

**Evaluation of Field-Collected Drifter and In Situ Fluorescence Data  
Measuring Subsurface Dye Plume Advection/Dispersion and  
Comparisons to High-Frequency Radar-Observation System Data  
for Dispersed Oil Transport Modeling**

**APPENDIX H – SIMAP MODEL APPLICATIONS  
TO DYE EXPERIMENTS**

**A Final Report Submitted to  
The Coastal Response Research Center**

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## **Appendix H. SIMAP Model Applications to Dye Experiments**

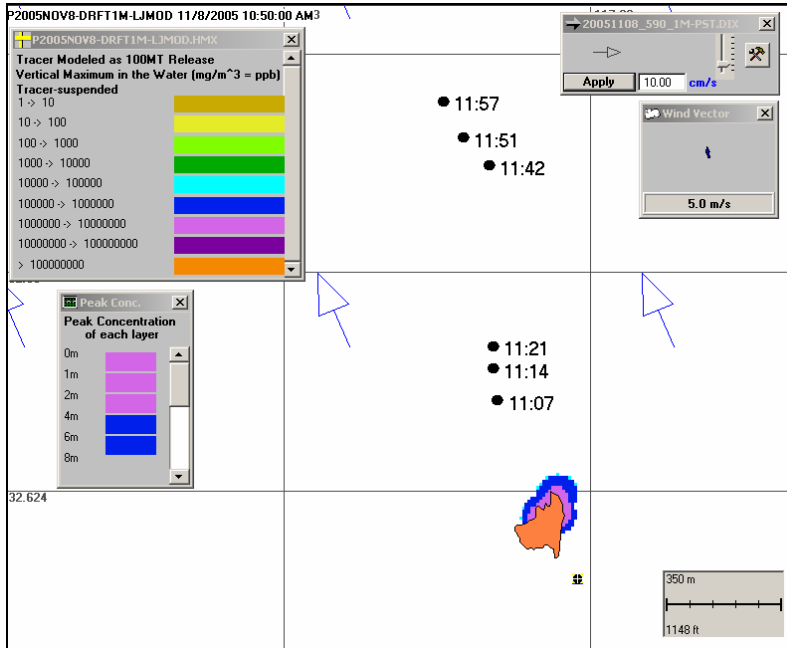
This appendix contains snapshots from SIMAP model simulations of the seven dye release experiments off Point Loma. These hindcasts were made with the following inputs:

- velocities as measured by the deepest drifter placed in the dye patch (which for 4-m and 5-m drifters, did not include significant wind drift);
- velocities as predicted by the wind drift model algorithm (Section 5.2.2 in main report) and added to the drifter velocities;
- the radial horizontal dispersion coefficient measured from the photo images (Table 5-6 in main report, no wind drift included);
- the vertical dispersion coefficients measured from fluorescence measurements (Tables 5-7 and 5-8 in main report); and
- a unit release of 100 MT (such that concentrations are relative to that release mass).

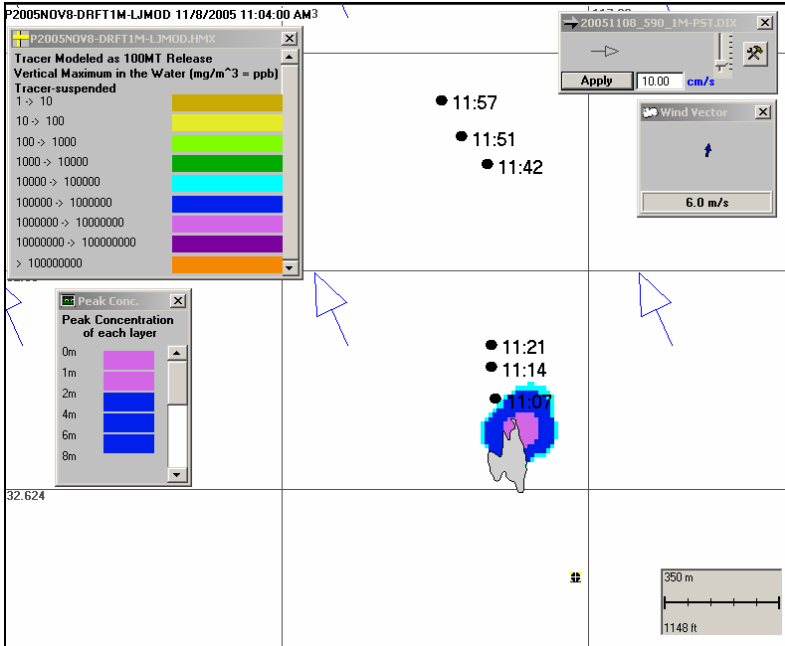
The model-predicted plume concentrations were plotted at times of photographic images of the dye plumes, with the shape of the corresponding image from the photographs overlaid on the modeled plumes. Because the dye was simulated as if it was a 100MT release, and the concentrations were measured by color intensity in the aerial photo, the absolute concentrations were not compared. The figures allow comparison of modeled versus observed movements (horizontal advection) and spreading (horizontal dispersion) of the dye, as indicated by the dimensions of the plume in the bird's-eye view.

## H.1 November 8, 2005 Experiment

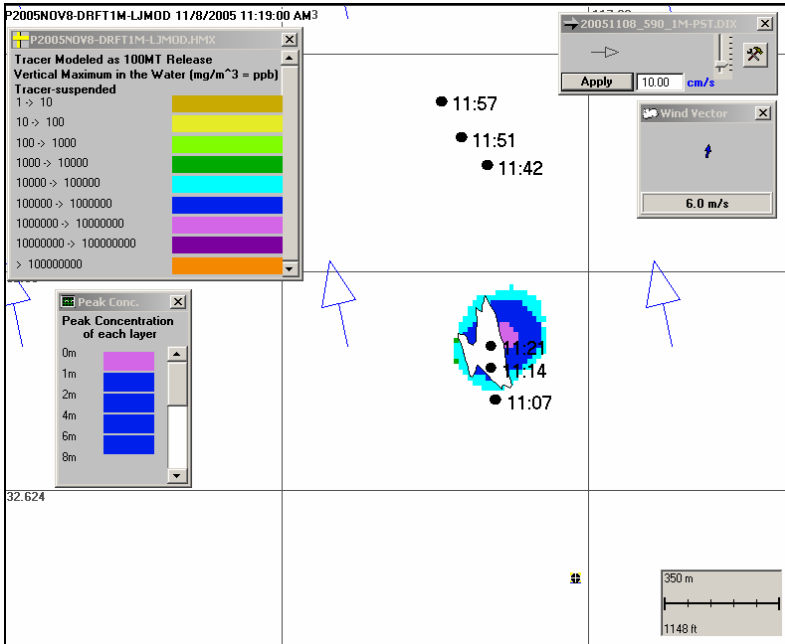
The hindcast of the 8 November 2005 dye release was made using velocities as measured by the 1-m drifter in the dye patch (#16767590); the radial horizontal dispersion coefficient measured from the photo images ( $0.5 \text{ m}^2/\text{s}$ , Table 5-6 in the main report); and the vertical dispersion coefficients measured from fluorescence measurements ( $16 \text{ cm}^2/\text{s}$ , Table 5-7 in the main report). Figures H.1-1 to H.1-4 show comparisons of the model hindcast to the observed as captured by the aerial photographic images.



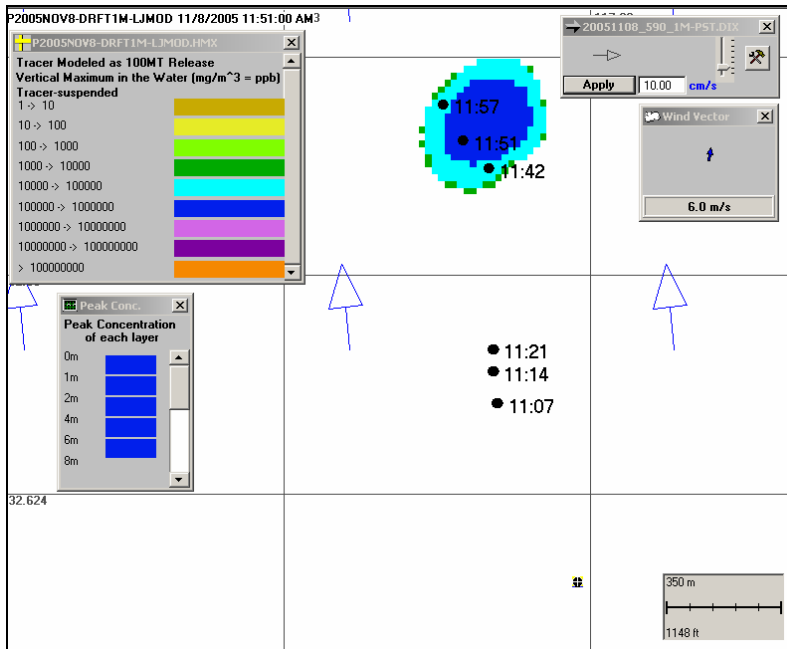
**Figure H.1-1. SIMAP model simulation of the 8 November 2005 dye release at 10:50 hrs PST, with the shape of the photographic image (colored orange) overlaid on the plume. The times of CTD casts made within the dye plume are also plotted for comparison.**



**Figure H.1-2. SIMAP model simulation of the 8 November 2005 dye release at 11:04 hrs PST, with the shape of the photographic image (colored gray) at that time overlaid on the plume. The times of CTD casts made within the dye plume are also plotted for comparison.**



