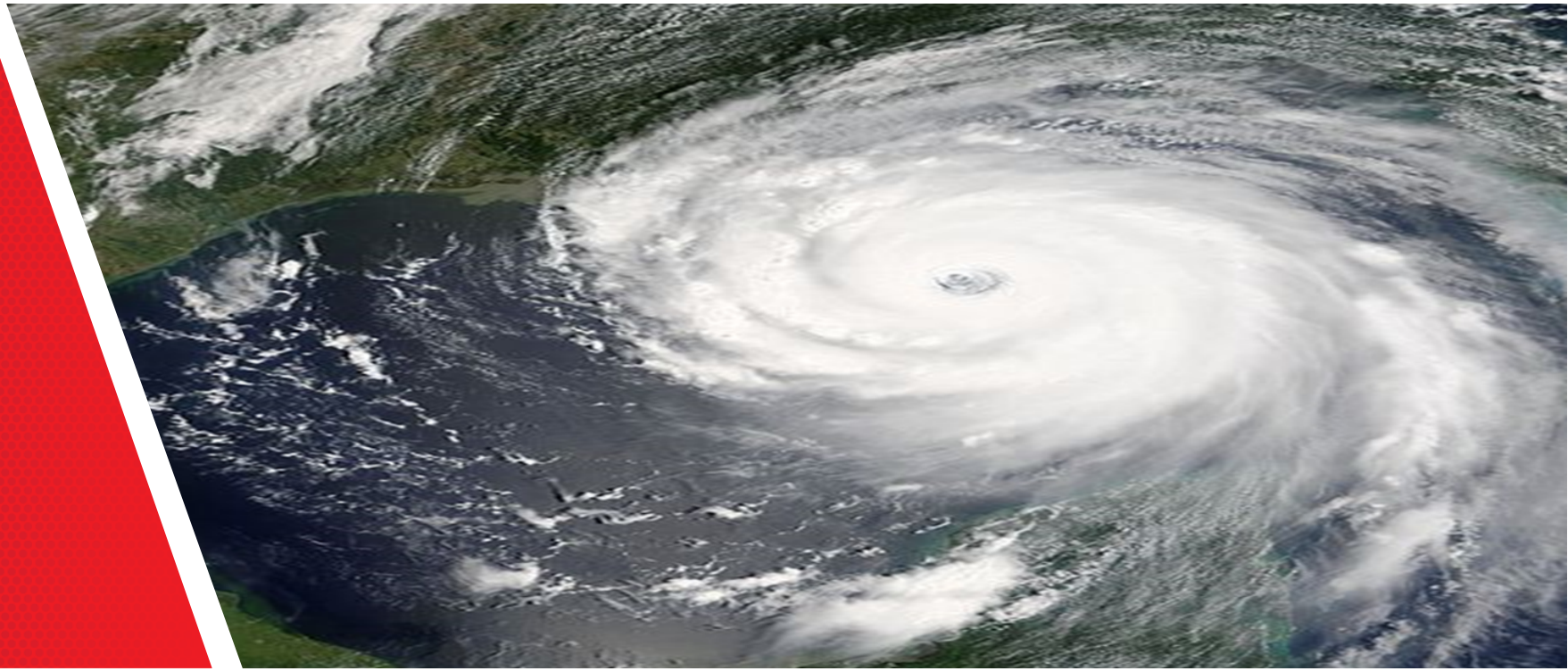
