

West Pacific DART Location Assessment (Stations 2-1 to 2-6)
 Hal Mofjeld, Mick Spillane, Frank González, Vasily Titov
 NOAA/PMEL National Center for Tsunami Research

Introduction. NDBC has scheduled the deployment of six new DART stations in the West Pacific, with the deployment cruise set to begin February-March, 2006. At the request of Shannon McArthur (NDBC), PMEL conducted a highly accelerated evaluation of a set of candidate locations developed by the Tsunami Warning Centers (TWCs). The rapidity of this evaluation was driven by the lead-time needed to secure advance permission from other nations to deploy DART systems in their territorial waters, if such deployments prove necessary in order to meet DART Network operational requirements. The purpose of this effort is to recommend refinements in the DART locations to the TWCs and NDBC, as well as to identify choices that will need to be made before the final locations can be established.

Analysis. The USGS conducted an intensive effort to provide PMEL with seismic source information for the West Pacific. PMEL then developed the earthquake parameters needed as input for tsunami modeling and developed a preliminary tsunami propagation database for the region. This database, in combination with specialized tools based on various travel time analyses were used to conduct the assessment and form the subsequent recommendations that were guided by the following set of criteria:

- (a) Tsunami travel times from potential tsunami sources,
- (b) Positions relative to tsunami propagation paths to U.S. impact sites,
- (c) Suitability of bottom conditions for hardware deployment,
- (d) Avoidance of wave scattering islands, seamounts and ridges,
- (e) Location relative to political boundaries.

Overall, only minor changes in location appear to be necessary in order to meet these criteria. After review of preliminary list of sites meeting these criteria, Shannon MacArthur, NDBC, requested that DART sites 2-3 and 2-4 be moved to international waters, if possible, and provided a graphic of EEZ boundaries in the region.

The original TWC candidate sites, the recommended locations and relevant comments and issues are listed in Table 1, and a graphical representation is provided in Figures 1 and 2.

Table 1. Original and Recommended DART positions in the W Pacific Ocean.

DART Station	Original Sites			Recommended Sites			Issue/Comment
	Latitude (°N)	Longitude (°E)	Depth (m)	Latitude (°N)	Longitude (°E)	Depth (m)	
2-1	30.55	152.10	5873	30.550	152.100	5874	Unchanged
2-2	18.28	155.57	5678	19.250	155.750	5639	Scatterers nearby
2-3	11.20	154.60	5740	11.562	154.598	5708	Now in Int'l Waters
2-4	20.84	134.97	5849	21.000	132.400	5837	Ridge nearby. Now in Int'l Waters.
2-5	02.38	145.65	4570	4.000	145.500	4489	Beam coverage
2-6	13.00	132.00	5695	13.000	132.000	5695	Unchanged

To better understand the role of these recommended DART stations in observing tsunamis from the full suite of possible subduction zone sources in the SW Pacific Region, it is helpful to view the tsunami beam patterns from the sources. These patterns are available at the website: <http://www.pmel.noaa.gov/~spillane/design/WestPacific.html> .

Summary and Recommendations. Each individual DART Station is addressed here in turn, together with a recommendation to either leave the candidate location unchanged or to move it, based on the analysis criteria listed above and the NDBC request for sites in international waters when possible. We believe all recommended DART sites are in international waters.

2-1. Placed on the 1.0-hr travel time curve from South Honshu Ridge and Japanese sources, the original location appears to be fully adequate.

2-2. Suggest moving to the east to avoid scatterers near the original location. This does increase the minimum travel time slightly. The final position for this station was adjusted to respond to Paul Whitmore's request to be more midway between 2-1 and 2-3 while remaining close to the 1.0-hr travel time line.

2-3. Also on the 1.0-hr travel time curve, the original location appears to be adequate. The final position was iterated with Shannon MacArthur and the TWCs, with the goal of placing the position outside of any EEZ, in international waters.

2-4. This station is in a difficult location because it is between the Kyushu Palau Ridge and water to the west with depths >6000m; the latter are beyond the depth limit of the DART bottom units. The suggested location is farther away from the ridge but in deeper water. A local bathymetric survey during the deployment cruise will be necessary to find a suitable location in terms of water depth. The original station was within waters claimed by Japan. The final position was iterated with Shannon MacArthur and the TWCs, with the goal of placing the position outside of any EEZ, in international waters.

2-5. Suggest moving the station northward to get within the main beam of more sources to the south.

2-6. Well-located.

