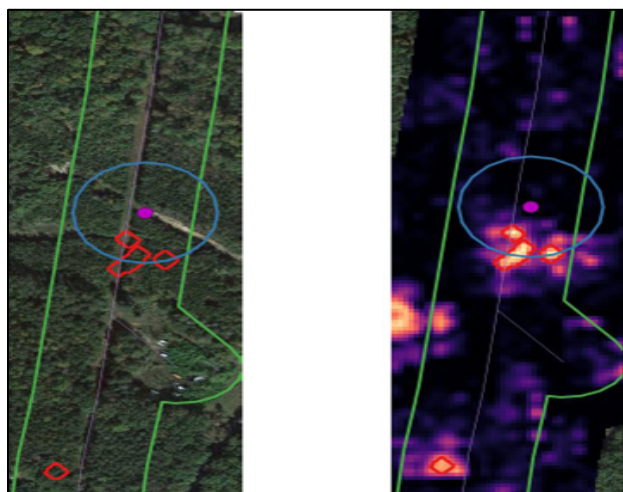


Assessment of Satellite Derived Radar Imagery for Initial Storm Damage Assessment



Background, Objectives, and New Learnings

Attaining a comprehensive overview of damage severity across a wide area immediately after severe weather is a challenging task. Typically, the storm danger must pass, and daylight is essential before assessors can safely identify damage extent and location of access-obstacles. The damage assessment process is also very labor intensive, at times requiring days to gain full visibility of damage from severe winds, hurricanes, or tornadoes.

Synthetic aperture radar (SAR) may offer an improved approach to damage assessment. Current satellite technology provides the availability to acquire a SAR image four times per day or once every six hours, and this frequency may improve as more SAR enabled satellites are launched. Because these are radar images, cloud cover and night-time visibility are non-factors in the image acquisition.

Once an image is downloaded and converted to useful terrain data, the post-storm images could be compared to a recent pre-storm images of the same area to rapidly assess storm damage. For example, analysis of the pre- and post-storm images could be assessed to determine where vegetation and structures are no longer present or appear to have fallen. This approach may provide insight into likely locations of power system damage. The approach may effectively project storm damage locations and severity before damage assessors can safely start their field work.

Project Highlights:

- Understand the role of synthetic aperture radar (SAR) in early storm damage assessment
- Document the necessary steps for overnight predictions of damage to vegetation and infrastructure
- Develop and compare different change detection algorithms useful for a variety of utility applications
- Learn about the future costs and available projections for overhead radar imagery

The objective of this research is to demonstrate the ability to acquire and quickly analyze satellite-attained radar data to discern the locations of downed trees and subsequent damage to the electric power infrastructure.

Benefits

Member benefits from this project include:

- Viability of satellite derived radar imagery for storm damage assessment
- Increased situational awareness on storm damage severity before traditional, visual assessment is possible
- Increased understanding of the role of remote sensing and GIS tools to evaluate system damage from tree fall-ins
- Enhanced customer and worker safety through early damage assessment and remote analytics
- Improved crew efficiencies and restoration times

Project Approach and Summary

To facilitate this project, EPRI intends to work with participating utilities to conduct the following activities:

Task 1: Area of Interest Determination

Define three areas of interest within a member's service territory where storm damage assessment technology is anticipated to be most beneficial due to vegetation and geospatial features. Characteristics of interest could include

the area's vegetation damage history and the difficulty in damage assessors gaining access for post-storm assessments. The three areas of interest will comprise the specific polygons where the satellite radar imagery will be collected for the before and after (storm incident) change assessment.

Task 2: Damage Assessment Criteria

Create a comprehensive damage assessment documentation and reporting form that will be used if storm damage hits one of the areas of interest and requires ground truthing to understand how well the change assessment algorithms perform. Of particular interest will be the geospatial locations of the actual trees that are down in the subject right of ways.

Task 3: Advanced Warning Storm Prioritization

Develop a procedure for predicting severe weather and for requesting pre-storm SAR imagery. The procedure is expected to include the following steps.

1. Participants will monitor weather forecasts and request a SAR data capture when a severe storm event is predicted across an area of interest.
2. Next, the research team orders the radar image capture both before and after the storm event has passed through the area of interest.
3. A damage assessment is predicted by comparing the before and after SAR data to identify radar discernible changes in trees and structures.
4. Finally, the SAR prediction is compared against the visual damage assessment conducted after the storm with emphasis on identifying exact locations of fallen trees on or near power lines.

Task 4: Technology Transfer Workshop and Image Repository

EPRI intends to collect all SAR images to support evaluation of any new change detection algorithms as they are developed. EPRI also intends to facilitate a member workshop to overview the synthetic aperture radar opportunity, including the preliminary learnings from at least three separate storm assessments completed during the project.

Deliverables

All project outcomes are anticipated to be disseminated over the course of the work as the results become available through:

- Quarterly webcasts, workshops, and forums
- A web-repository of test results

The non-proprietary results of this work will be incorporated into EPRI's Power Delivery and Utilization R&D programs and made available to the public for purchase or otherwise.

Price of Project

The cost of participation is \$35,000. Funding can be split over the two-year project duration. This project qualifies for tailored collaboration (TC) or self-directed funding (SDF).

Project Status and Schedule

This project is expected to begin in the second quarter of 2023 and take approximately 18 months.

Who Should Join?

Utilities interested in improving storm damage assessment efficiencies and turnaround times.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

Technical Contacts

Doug Dorr at 407.968.3010 (ddorr@epri.com)

Jared Green at 865.360.7967 (jgreen@epri.com)

Member Support Contacts

Brian Dupin at 650.906.2936 (bdupin@epri.com)

Barry Batson at 704.905.2787 (bbatson@epri.com)

Chuck Wentzel at 618.320.0011 (cwentzel@epri.com)

Evan Birenbaum at 424.275.5110 (ebirenbaum@epri.com)

Warren Frost at 403.474.4432 (wfrost@epri.com)