**Figure H.1-3. SIMAP model simulation of the 8 November 2005 dye release at 11:19 hrs PST, with the shape of the photographic image (colored white) at that time overlaid on the plume. The times of CTD casts made within the dye plume are also plotted for comparison.**



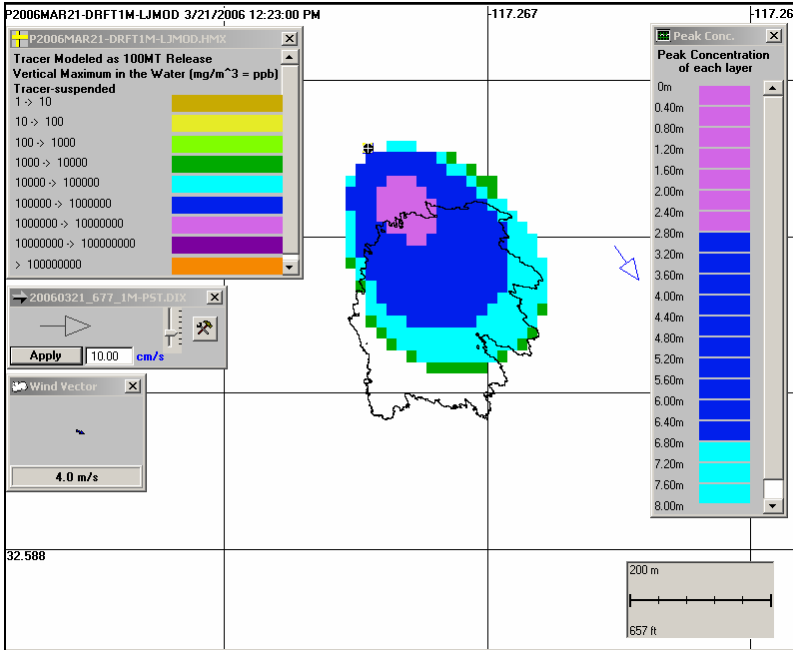
**Figure H.1-4. SIMAP model simulation of the 8 November 2005 dye release at 11:51 hrs PST. The times of CTD casts made within the dye plume are also plotted for comparison. The dye plume was no longer visible from the air.**

## H.2 March 21, 2006 Experiment

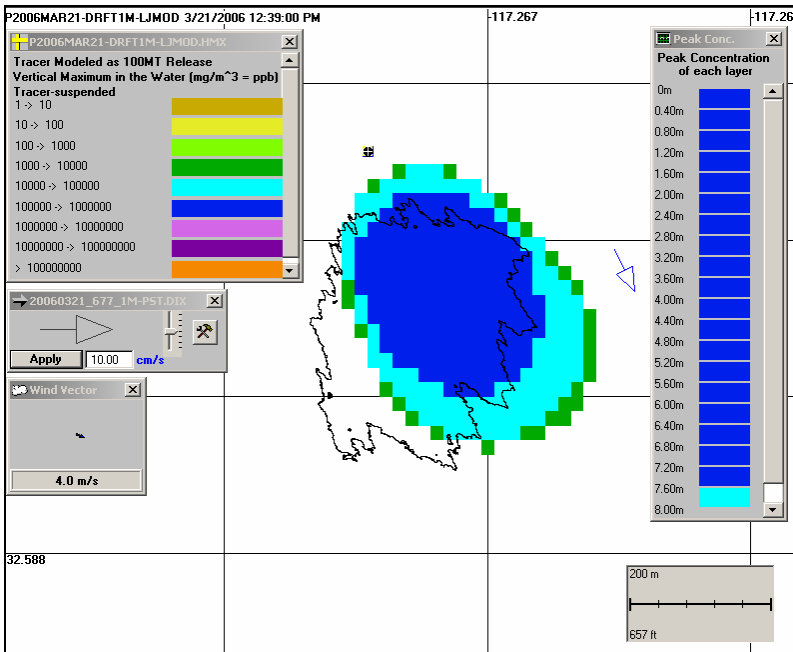
The hindcast of the 21 March 2006 dye release was made using velocities as measured by the 1-m drifter in the dye patch (#15723677); the radial horizontal dispersion coefficient measured from the photo images ( $1.0 \text{ m}^2/\text{s}$ , Table 5-6 in the main report); and the vertical dispersion coefficients measured from fluorescence measurements ( $30 \text{ cm}^2/\text{s}$ , Table 5-7 in the main report). Figures H.2-1 to H.2-3 show comparisons of the model hindcast to the observed as captured by the aerial photographic images.

In addition, on 21 March, a large patch of floating weed near the dye release was followed and photographed from the air. The locations of the weed patch over time and a SIMAP model simulation of floating material (simulating weed or oil), using velocities as predicted by the wind drift model algorithm (Section 5.2.2 in main report) added to the drifter velocities, are in Figure H.2-4. The model prediction (of wind drift added to observed drifter velocities) agrees well with the observed positions of the weed patch, confirming that the steady state wind drift algorithm fit the observations on this date.

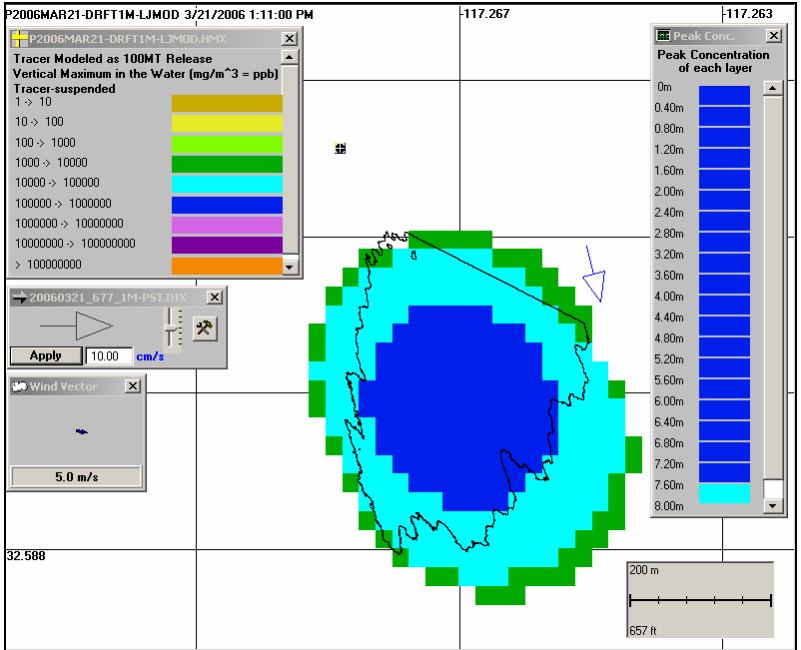




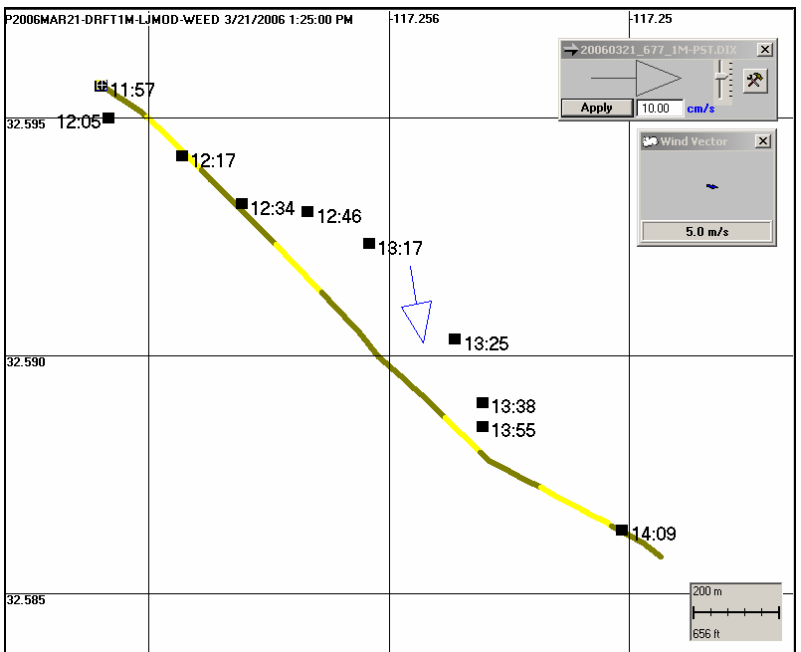
**Figure H.2-1. SIMAP model simulation of the 21 March 2006 dye release at 12:23 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



**Figure H.2-2. SIMAP model simulation of the 21 March 2006 dye release at 12:39 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



**Figure H.2-3. SIMAP model simulation of the 21 March 2006 dye release at 13:11 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

