Lightning Enhancement of Satellite Precipitation Estimates

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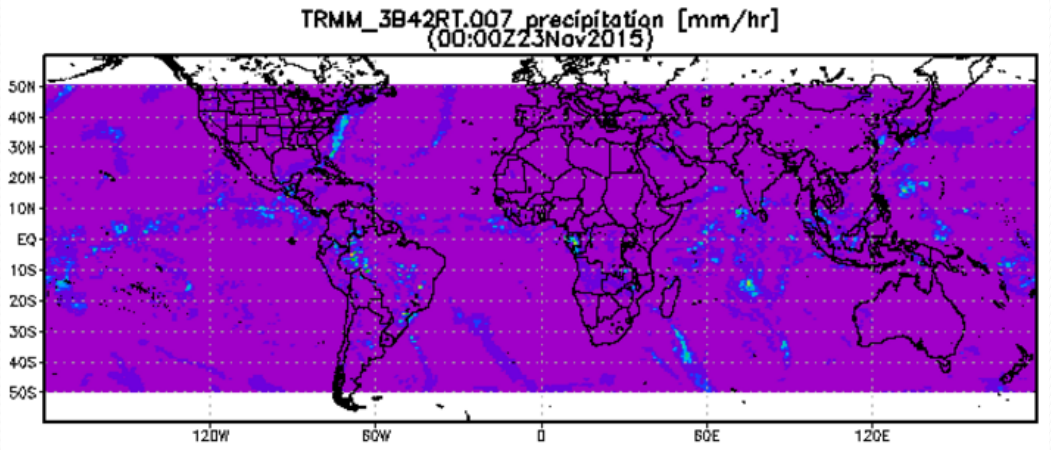
CICS Science Meeting

November 23rd, 2015

Introduction

- Near-global satellite precipitation estimates are crucial for hydrological monitoring & forecasting
- Satellite precipitation products rely primarily on passive microwave, and propagate precipitation with cloud motion from GEO
- IR-Rain Rate relationships subject to errors from cirrus cloud shield for convective systems