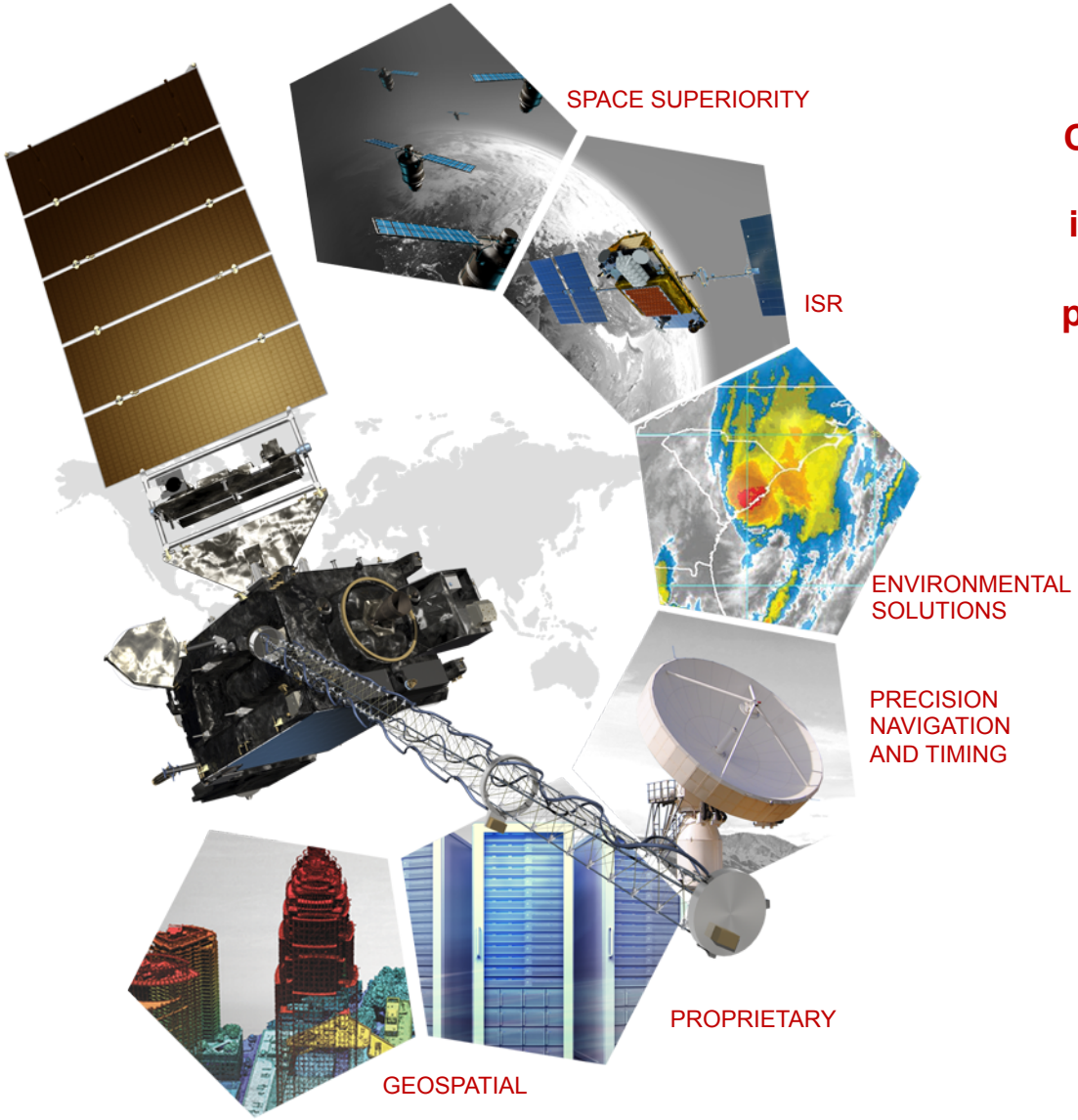