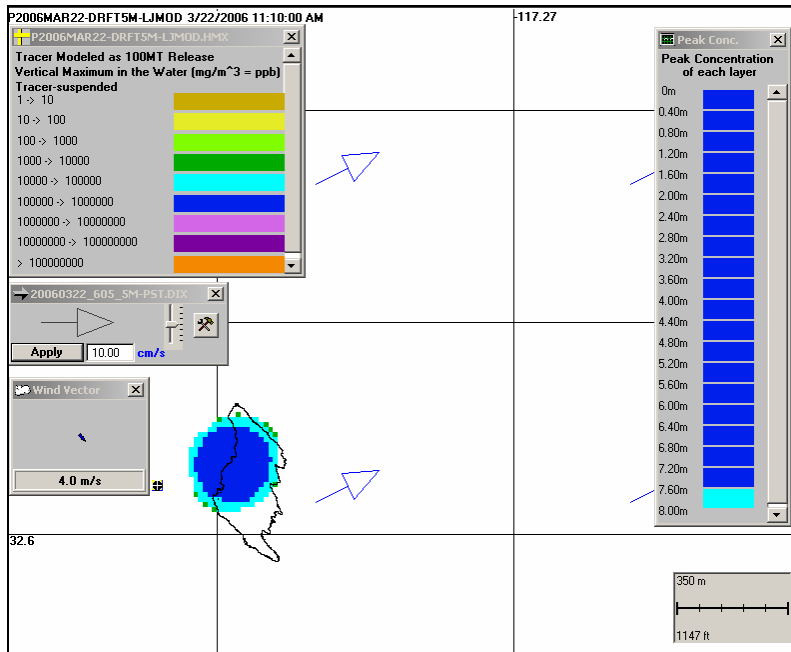


**Figure H.2-4. Observed movements of floating weed on 21 March 2006 and SIMAP model simulation using the wind drift algorithm in Section 5.2.2. (Alternating colors on the path of the trajectory are changed at times coincident with the plotted weed waypoints.)**

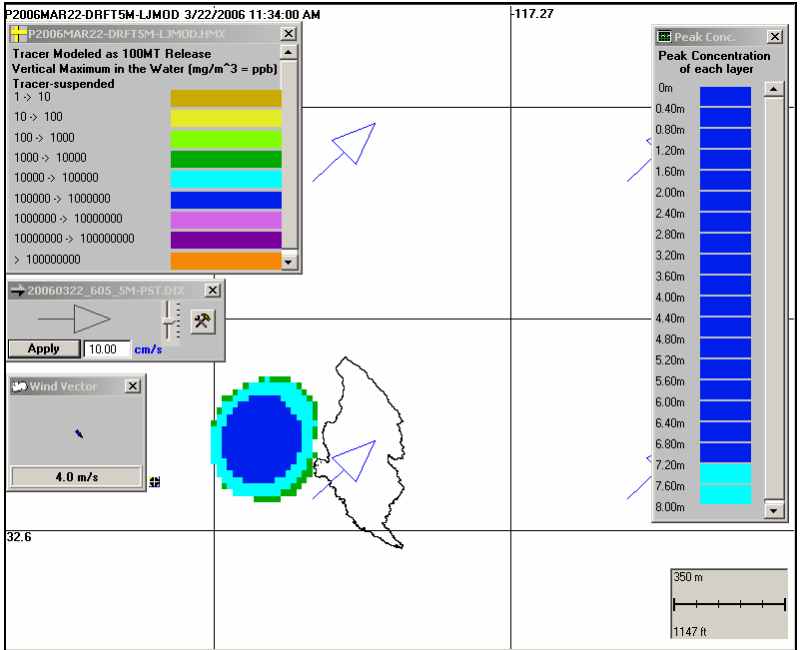
### H.3 March 22, 2006 Experiment

The hindcast of the 22 March 2006 dye release was made using velocities as measured by the 5-m drifter in the dye patch (#16766605); the radial horizontal dispersion coefficient measured from the photo images ( $0.45 \text{ m}^2/\text{s}$ , Table 5-6 in the main report); and the vertical dispersion coefficients measured from fluorescence measurements ( $6 \text{ cm}^2/\text{s}$ , Table 5-7 in the main report). Figures H.3-1 to H.3-5 show comparisons of the model hindcast to the observed plume behavior as captured by the aerial photographic images.

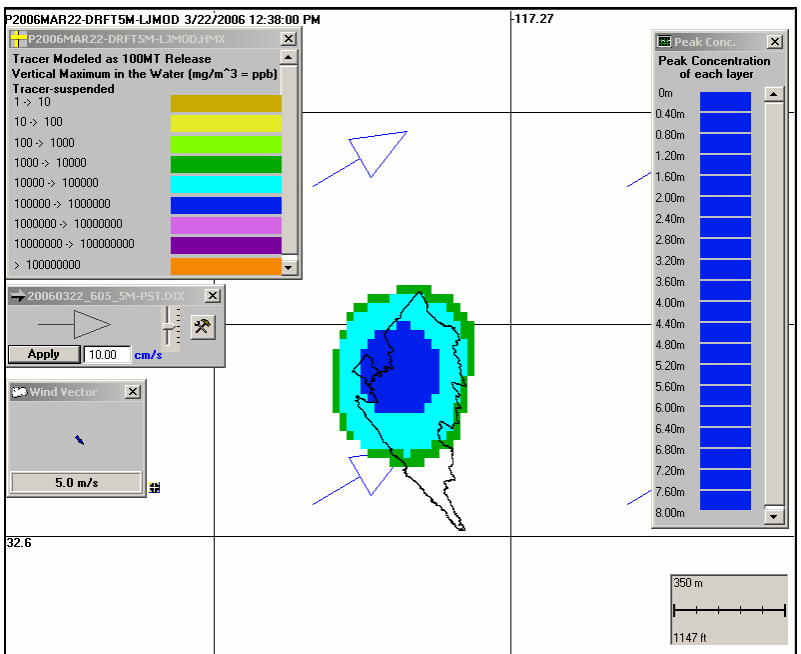
In addition (as for 21 March), on 22 March a large patch of floating weeds near the dye release was followed and photographed from the air. The locations of the weed patch over time and a SIMAP model simulation of floating material (simulating weed or oil), using velocities as predicted by the wind drift model algorithm (Section 5.2.2 in main report) added to the drifter velocities, are in Figure H.3-6. The model prediction (of wind drift added to observed drifter velocities) does not agree with the observed positions of the weed, as the wind and resulting waves had not reached steady state. Thus, the steady state wind drift algorithm did not apply on this date. Figure H.3-7 shows that the model using the drifter velocities plus 2.5% of wind speed with a zero angle fit the observations best. This is consistent with wind drift theory and the spin-up described in Youssef and Spaulding (1993, 1994).



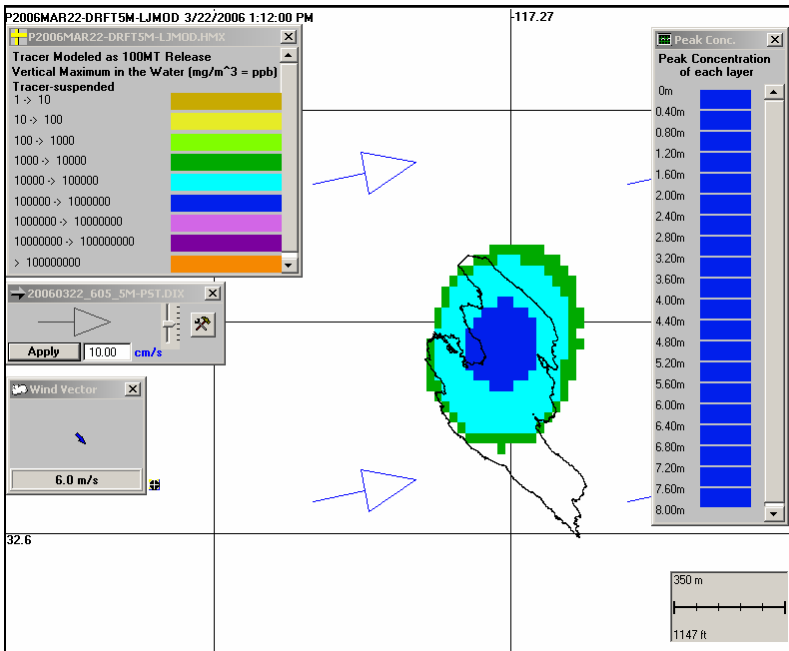
**Figure H.3-1. SIMAP model simulation of the 22 March 2006 dye release at 11:10 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



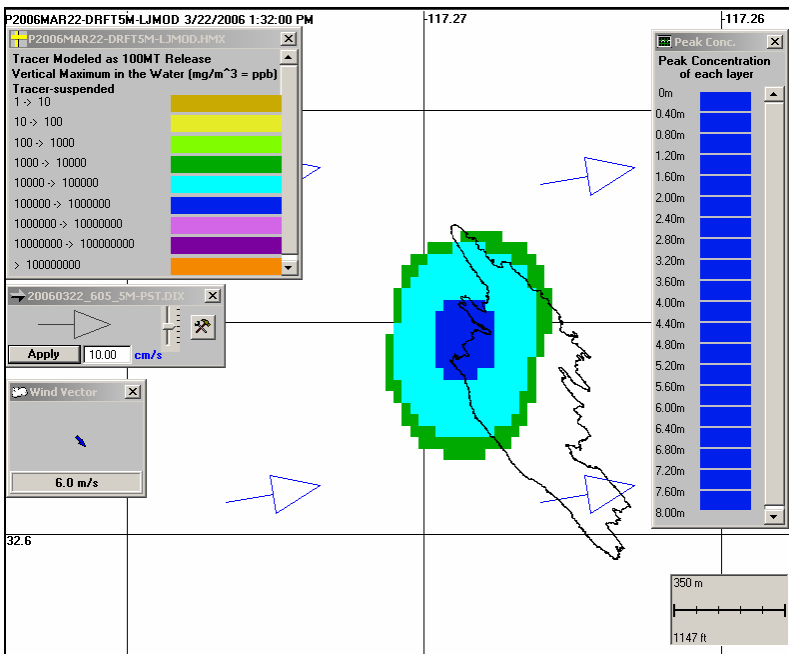
**Figure H.3-2. SIMAP model simulation of the 22 March 2006 dye release at 11:34 hrs PST, with the outline shape of the photographic image at that time (which may be displaced to the east) overlaid on the plume.**



