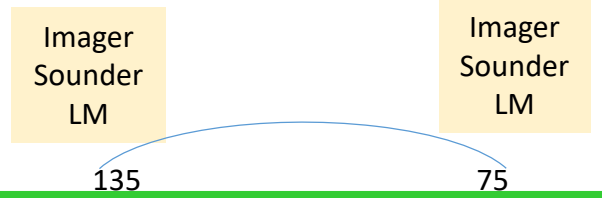

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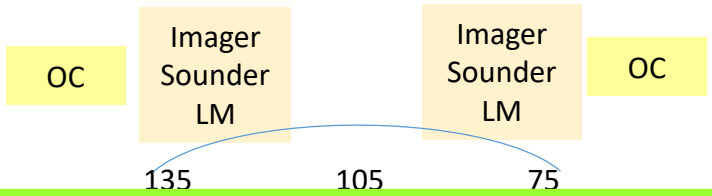

NOAA Satellite	Hosted Payloads
NOAA SmallSat	Commercial Data

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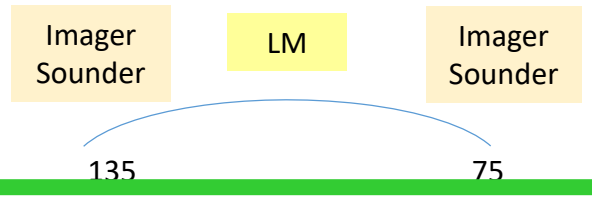

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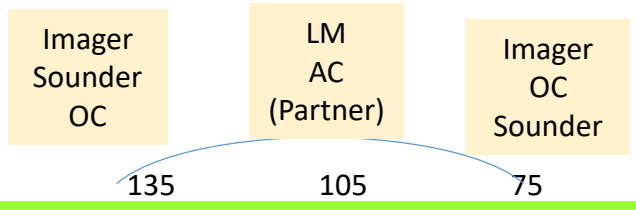
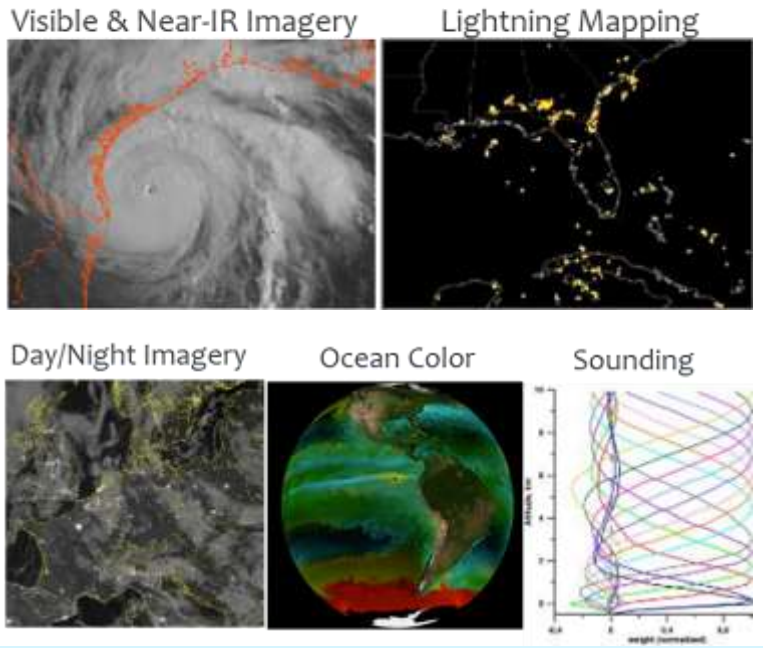


GEO-XO – What's Next?

- XORWG will use information gathered from instrument value assessments, user workshops, and industry/program studies to deliver a set of recommended instruments/constellation in mid-November 2020
- GEO-XO Mission Concept Review (MCR) will occur in March 2021
- System Requirements Review (SRR) in 2022
- System Preliminary Design Review in 2025
- First GEO-XO launch ~2032



Data Continuity, and Potential New Observations

We Want to Hear from You

- Join our events:
  - National Weather Association 2020 Virtual Meeting, Sep 14
    - 90min GEO-XO Listening Session – 1:00 – 2:30 pm EDT
  - Community Meeting on NOAA Satellites, Sep 29 – Oct 2
    - Future plans for GEO, LEO, and Space Weather
- Contact me with comments or concerns
  - Dan.Lindsey@noaa.gov

Now is *exactly* the time to influence what your next geostationary observing system looks like