City Scale Carbon Monitoring in Paris:
Implications for COP21 and Beyond

Anne Connor
Manager, Domestic and International
Government Advocacy

Space and Intelligence Systems



Complete Earth observation, weather, geospatial, space protection, and intelligence solutions from advanced sensors and payloads, ground processing, and information analytics

U.S. Civil and Intelligence Community

U.S. Department of Defense

Commercial Customers

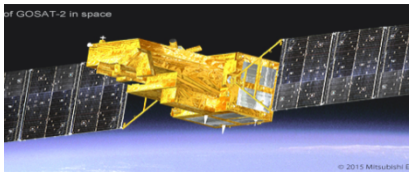
DigitalGlobe exactEarth Dewberry iridium SiriusXM SATELLITE RADIO

Providing Sensors to Information

Environmental Sensors (Space and Ground)

Advanced Baseline Imager (ABI)

Cross-track Infrared Sounder (CrIS)



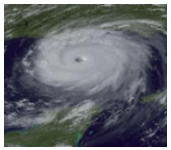
TANSO FTS GOSAT-2

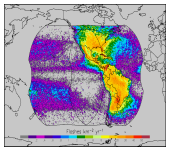
Multi-Functional Fiber Laser LiDAR

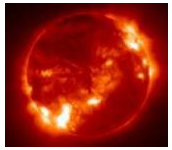
GreenLITE

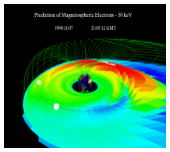
Ground Processing

WxConnect™ Direct Receive Systems





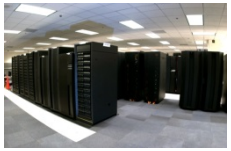




IntelliEarth Sensor Processing Engine

IntelliEarth Mission Management

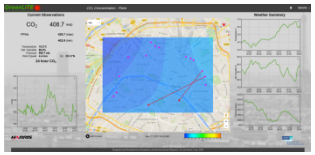
Application & Analytics



Forecasting & Distribution Infrastructure

Weather Data Service

Helios Hyperlocal Weather



GreenLITE Data Service

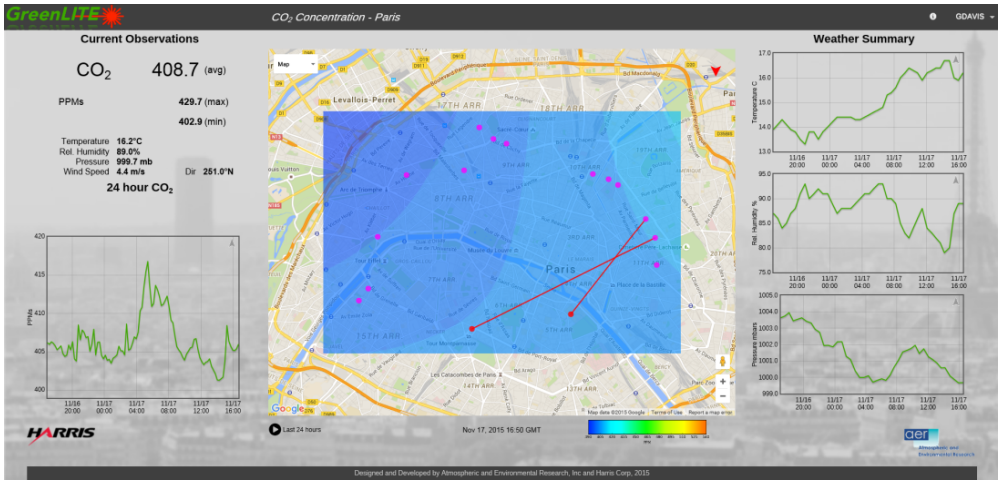
Global Context – Local Impacts

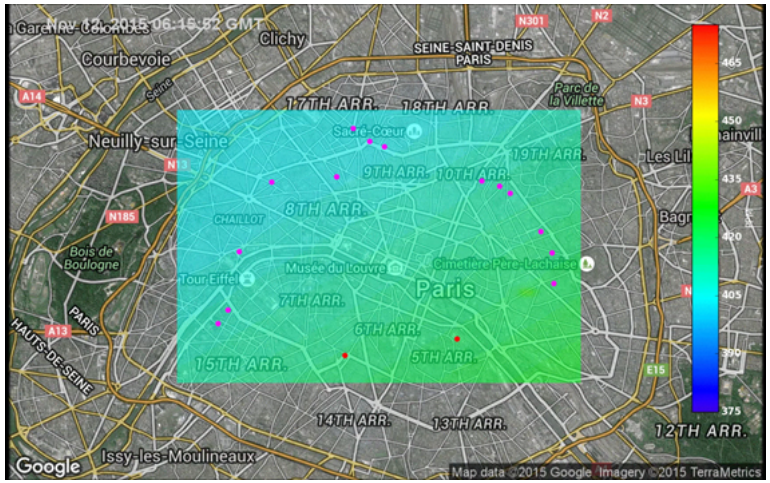
- Paris Agreement
  - 171 Countries signed on April 22 – Historic Agreement
  - Key Relevant Themes:
    - Transparency
    - Measurement, Reporting, and Verification (MRV)
- Role of international partnerships to develop integrated measurement system
  - Multiple international projects on orbit or in development
  - Layer with airborne and ground-based systems
  - Current baseline is IPCC inventory reporting system
- Role of Cities in Global Context
  - Decision support services that enable better use of limited resources
- Role of technology to inform policy
  - Integrated picture from global to ground (similar to weather – airborne, ground, space)
  - Deploy resources where most needed


Chesnot via Getty Images

Ongoing GreenLITE Demonstration in Paris

- System monitoring CO2 in 30 km^2 of central Paris
  - Teamed with Laboratoire des Sciences du Climat et de l'Environnement (LSCE), Atmospheric and Environmental Research (AER), EnviroEarth & LATMOS
  - Development funded by Harris, US DOE, US National Institute of Standards and Technology (NIST)