Note on EEZ Issues. Even modest changes in some of the candidate locations can move these locations into the territorial waters claimed by one nation or another. In addition, some of the borders separating these waters are in dispute.

It may be that the NOAA/NWS already has existing relationship with some of the Island Nations that will facilitate getting permission for the DART deployments in their waters. It may be that the NWS Pacific Region HQ in Honolulu has experience in dealing with instrumentation deployments and maintenance in these nations that would be useful in this regard. This possibility needs to be explored further since delays associated in getting permission from other nations can be substantial, potentially delaying the DART deployments in the SW Pacific or leading to a less-than-optimal DART array there.

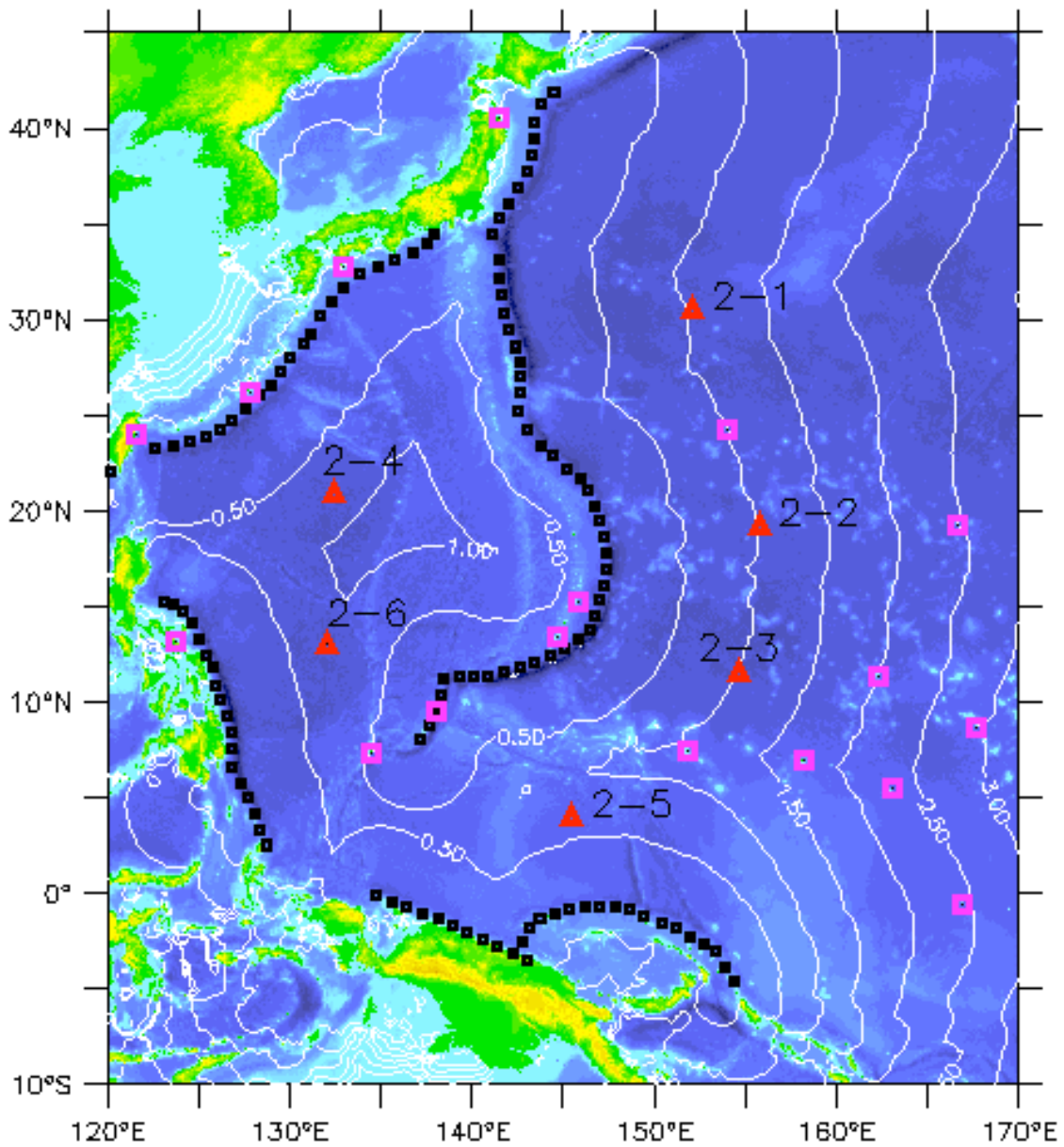


Figure 1. Recommended DART locations in the SW Pacific Ocean. Also shown are tsunami travel times to nearest tsunami source (white lines, in hrs), potential tsunami sources (black squares), TWC warning points (pink squares) and bathymetry (indicating islands, seamounts, and mid-ocean ridges).