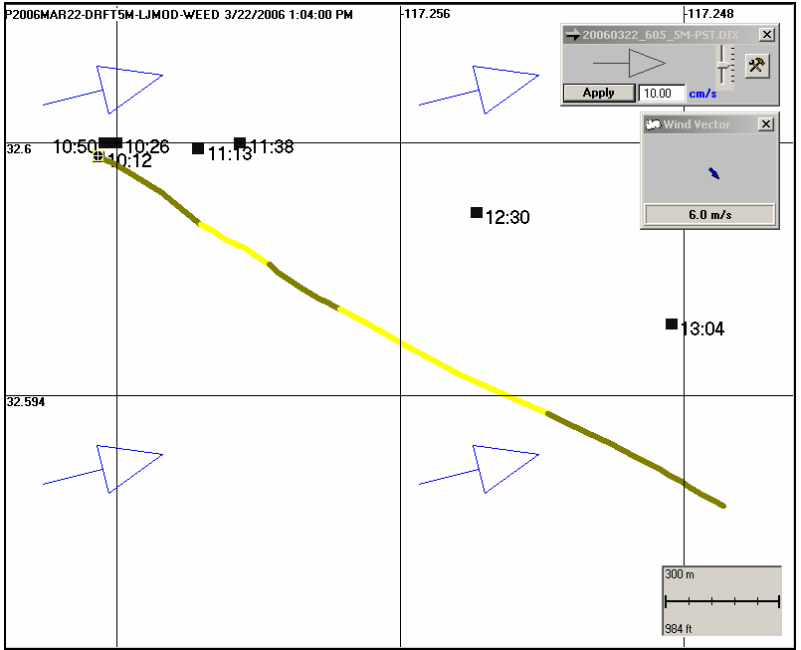
**Figure H.3-3. SIMAP model simulation of the 22 March 2006 dye release at 12:38 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



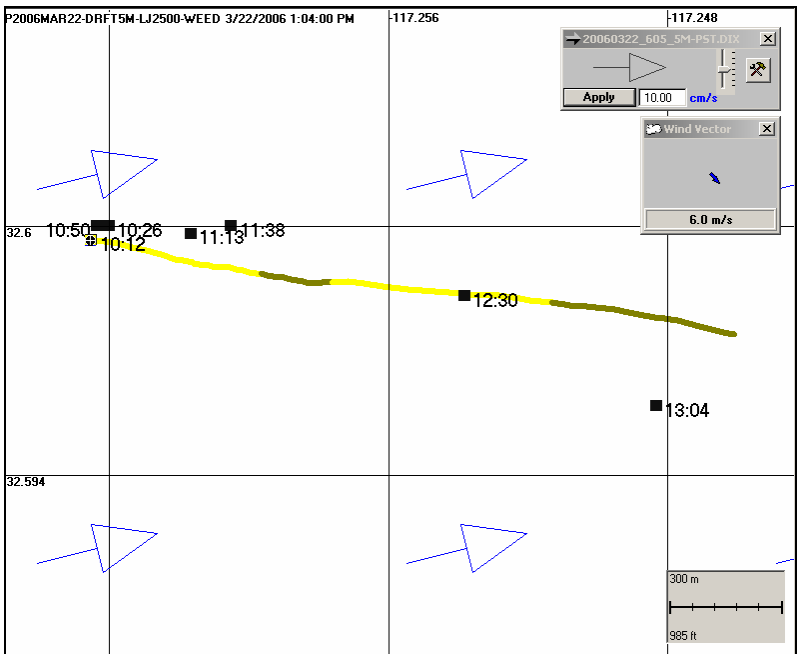
**Figure H.3-4. SIMAP model simulation of the 22 March 2006 dye release at 13:12 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



**Figure H.3-5. SIMAP model simulation of the 22 March 2006 dye release at 13:32 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



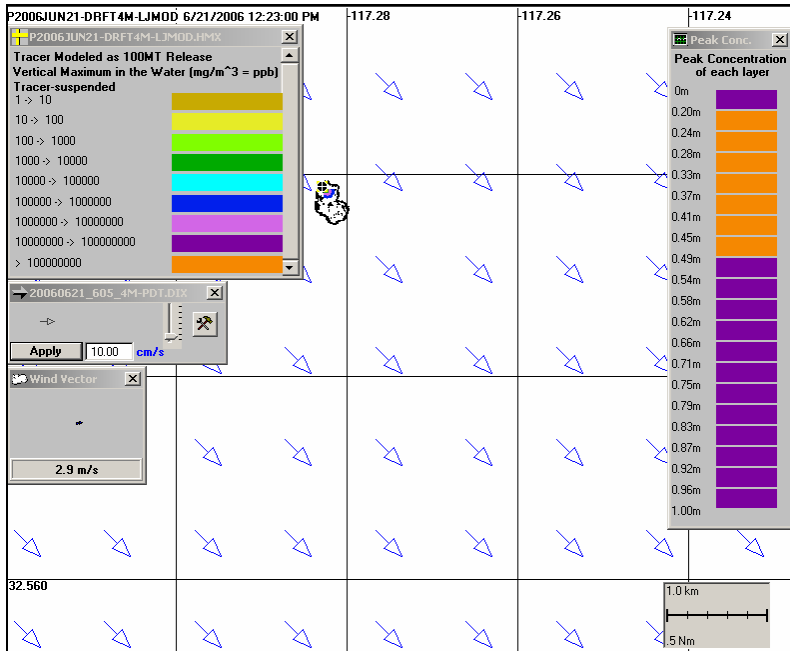
**Figure H.3-6. Observed movements of floating weed on 22 March 2006 and SIMAP model simulation assuming the wind drift algorithm in Section 5.2. (Alternating colors on the path of the trajectory are changed at times coincident with the plotted weed waypoints.)**



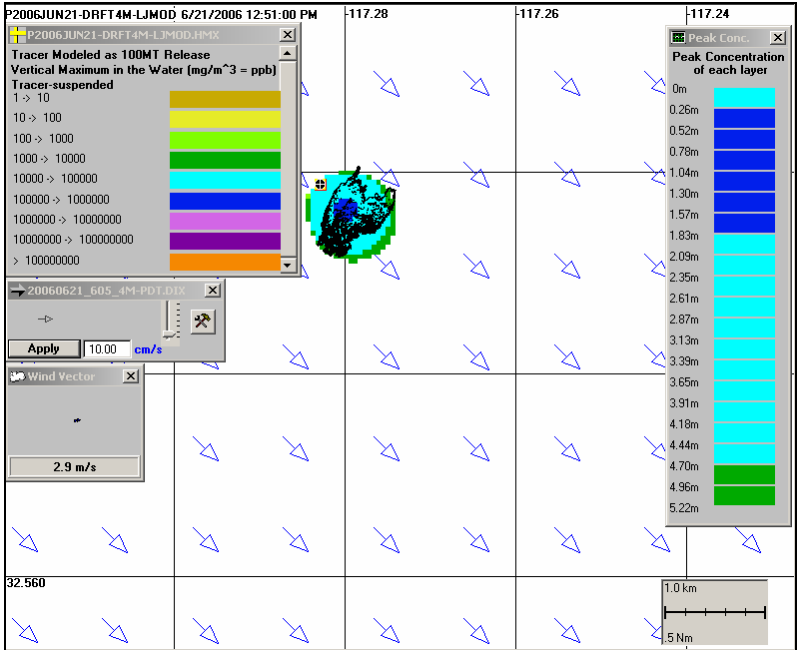
**Figure H.3-7. Observed movements of floating weed on 21 March 2006 and SIMAP model simulation assuming the weed drifted at 2.5% of wind speed directly down wind. (Alternating colors on the path of the trajectory are changed at times coincident with the plotted weed waypoints.)**

## H.4 June 21, 2006 Experiment

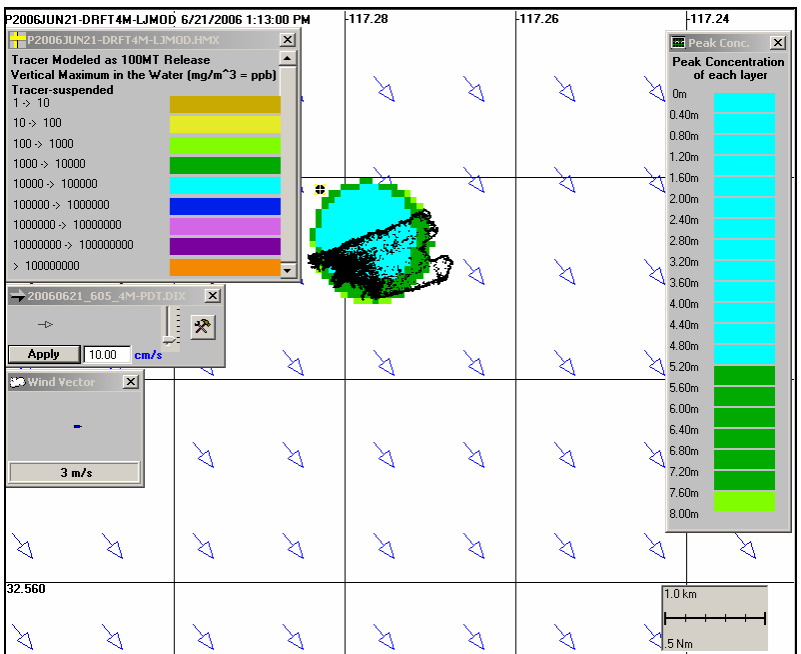
The hindcast of the 21 June 2006 dye release was made using velocities as measured by the 5-m drifter in the dye patch (#16766605); the radial horizontal dispersion coefficient measured from the photo images ( $17 \text{ m}^2/\text{s}$ , Table 5-6 in the main report); and the vertical dispersion coefficients measured from fluorescence measurements ( $6 \text{ cm}^2/\text{s}$ , Table 5-7 in the main report). Figures H.4-1 to H.4-6 show comparisons of the model hindcast to the observed plume behavior as captured by the aerial photographic images.



