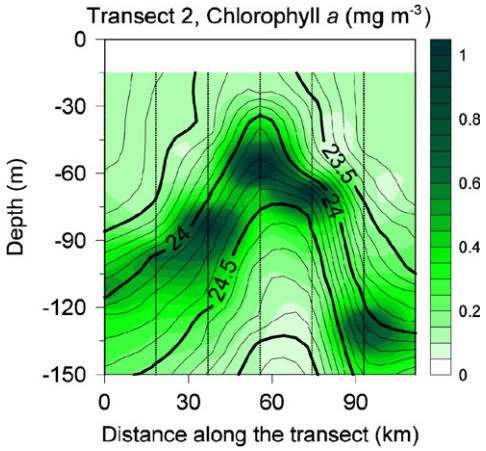

Fig. 21. Fluorescence derived total chlorophyll *a* concentrations (shaded) superimposed on isopycnals (contourlines) for Transect 2. Chlorophyll data were interpolated relative to depth; therefore the DCML representation in this particular section is distorted.

chlorophyll concentrations were simply interpolated against depth and therefore the representation of the DCML is distorted. However, the important feature evidenced by the figure is a deep (~135 m) peak of high chlorophyll concentrations at a distance of 90 km along the transect. This is roughly 40 km from the center of the eddy, which in Transect 2 is located at about 50 km along the transect. Considerations of the relative motion of *Opal* with respect to the ship while the transect was performed suggest that this peak might have been located at even greater distance from the center than it appears in Fig. 21. Such a deep and distant peak was not observed for any of the other transects, and for this reason it might be interpreted as an indication of the presence of a wake of relatively high phytoplankton concentrations developed behind the fast moving *Opal*.

Although there appears to be reasonable evidence supporting the proposed hypothesis, it remains to be tested with additional relevant data sets and analyses. Our studies have demonstrated that the ocean waters in the lee of the Hawaiian Islands are ideal for focused interdisciplinary eddy experiments. Clearly, numerical simulations using coupled physical–biogeochemical–biological models are needed to test and validate our hypothesis.

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References

Allen, C.B., Kanda, J., Laws, E.A., 1996. New production and photosynthetic rates within and outside a cyclonic mesoscale eddy in the North Pacific subtropical gyre. Deep-Sea Research I 43, 917–936.

Benitez-Nelson, C., Bidigare, R.R., Dickey, T.D., Landry, M.R., Leonard, C.L., Brown, S.L., Nencioli, F., Rii, Y.M., Maiti, K., Becker, J.W., Bibby, T.S., Black, W., Cai, W.J., Carlson, C.A., Chen, F., Kuwahara, V.S., Mahaffey, C., McAndrew, P.M., Quay, P.D., Rappe, M.S., Selph, K.E., Simmons, M.P., Yang, E.J., 2007. Mesoscale eddies drive increased silica export in the subtropical Pacific Ocean. Science 316, 1017–1020.

Bidigare, R.R., Benitez-Nelson, C., Leonard, C.L., Quay, P.D., Parsons, M.L., Foley, D.G., Seki, M.P., 2003. Influence of a cyclonic eddy on microheterotroph biomass and carbon export in the lee of Hawaii. Geophysical Research Letters 30 (6), 1318.

Brown, S.L., Landry, M.R., Selph, K.E., 2008. Diatoms in the desert. Deep-Sea Research II, this volume.

Calil, P.H.R., Richards, K.J., Jia, Y., Bidigare, R.R., 2008. Eddy activity in the lee of the Hawaiian Islands. Deep-Sea Research II, this issue [doi:10.1016/j.dsr2.2008.01.008].

Chavanne, C., Flament, P., Lumpkin, R., Dousset, B., Bentamy, A., 2002. Scatterometer observations of wind variations induced by oceanic islands: Implications for wind-driven ocean circulation. Canadian Journal of Remote Sensing 28 (3), 466–474.

Dickey, T.D., Bidigare, R.R., 2005. Interdisciplinary oceanographic observations: the wave of the future. Scientia Marina 69 (Suppl. 1), 23–42.

Dickey, T.D., Nencioli, F., Kuwahara, V.S., Leonard, C.L., Black, W., Bidigare, R.R., Rii, Y.M., Zhang, Q., 2008. Physical and bio-optical observations of oceanic cyclones west of the island of Hawai'i. Deep-Sea Research II, this issue [doi:10.1016/j.dsr2.2008.01.006].

Falkowski, P.G., Ziemann, D., Kolber, Z., Bienfang, P.K., 1991. Role of eddy pumping in enhancing primary production in the ocean. Nature 352, 55–58.

