Radio-Tomography-of-the-Ionosphere-based Earthquake Predictions

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8 May 2013

Phase I Experiment

Radio-Hydro-Physics will modify and reposition ground stations to support Phase I Experiment

- Five ground stations, exploiting 3 satellite/beacons (LORT system)
- 150+ GPS receiving stations (HORT system)
- RHP software suite, current as of time of experiment
- No new equipment, hardware or software required
- Two new ground station locations to be set up

RHP will deliver predictions via email to SCEC with the following content:

- Date, time, place, and magnitude of anticipated EQ event.
- Initial location of test area will be States of Oregon and Washington, extended to Cascadia fault zone in Pacific
- Date/time will be specified, with target of 24 to 72 hours as goal.
- Location will be specified in terms of latitude, longitude, and uncertainty error zone; i.e., +/- “x” kilometers
- Magnitude and depth will be estimated, with magnitude 4 and higher as triggering
- Triggering data will be provided; i.e., RTI images for projected event, along with ambient background images.

Modifications -- Predictions may be modified after initial submission up to four hours prior to event deadline:

- Modifications likely due to subsequent satellite passes which may improve tlm (time, location, magnitude of prediction)
- Enhancements may be made as to date/time, within the initial window based on new geophysical evidence (to be submitted)
- Withdrawal of submitted prediction may be made, based on new geophysical evidence up to four hour cutoff
- Four hour (or alternative) window based on “government alerting/evacuation needs”

Influencing Factors

Characteristics of Test Region
- Value of prediction
- Ancillary Benefits
  - Tsunami warning? Or just EQ prediction
  - Other end-users (Navy, OTHR, global weather, climate)
- Frequency of EQs
- Demographics/Infrastructure being protected

Value to DHS (human utility)
- Value in lives/property/security

Cost to DHS
- Opportunity cost/time consumed waiting for evolution of event archive
- Implementation cost

Potential for synthesis and synergism with other prediction techniques

Temporal aspects
- Minutes important for Tsunami warnings
- Hours important for EQ predictions

Measures of Effectiveness

Event did/did not occur as predicted

- Error bars in time, location, magnitude

Test Venue criteria – all test areas are not equivalent; i.e. rate of occurrence of EQs, degree of difficulty, ...

Prediction had human utility?

- Temporal utility; i.e., days/hours for EQ, minutes for TS, not seconds or weeks

Was prediction reasonable, and sufficiently accurate to have utility if acted upon by DHS?

Was prediction in area of importance (demographics, installations, infrastructure) – national valuation

Growth potentials for technique?

- Extensible to other regions?
- Modifications warranted to optimize technique.

Synergistic with other prediction regimes?

- Goal is effective prediction system, with low false alarm rate
- Competition between techniques is not the goal: we seek the most cost-effective mix of techniques

Do other end-users exist?

Costs in $

Does technique warrant further consideration for possible integration into national/global system?

Source data cost and availability, short- and long-term