**Figure H.4-1. SIMAP model simulation of the 21 June 2006 dye release at 12:23 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

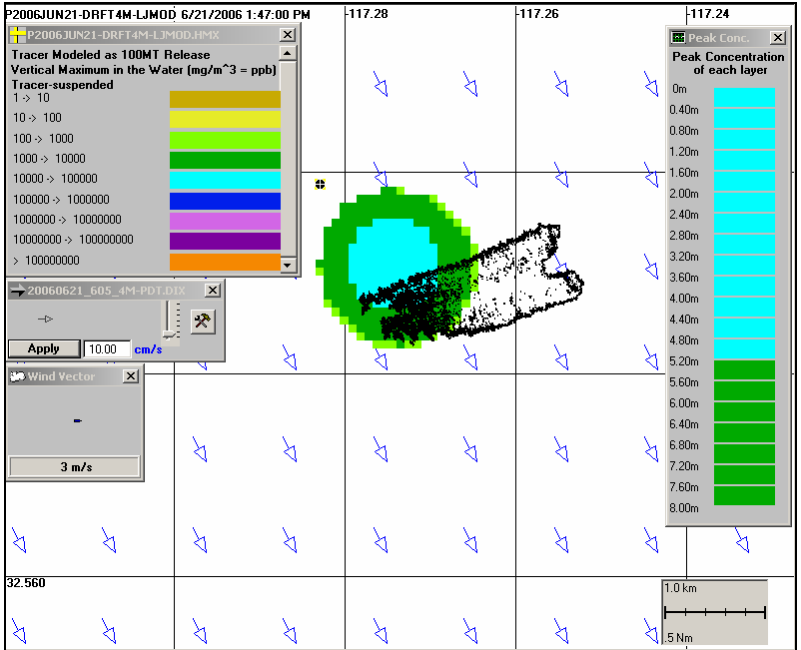


**Figure H.4-2. SIMAP model simulation of the 21 June 2006 dye release at 12:51 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

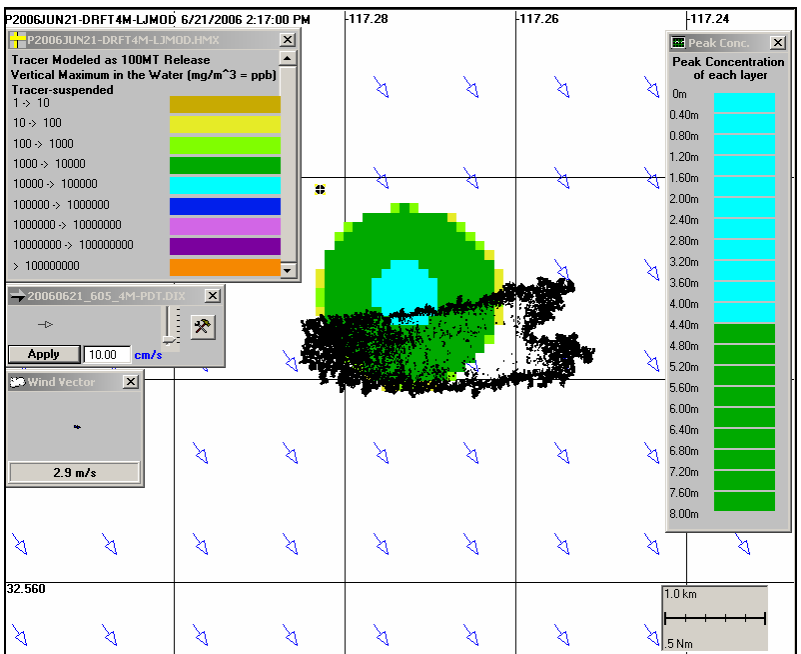


**Figure H.4-3. SIMAP model simulation of the 21 June 2006 dye release at 13:13 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

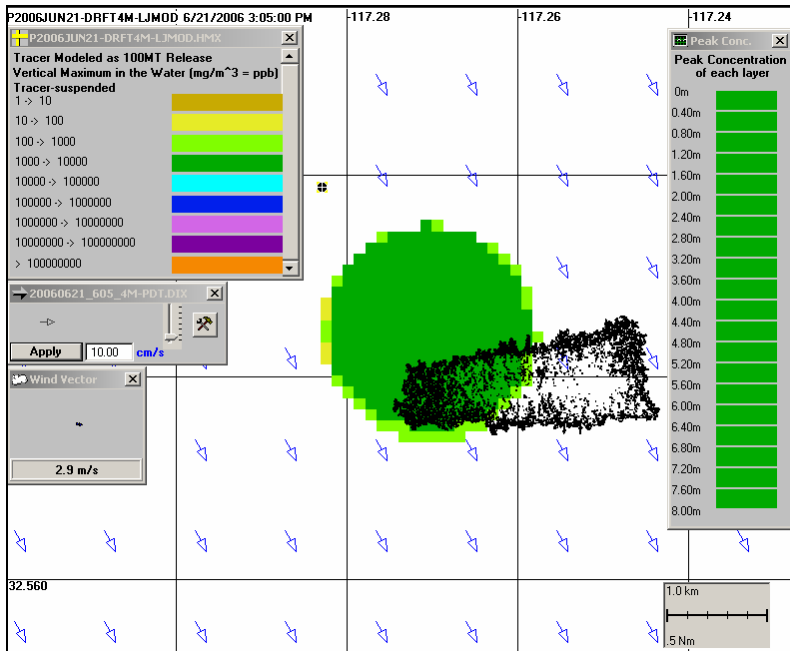




**Figure H.4-4. SIMAP model simulation of the 21 June 2006 dye release at 13:47 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



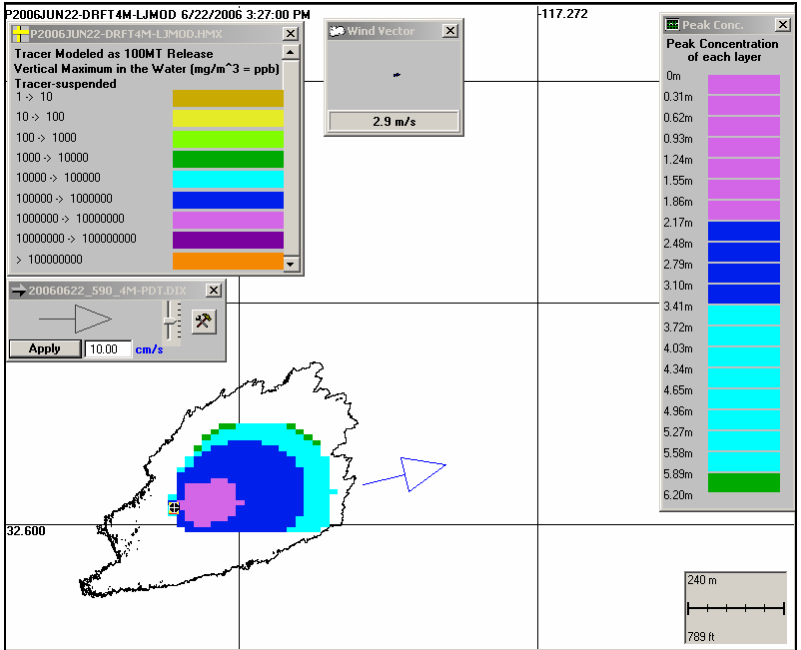
**Figure H.4-5. SIMAP model simulation of the 21 June 2006 dye release at 14:17 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



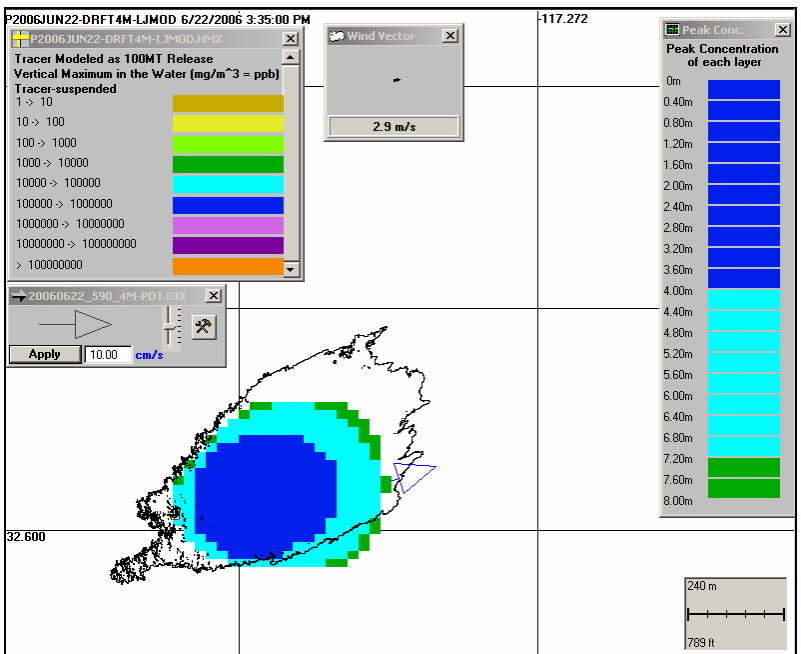
**Figure H.4-6. SIMAP model simulation of the 21 June 2006 dye release at 15:05 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