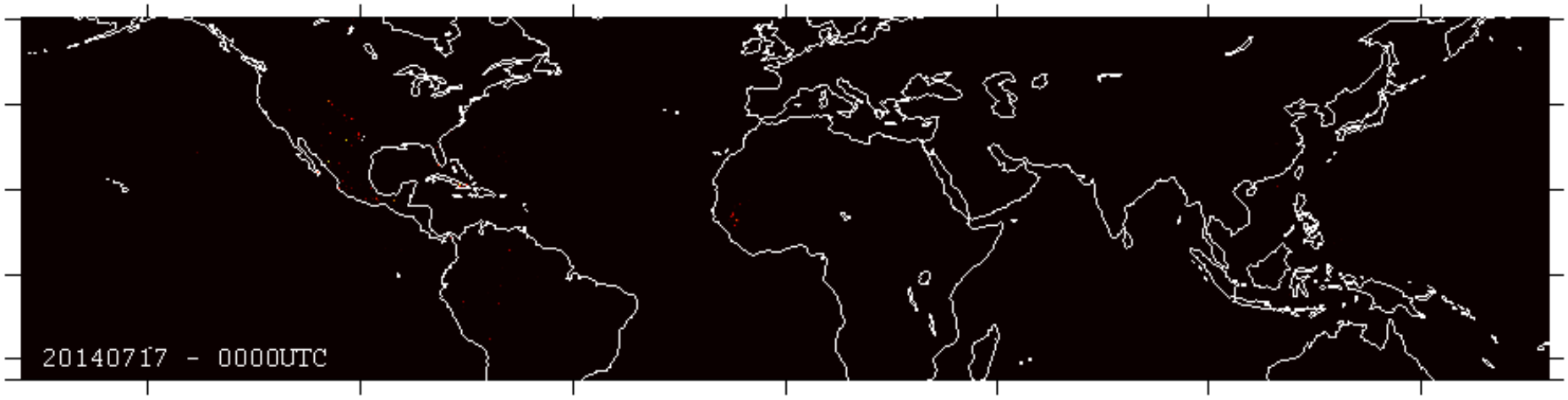


Motivation & Goals

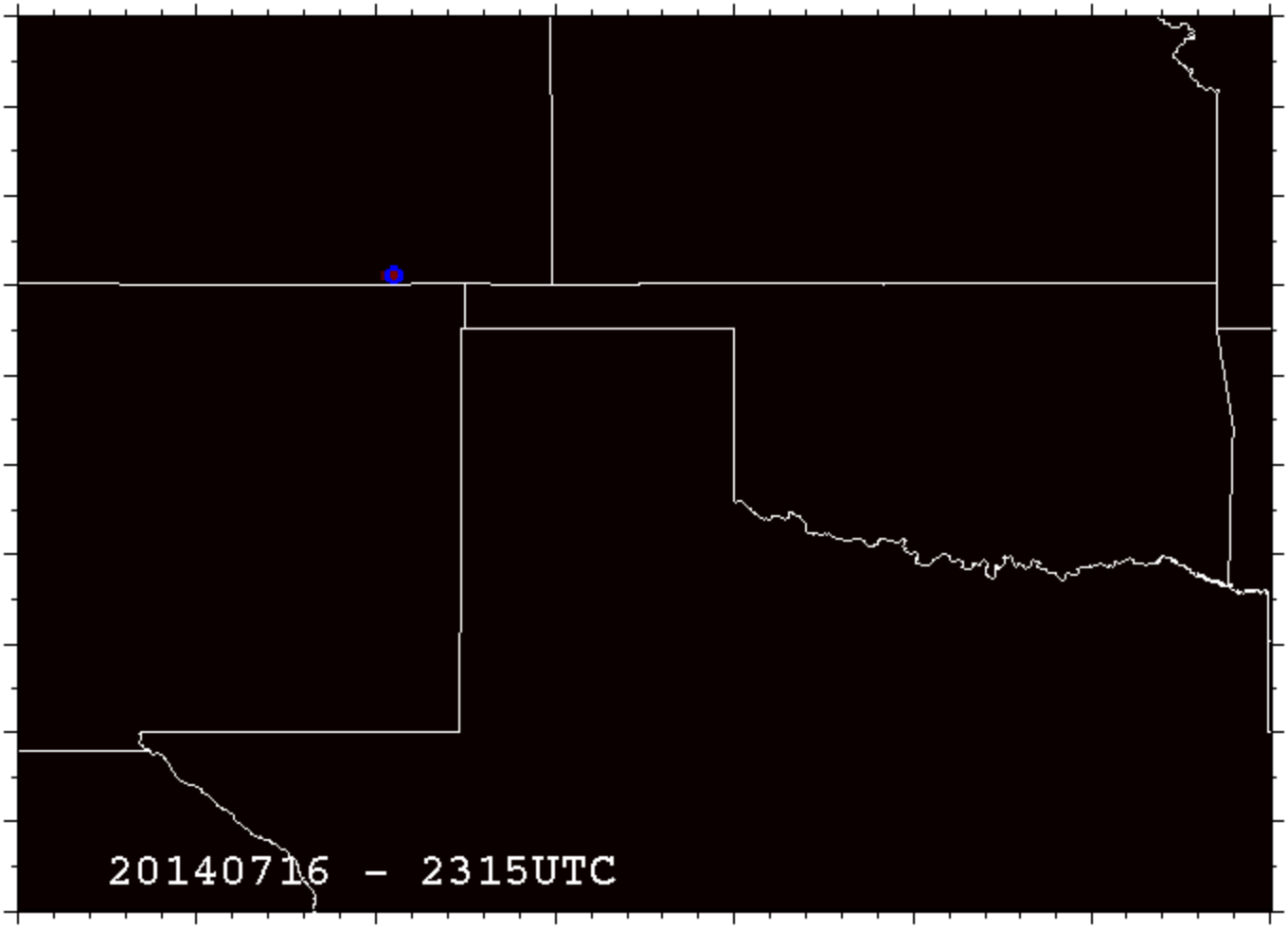
- Remote Sensing Data Fusion
- Leverage lightning data for satellite precipitation estimates and now-casting
- Lightning identifies convective cores and can identify storm life-stage
- Intersection of several related tasks
  - Near Real-Time Precipitation Propagation Using Lightning
  - Supporting ProbSevere Development
  - Monitoring and Day-2 Algorithms of AMSR2 EDRs

Global Lightning Data

- 1-yr of Vaisala's GLD360 data
  - Position, time, and current of total lightning
  - Near-global coverage
- Proxy for GOES-R Geostationary Lightning Mapper
  - GLD360 sampled into "lightning density"
    - 15 minute accumulation 0.1° x 0.1° grid