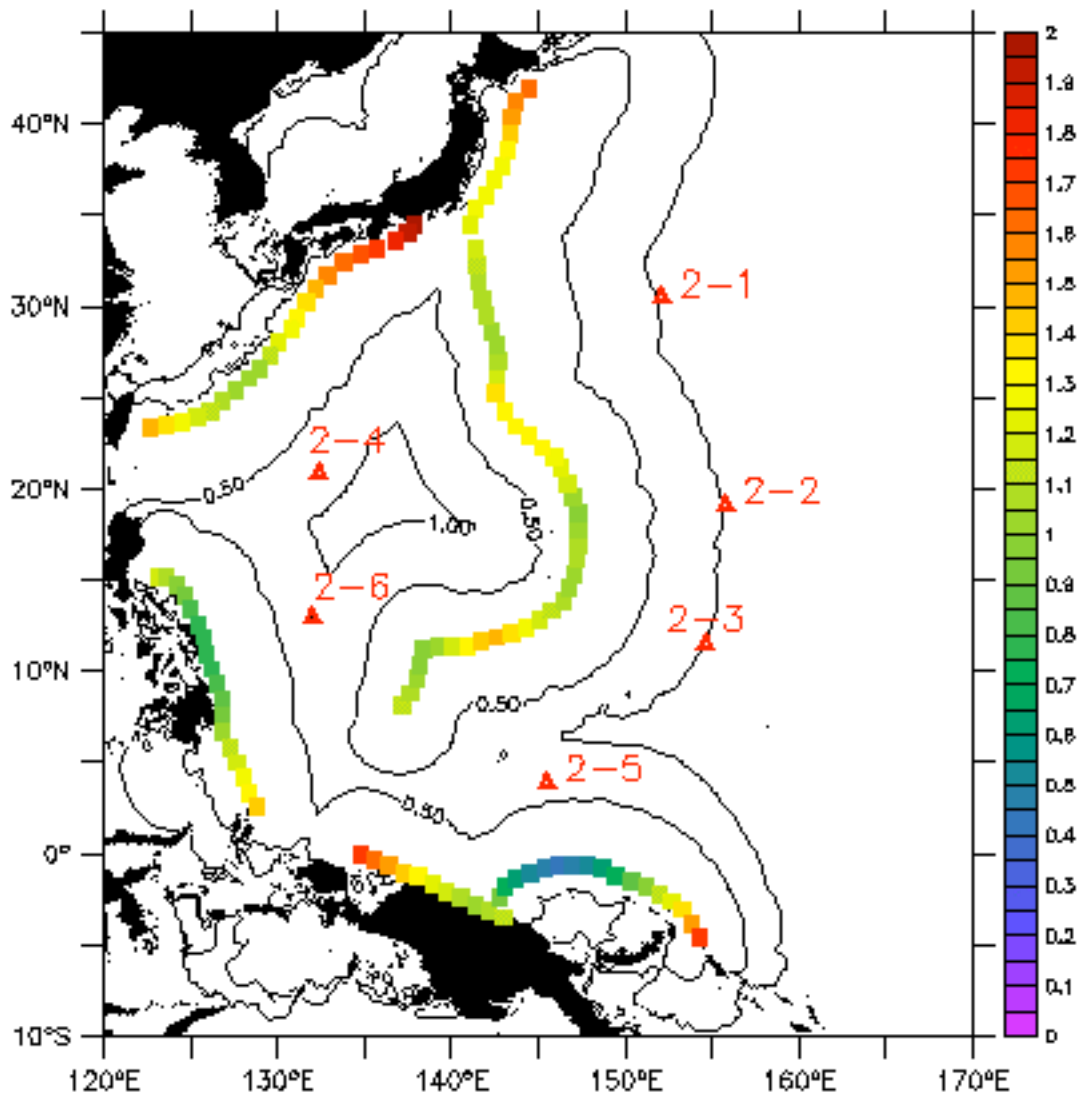


Figure 2. Recommended DART station locations (red triangles). Minimum tsunami travel times are shown in black, and the color code refers to the earliest DART network detection of a tsunami generated by the associated source.