### H.5 June 22, 2006 Experiment

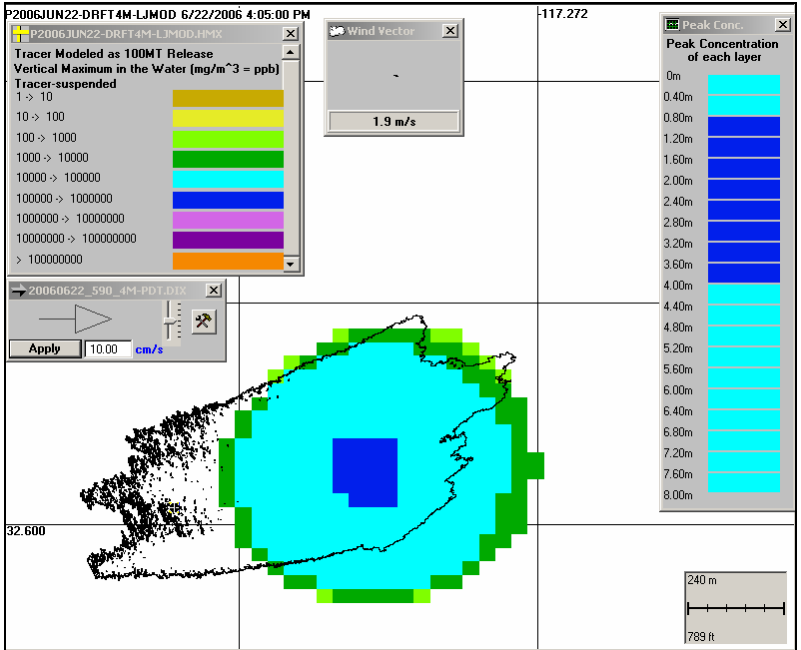
The hindcast of the 22 June 2006 dye release was made using velocities as measured by the 4-m drifter in the dye patch (#16767590); the radial horizontal dispersion coefficient measured from the photo images (4.2 m<sup>2</sup>/s, Table 5-6 in the main report); and the vertical dispersion coefficients measured from fluorescence measurements (8 cm<sup>2</sup>/s, Table 5-7 in the main report). Figures H.5-1 to H.5-4 show comparisons of the model hindcast to the observed plume behavior as captured by the aerial photographic images.



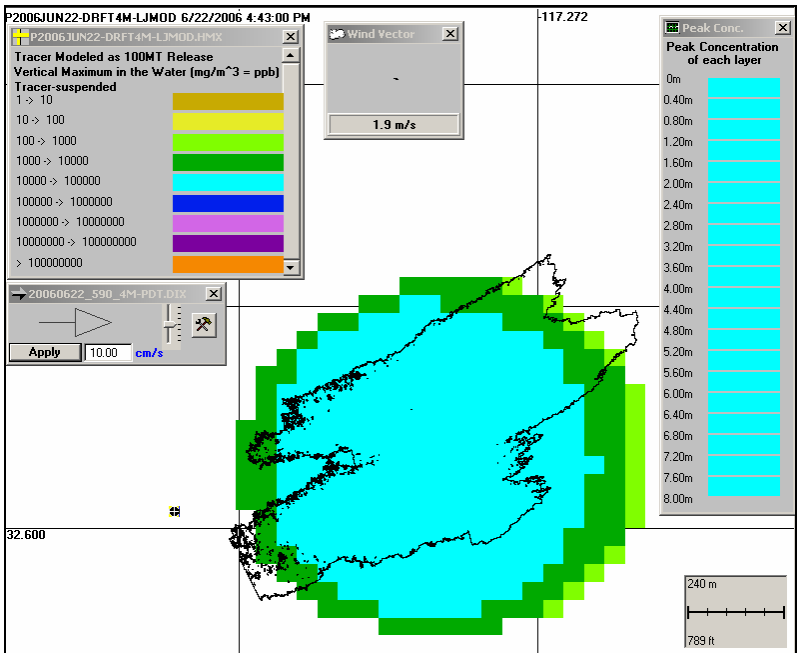
**Figure H.5-1. SIMAP model simulation of the 22 June 2006 dye release at 15:27 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



**Figure H.5-2. SIMAP model simulation of the 22 June 2006 dye release at 15:35 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



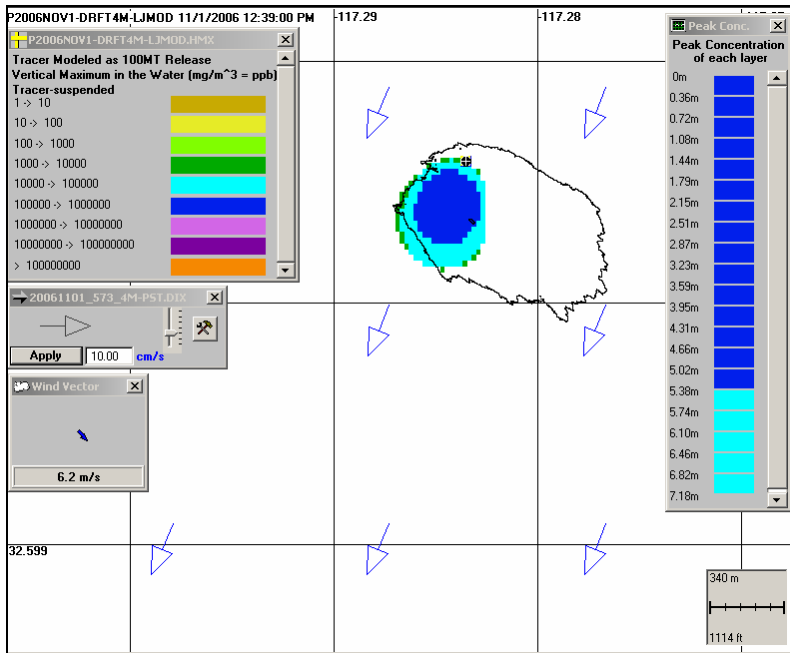
**Figure H.5-3. SIMAP model simulation of the 22 June 2006 dye release at 16:05 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



**Figure H.5-4. SIMAP model simulation of the 22 June 2006 dye release at 16:43 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

## H.6 November 1, 2006 Experiment

The hindcast of the 1 November 2006 dye release was made using velocities as measured by the 4-m drifter in the dye patch (#16757573); the radial horizontal dispersion coefficient measured from the photo images ( $3.2 \text{ m}^2/\text{s}$ , Table 5-6 in the main report); and the vertical dispersion coefficients measured from fluorescence measurements ( $8 \text{ cm}^2/\text{s}$ , Table 5-8 in the main report). Figures H.6-1 to H.6-6 show comparisons of the model hindcast to the observed plume behavior as captured by the aerial photographic images.



**Figure H.6-1. SIMAP model simulation of the 1 November 2006 dye release at 12:39 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

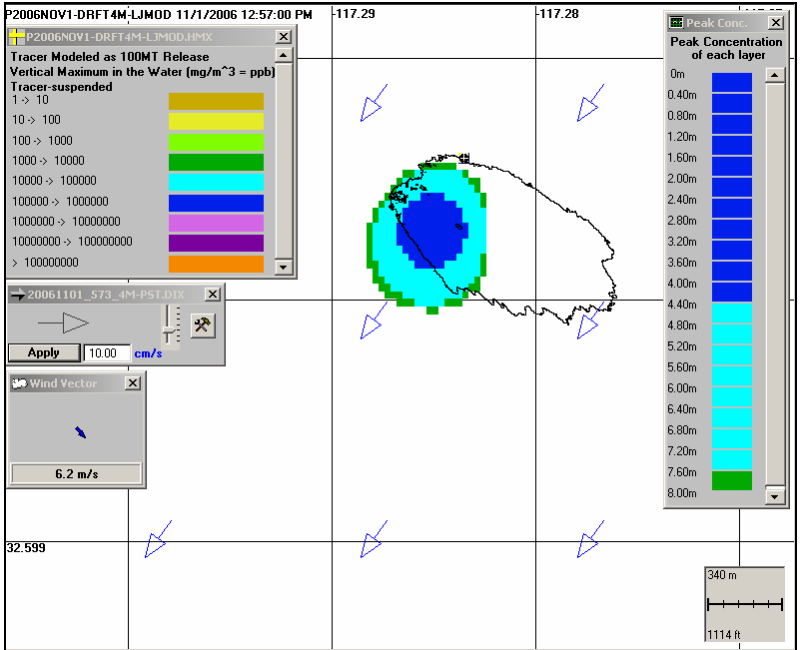


Figure H.6-2. SIMAP model simulation of the 1 November 2006 dye release at 12:57 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.