Goldman, J.C., 1993. Potential role of large oceanic diatoms in new primary production. Deep-Sea Research I 40, 159–168.

Kuwahara, V.S., Nencioli, F., Dickey, T.D., Rii, Y.M., Bidigare, R.R., 2008. Physical dynamics and biological implications of cyclone Noah in the lee of Hawai'i during E-Flux I. Deep-Sea Research II, this issue [doi:10.1016/j.dsr2.2008.01.007].

Landry, M.R., Brown, K.E., Selph, K.E., Simmons, M.P., Rii, Y.M., 2008. Depth-stratified phytoplankton dynamics in Cyclone Opal, a subtropical mesoscale eddy. Deep-Sea Research II, this issue [doi:10.1016/j.dsr2.2008.02.001].

Lewis, M.R., 2007. Variability of plankton and plankton processes on the mesoscale. In: Williams, P.J., Thomas, D.N., Reynolds, C.S. (Eds.), Phytoplankton Productivity: Carbon Assimilation in Marine and Freshwater Ecosystems. Blackwell Science, Oxford, UK, pp. 141–155.

Lobel, P.S., Robinson, A.R., 1986. Transport and entrapment of fish larvae by ocean mesoscale eddies and currents in Hawaiian waters. Deep-Sea Research 33 (4), 483–500.

Lumpkin, C.F., 1998. Eddies and currents in the Hawaii islands. Ph.D. thesis, University of Hawaii.

Maiti, K., Benitez-Nelson, C., Rii, Y.M., Bidigare, R.R., 2008. Influence of a mature cyclonic eddy on particulate export in the lee of Hawai'i. Deep-Sea Research II, this issue [doi:10.1016/j.dsr2.2008.02.008].

McGillicuddy, D.J., Robinson, A.R., Siegel, D.A., Jannasch, H.W., Johnson, R., Dickey, T.D., McNeil, J.D., Michaels, A.F., Knap, A.H., 1998. Influence of mesoscale eddies on new production in the Sargasso Sea. Nature 394, 263–266.

Morel, A., 1988. Optical modeling of the upper ocean in relation to its biogenous matter content (Case I waters). Journal of Geophysical Research 93 (C9), 10749–10768.

Olson, D.B., 1980. The physical oceanography of two rings observed by the Cyclonic Ring Experiment, Part II: dynamics. Journal of Physical Oceanography 10, 514–527.

Patzert, W.C., 1969. Eddies in Hawaiian Islands. Technical Report HIG-69-8, Hawaii Institute of Geophysics, University of Hawaii.

Pedlosky, J., 1979. Geophysical Fluid Dynamics. Springer, New York.

Qiu, B., Koh, D.A., Lumpkin, C., Flament, P., 1997. Existence and formation mechanism of the North Hawaiian Ridge Current. Journal of Physical Oceanography 27, 431–444.

Rii, Y.M., Brown, S.L., Nencioli, F., Kuwahara, V.S., Dickey, T.D., Karl, D.M., Bidigare, R.R., 2008. The transient oasis: nutrient-phytoplankton dynamics and particle export in Hawaiian lee cyclones. Deep-Sea Research II, this issue [doi:10.1016/j.dsr2.2008.01.013].

Seki, M.P., Polovina, J.J., Brainard, R.E., Bidigare, R.R., Leonard, C.L., Foley, D.G., 2001. Biological enhancement at cyclonic eddies tracked with GOES thermal imagery in Hawaiian waters. Geophysical Research Letters 28 (8), 1583–1586.

Seki, M.P., Lumpkin, R., Flament, P., 2002. Hawaii cyclonic eddies and blue marlin catches: the case study of the 1995 Hawaiian International Billfish Tournament. Journal of Oceanography 58, 739–745.

Simpson, J.J., Dickey, T.D., Koblinsky, C.J., 1984. An offshore eddy in the California Current System, Part I: Interior dynamics. Progress in Oceanography 13 (1), 5–49.

Sweeney, E.N., McGillicuddy, D.J., Buesseler, K.O., 2003. Biogeochemical impacts due to mesoscale eddy activity in the Sargasso Sea measured at the Bermuda Atlantic Time-series Study (BATS). Deep-Sea Research II 50, 3017–3039.

Vaillancourt, R.D., Marra, J., Seki, M.P., Parsons, M.L., Bidigare, R.R., 2003. Impact of a cyclonic eddy on phytoplankton community structure and photosynthetic competency in the subtropical North Pacific Ocean. Deep-Sea Research I 50, 829–847.

Wyrtki, K., Kilonsky, B., 1984. Mean water and current structure during the Hawaii-to-Tahiti shuttle experiment. Journal of Physical Oceanography 14, 242–254.