Planned Operation Nov 2015 thru 2016

GreenLITE Regional GHG Monitoring

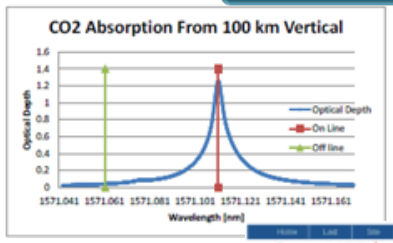
- **Delivers a wide area GHG 'monitoring net'**
  - Autonomous operation
  - Near real time information
  - Alerts, alarms & other analytics
  - Spatial distribution information

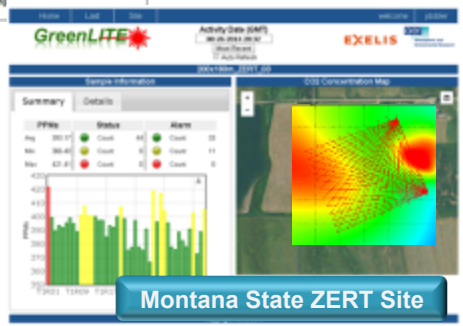
- **High reliability low cost technology**
  - Open Path Laser Absorption Spectroscopy
  - Telecommunication fiber optic components
  - Horizontal measurements integrated into a 2-D map
  - Horizontal or vertical mapping possible

- **Complete end-to-end solution**
  - Sensors to data products
  - Several GHGs (CO2, CH4, N2O, etc) single or multiple

- **Status**
  - Two operational systems built and tested
    - 1 km^2 and 30 km^2 regions
  - Funded through DOE, NIST and Harris
  - Methane integration underway

Paris GreenLITE Net





Montana State ZERT Site

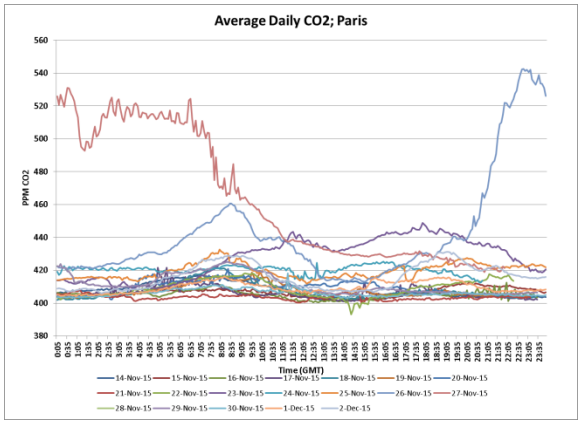
Wide Area Near Real Time Mapping of GHG Concentrations and Fluxes

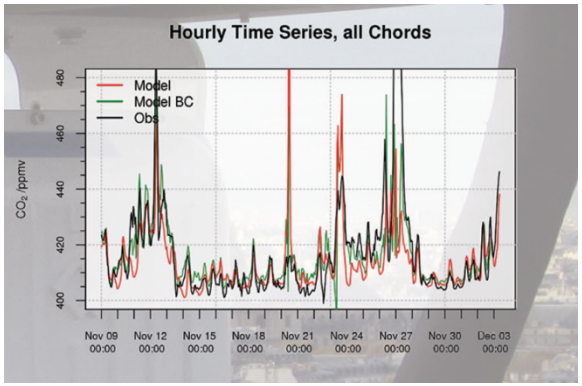
Initial Results and Next Steps

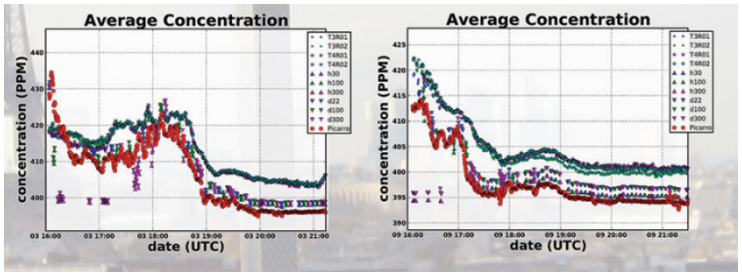
- System started collecting data on November 4, 2015
  - Collected over 700,000 raw samples within the first 2 months with over half passing quality control
  - Hourly average concentrations have ranged between 382 and 542 parts per million
  - Accuracy at least 1 part per million and likely better
- Visualizes Human Activity
  - Morning/evening commutes clearly seen
  - November and Early December saw higher concentrations; later in December those decrease
  - Specific event in November saw concentrations up to over 542 parts per million attributed to incineration plant and stalled wind pattern
- LSCE looking at seasonal data and research will continue throughout 2016
- Looking for expanded opportunities to verify/validate findings
  - Ongoing partnership with NIST
  - Developing collaboration with NOAA
  - Opportunities with NASA?