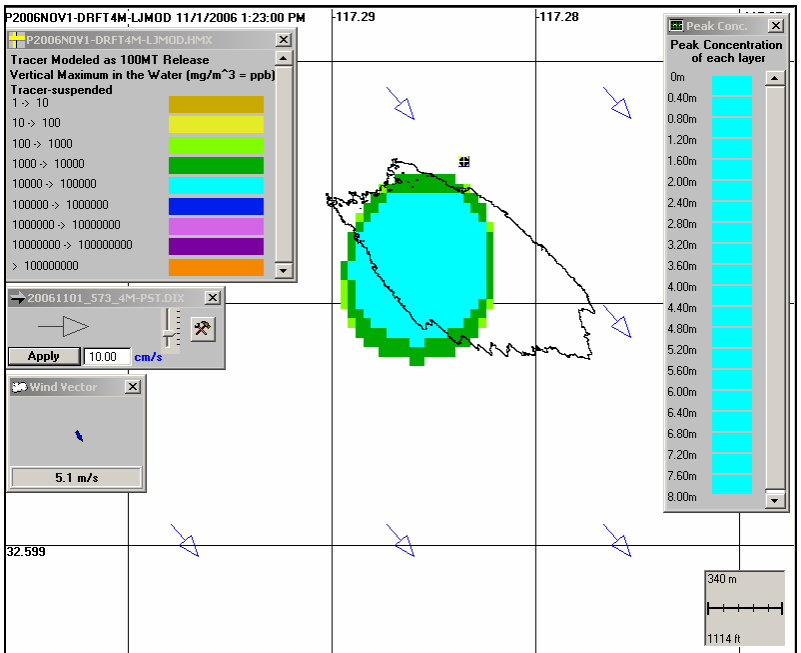
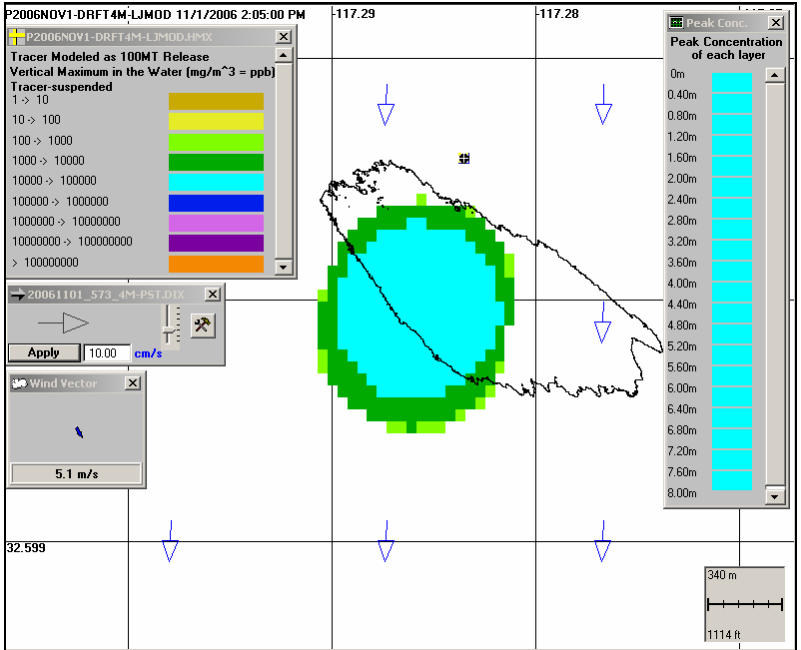
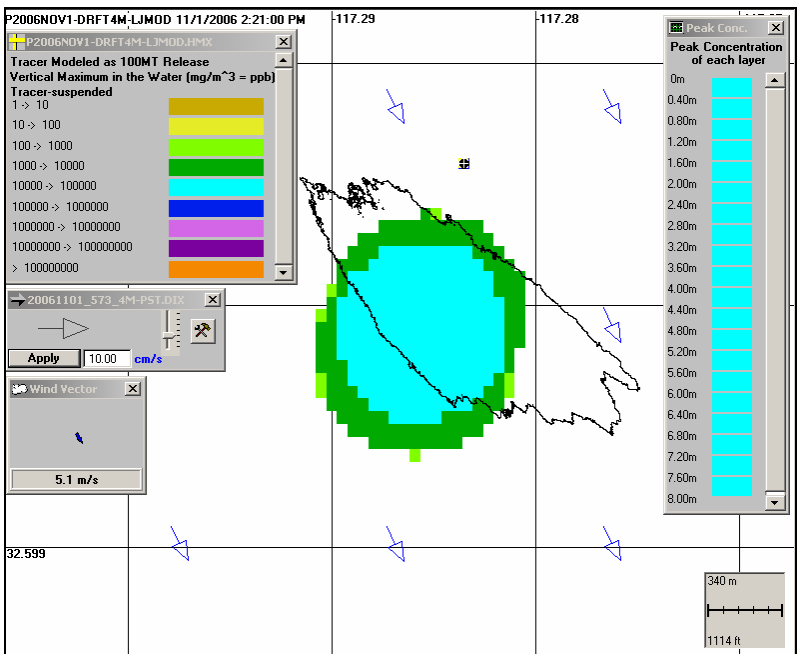


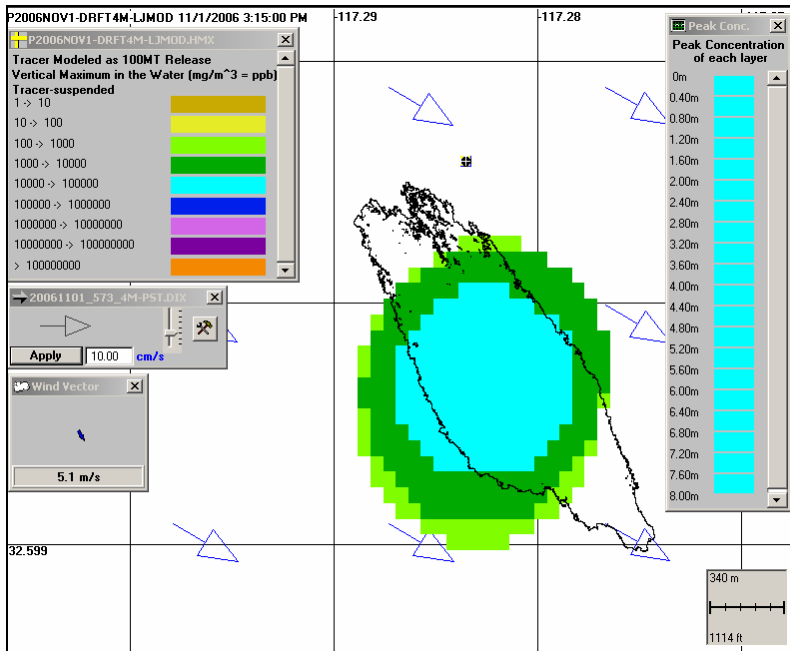
Figure H.6-3. SIMAP model simulation of the 1 November 2006 dye release at 13:23 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.



**Figure H.6-4. SIMAP model simulation of the 1 November 2006 dye release at 14:05 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



**Figure H.6-5. SIMAP model simulation of the 1 November 2006 dye release at 14:21 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

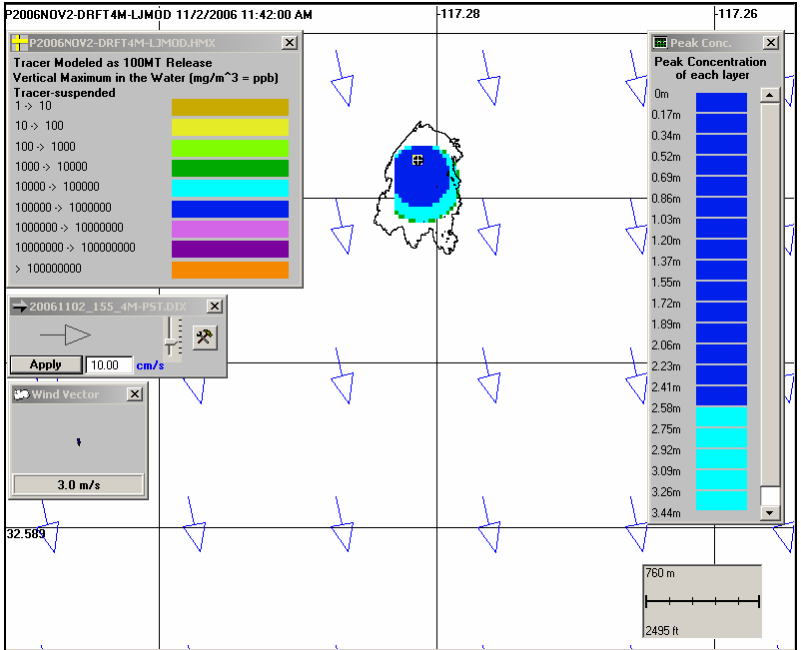


**Figure H.6-6. SIMAP model simulation of the 1 November 2006 dye release at 15:15 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

