# Implementation of Hard and Soft Exclusion Sources in conjunction with DART 4G Technology for Rapid and Accurate Assessment of Cascadia Events

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In recent years, research at the NOAA Center for Tsunami Research (NCTR) has been focused on the improvement of NOAA's current forecast methodology to improve and expedite tsunami forecast assessment of the near-field. NCTR considers its current forecast methodology based on inversion from DART stations to provide the most accurate forecast results, but at a significant penalty in terms of timeliness. This shortcoming is particularly relevant in the near field, where tsunami impact is expected to be most severe, as will be the case of the Pacific Northwest coast of the US during a Cascadia event. In order, to improve the current situation, research at NCTR has been focused along two lines:

1-Improvement of initial and provisional forecasts for the near-field region prior to the availability of a DART inverted forecast.
2-Reduction of the latency time for a DART inverted forecast

In order to make headway in (1) work has started with collaborators from Central Washington University, NASA, Scripps and the University of Oregon (Diego Melgar, Amy Williamson) to use GPS data of ground displacement in real-time to generate a fast and accurate PGD Magnitude, CMT and finite fault solution of the event (Melgar et al.), tentatively within 5 minutes of rupture initiation.
In addition, tsunami hydrodynamic models have been parallelized and optimized for GPU architecture, resulting in the acceleration of real-time inundation models by a factor of 10 to 20. The goal is to have a preliminary but sufficiently accurate inundation forecast for coastal communities within 10 minutes of the rupture initiation.
Simultaneously, in order to make progress towards (2), a new generation of DART buoys (4G) was developed that can be deployed in close proximity of the rupture area effectively reducing latency time to tsunami detection from 30 minutes to approximately 5 minutes. NCTR has proposed a dense configuration of DART systems along the offshore margin of Cascadia that would guarantee tsunami detection between 5 and 10 minutes after origin time. These dense DART network would require the modification of the current inversion algorithm (Percival et al.) to be used with a fractional inversion approach, whereby each DART station would be exclusively used for inversion of rupture segments located in regions within tsunami travel time of the DART station (Valid Sources), potentially tsunamigenic areas within shorter tsunami travel time than the time of tsunami detection at DART will be excluded (Hard-Exclusion Sources) and potentially tsunamigenic areas with a tsunami travel time larger than the time elapsed since origin time will be conditionally excluded (Soft-exclusion sources). Such approach could result in the generation of a series of partial inversions with local validity along the coast prior to the final generation of a joint inversion solution.

References:

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