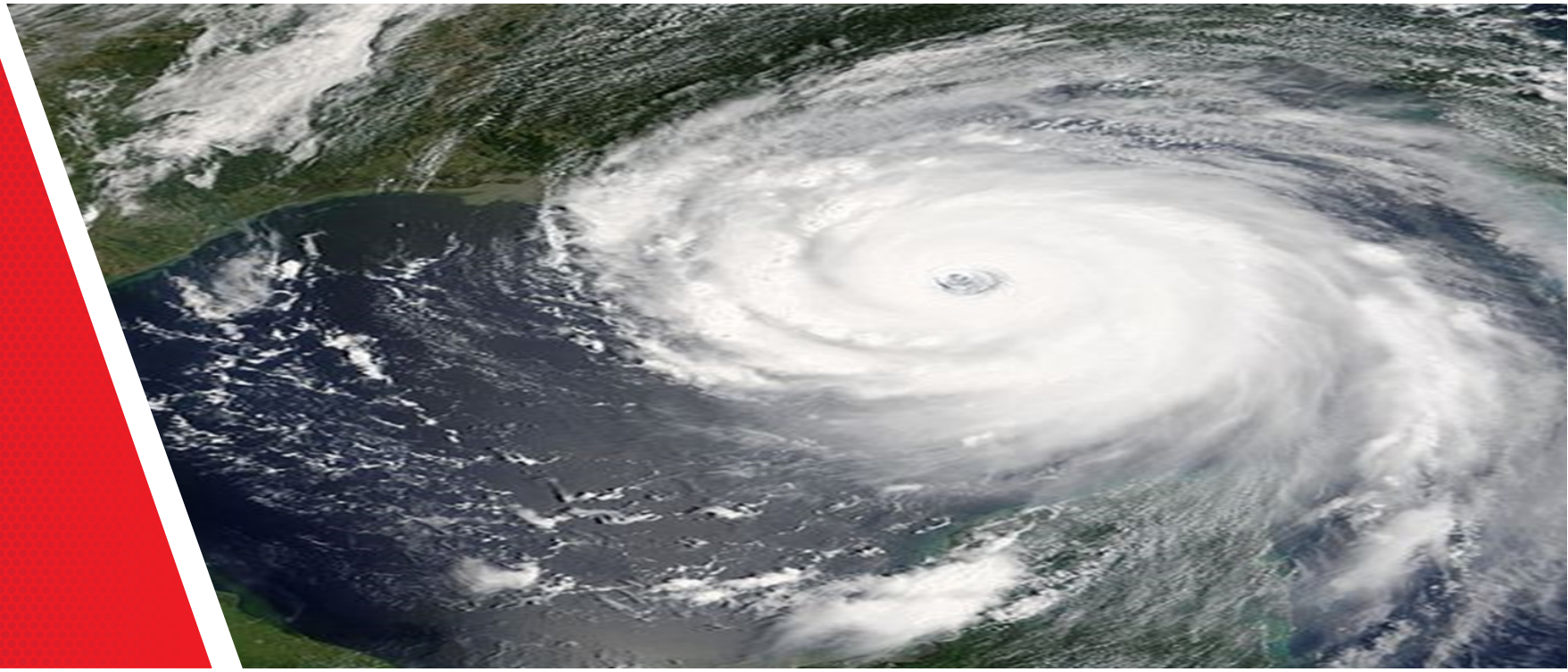
Many Potential Monitoring Applications

- Enable valuable new insights and analysis
  - Trending and analysis of hourly, daily, weekly & seasonal cycles
  - Correlation with natural and anthropogenic cycles
  - Internal/external influences
- City/Urban
  - Inventory validation and uncertainty reduction, identification of unaccounted for sources
  - Cycles of human activity (traffic, heating, etc)
  - Resilience investment planning and return analysis
- Commercial
  - Energy facilities; Methane storage, Coal mines, Oil/Gas Wells, Fracking sites, oil sands, tailings ponds
  - Industrial sites; Power Plants, Factories, Land fills
  - Agriculture; feed lots, farming processes
  - Carbon Sequestration sites
- Baseline and Monitor Natural Sources
  - Permafrost, volcanos, reservoirs, lakes/ponds, coastal waters, other CO2/CH4 sources









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