Lightning Feature Database

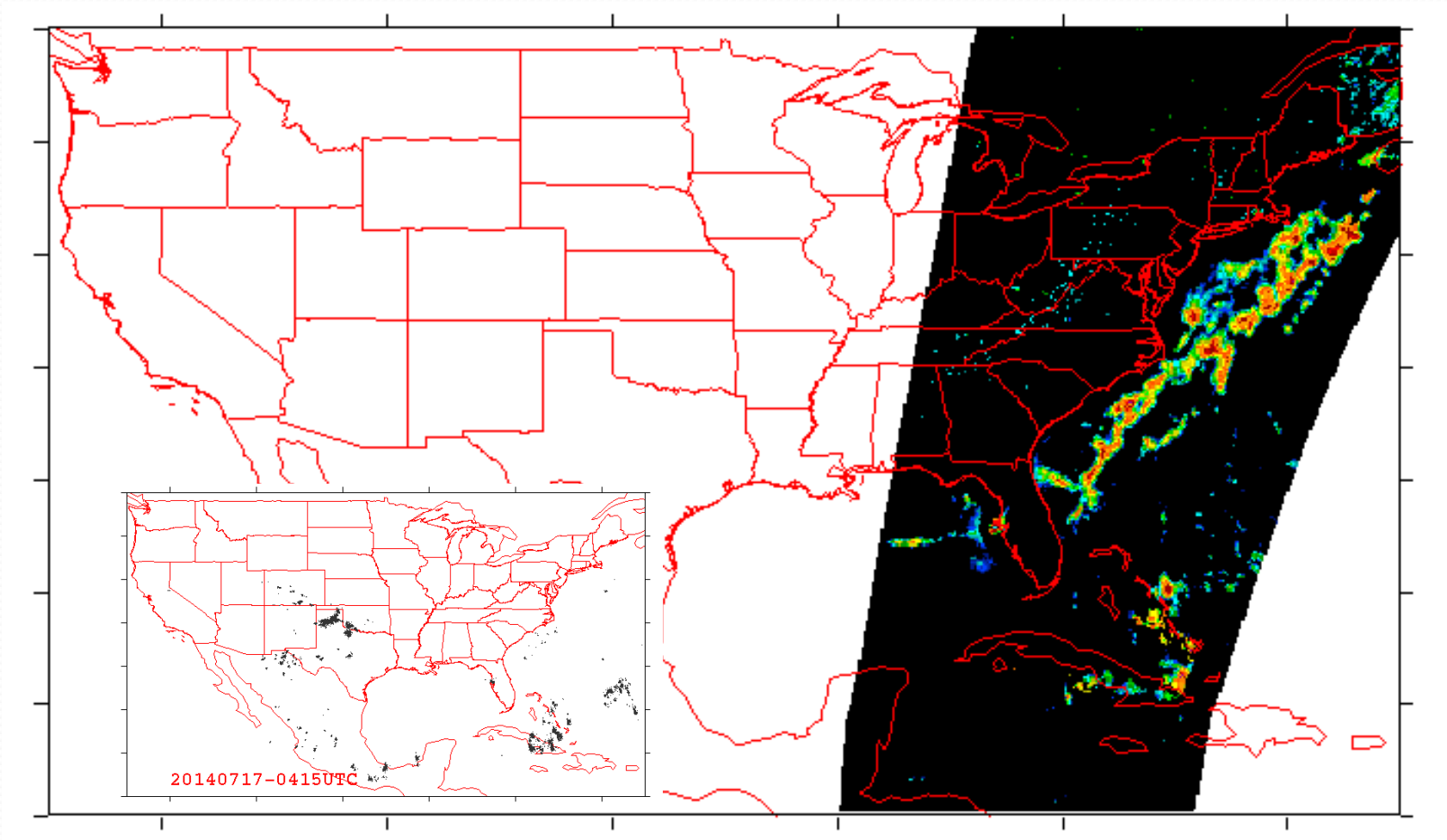


Propagation of AMSR2 Precipitation Obs

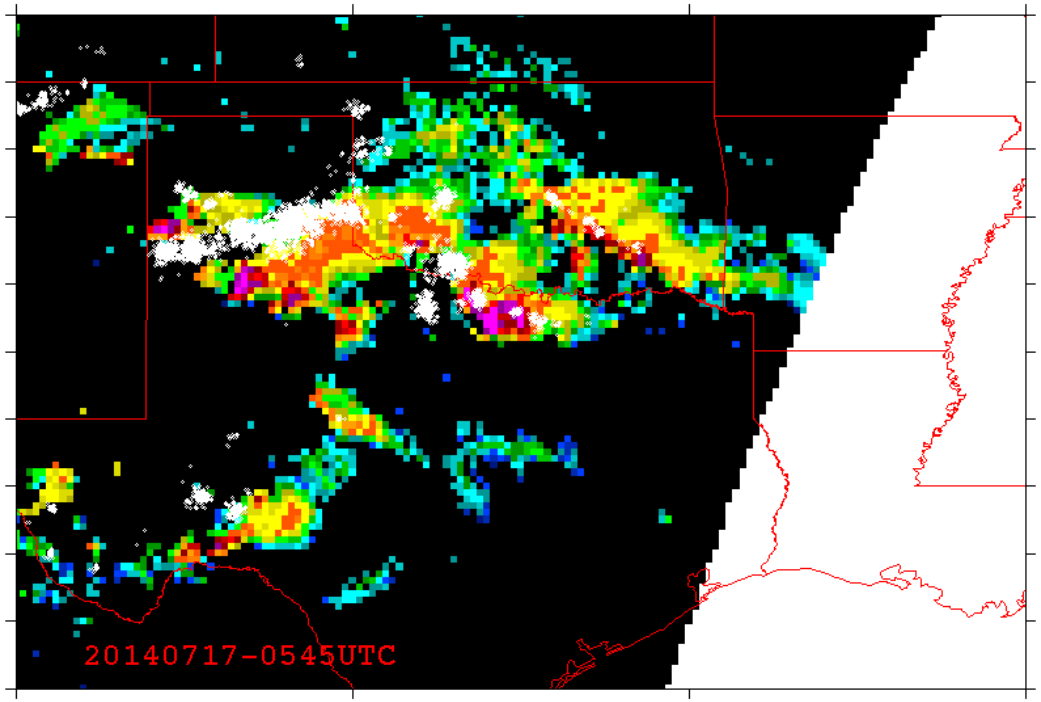
Simple Proof-of-Concept Model

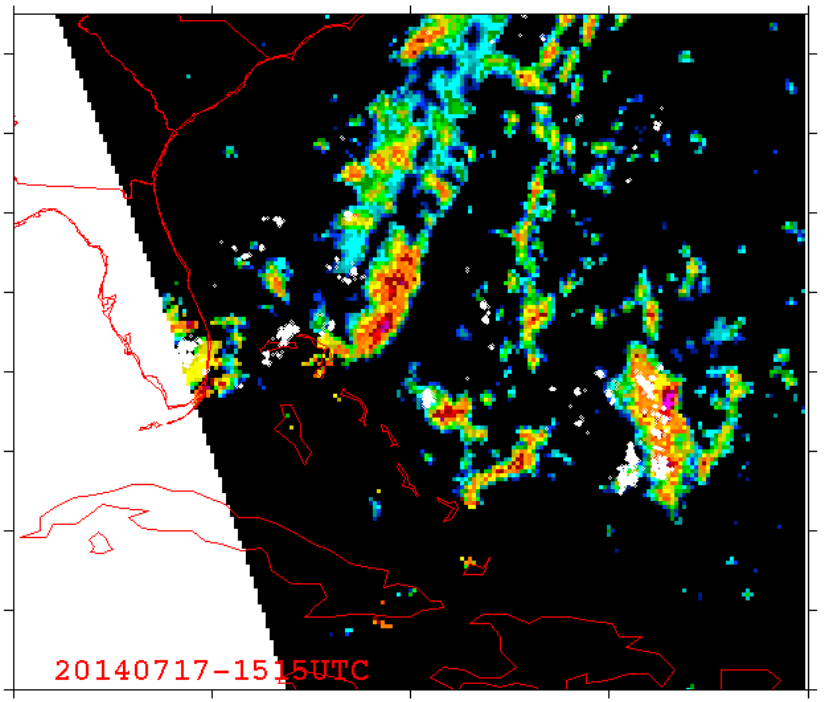
- Create lightning density maps using GLD360 locations
- Aggregate 15-minutes of data at 0.01° x 0.01°
- Identify local lightning density maxima
- For each maxima, spatially correlate to previous time step to identify most-likely displacement
- Interpolate individual motion vectors to gridded domain
- Horizontal Gaussian filter and temporal median filter
- Limitations: No “morphing”, no background flow