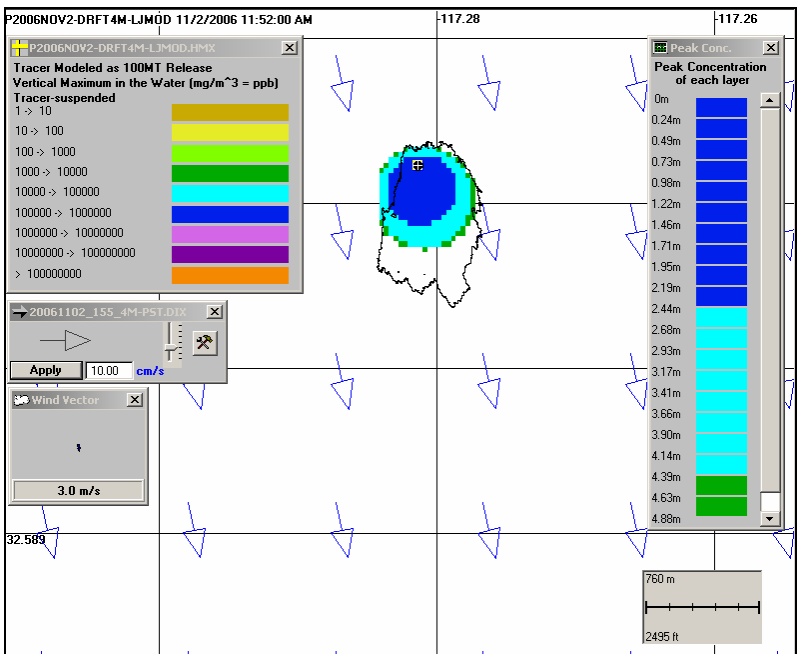
## H.7 November 2, 2006 Experiment

The hindcast of the 2 November 2006 dye release was made using velocities as measured by the 4-m drifter in the dye patch (#15660155); the radial horizontal dispersion coefficient measured from the photo images ( $8.3 \text{ m}^2/\text{s}$ , Table 5-6 in the main report); and the vertical dispersion coefficients measured from fluorescence measurements ( $3 \text{ cm}^2/\text{s}$ , Table 5-8 in the main report). Figures H.7-1 to H.7-6 show comparisons of the model hindcast to the observed dye plume behavior as captured by the aerial photographic images.

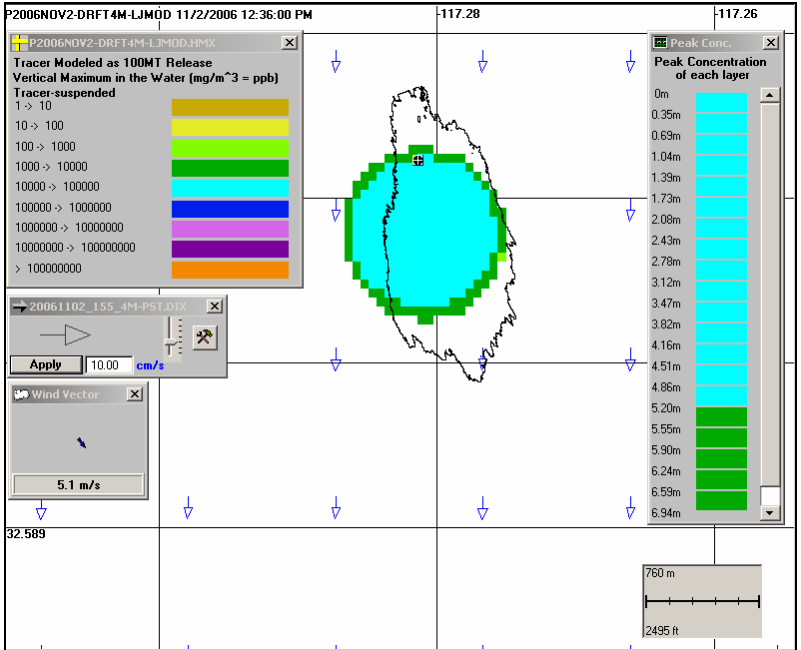




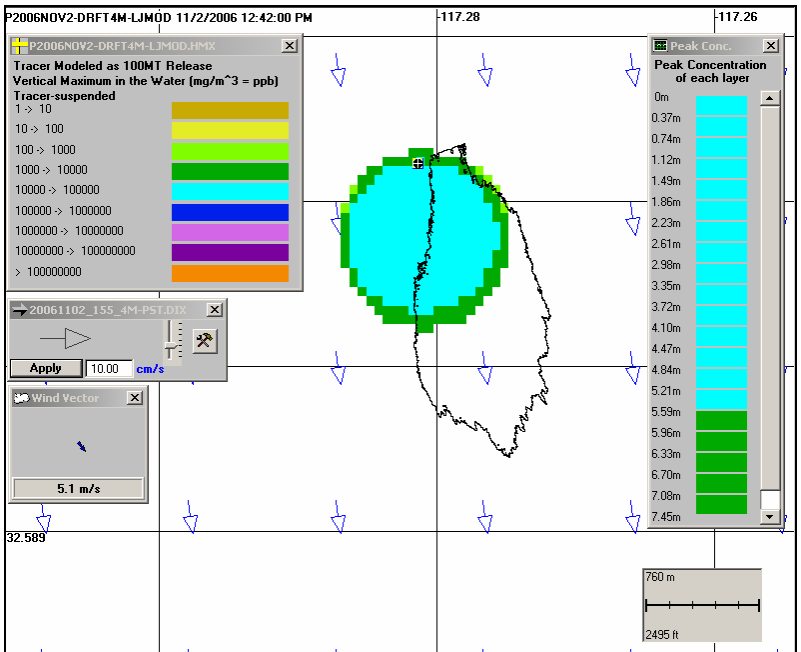
**Figure H.7-1. SIMAP model simulation of the 2 November 2006 dye release at 11:42 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



**Figure H.7-2. SIMAP model simulation of the 2 November 2006 dye release at 11:52 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



**Figure H.7-3. SIMAP model simulation of the 2 November 2006 dye release at 12:36 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**



**Figure H.7-4. SIMAP model simulation of the 2 November 2006 dye release at 12:42 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.**

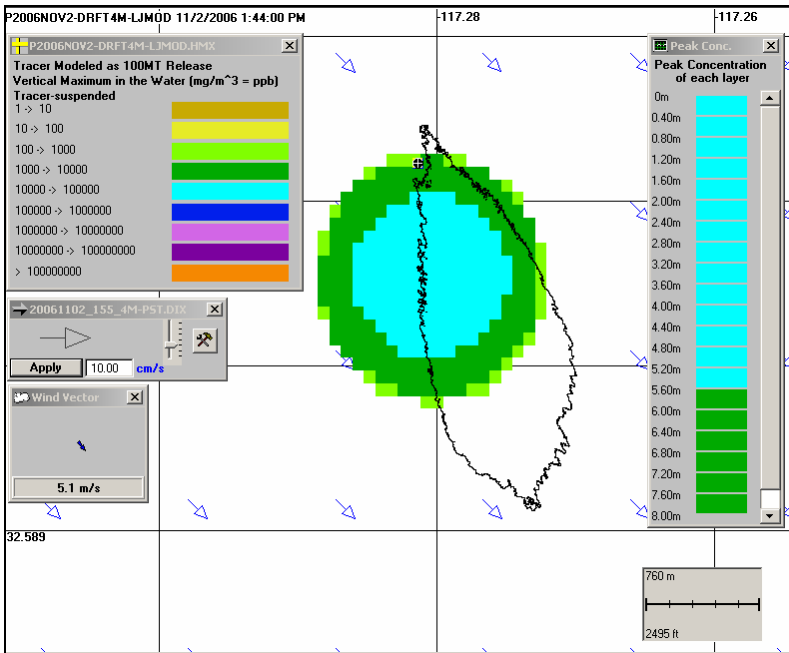


Figure H.7-5. SIMAP model simulation of the 2 November 2006 dye release at 13:44 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.

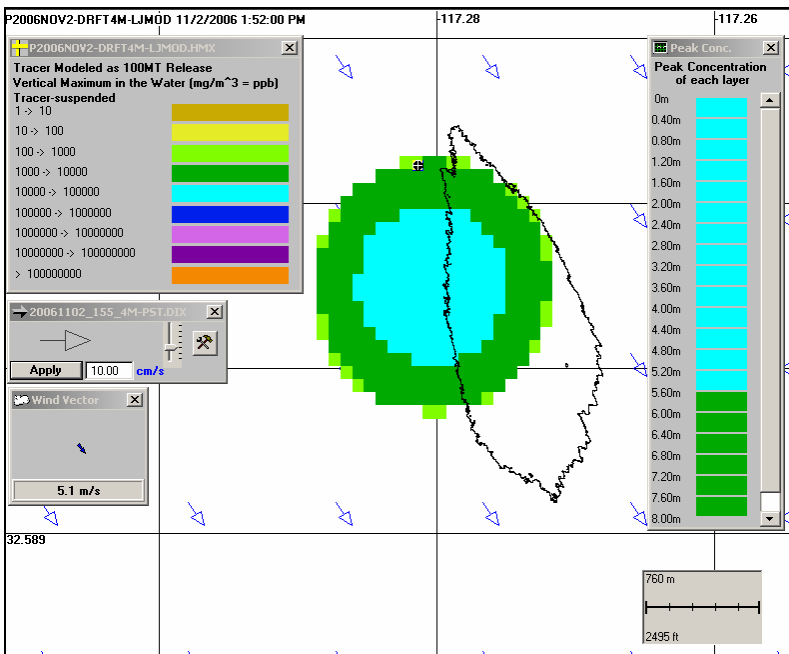


Figure H.7-6. SIMAP model simulation of the 2 November 2006 dye release at 13:52 hrs PST, with the outline shape of the photographic image at that time overlaid on the plume.