24-hr Example



Regional Focus





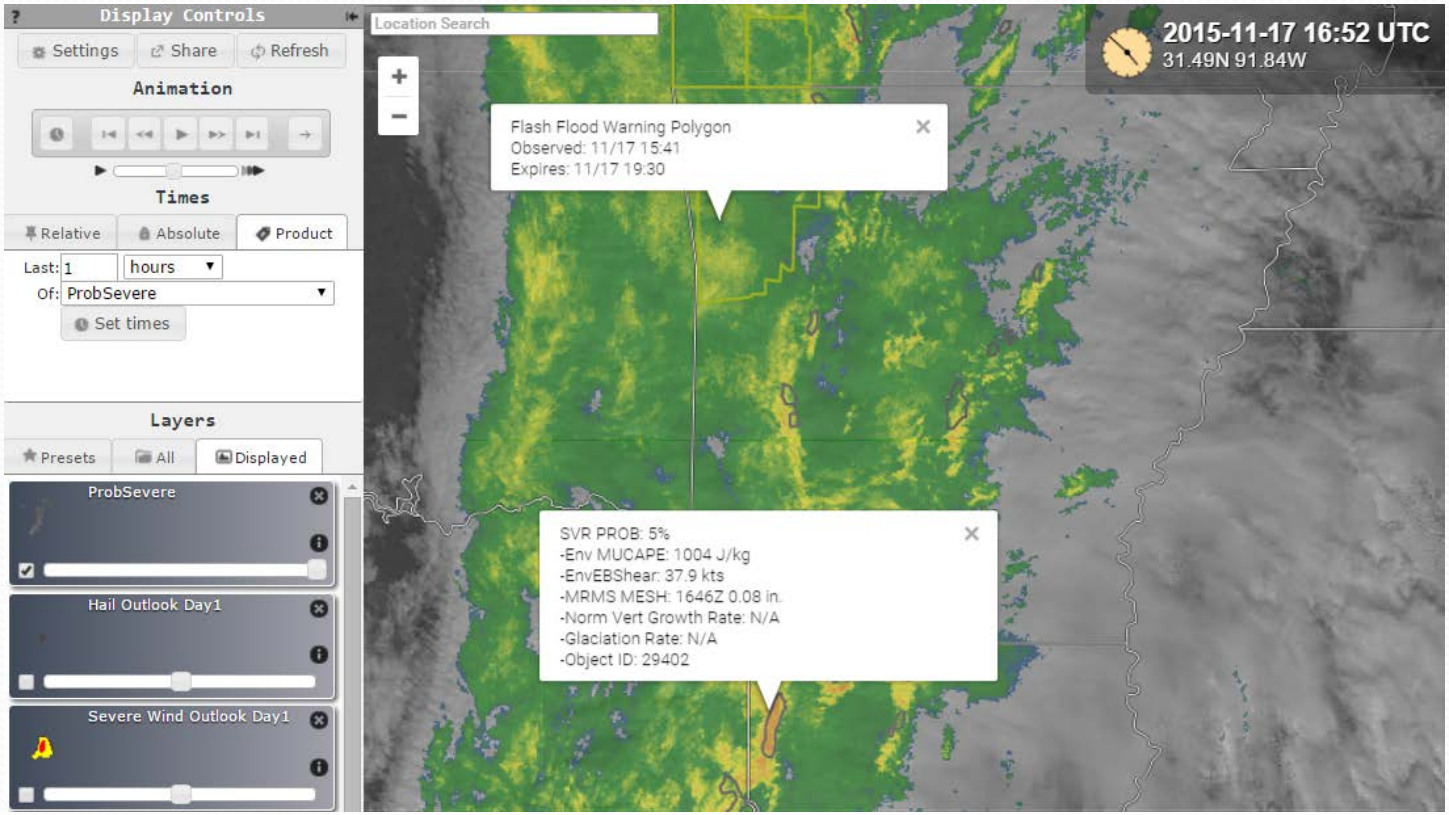
Future Applications

Potential Value

- Apply lightning for offshore storm applications
  - Lack of quality radar coverage
  - Interest from the Pacific Region (led by Nai-Yu Wang)
- Add lightning to Level3 satellite precipitation products
  - i.e. IMERG, CMORPH
  - Storm initiation/development/forecasting

ProbSevere

- Forecasting tool under development by CIMSS
- Tracks radar, geostationary, & NWP parameters



Future Work & Challenges

- Downgrading data for GOES-R GLM equivalence
- Validation of GLD360 (spatial & temporal consistency)
  - Develop application/use for other lightning products
- Evaluate storm lifecycle
- Assist ProbSevere incorporate & interpret lightning
- Expand ProbSevere concepts for offshore/OCONUS