

DYE DIFFUSION STUDY OF THE OCEANIC DIFFUSION

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Slug dye diffusion study to obtain the horizontal diffusivity was often conducted in Japan in 1960s and 1970s. A good example of such a data is given in Fig. 1 in which dye concentration distribution is obtained for a set time interval. Often, the only data obtained is the dye cloud area photographed from an airplane and it is difficult to obtain the horizontal diffusivity from such a data. Common practices are (1) to calculate the temporal rate of change of the dye cloud area and regard it as the horizontal diffusivity and (2) to fit the radius of the dye cloud area replacing it as an equivalent circular cloud to the oceanic theory of diffusivity. Both these methods have drawbacks originating from the difficult job of fitting into the complicated theoretical curves.

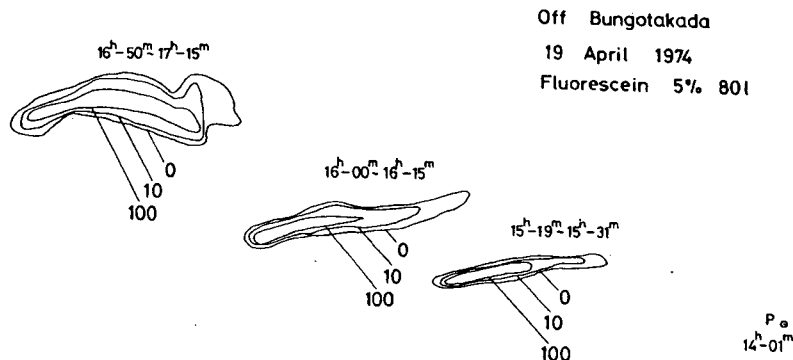


Fig. 1 Slug Dye Diffusion Experiment(Figures represent dye concentration in ppb)

A new method is proposed to compute the dye cloud dispersion radius from the dye cloud radius at each instant with the maximum radius as a parameter. The dispersion radius is known to be power of time with its exponent depending on the oceanic theory. Fig. 2 is an example of the application of this method and shows that the data follows the oceanic diffusion law.

The drawback of this new method is need to know the maximum radius of dye cloud, which is often not met. In most cases the only data available is dye cloud area with time and without the maximum cloud radius. In such a case, a simple analysis of the method (1) seems to be the only tool to be applied to a large number of data

The end result is given in Fig. 3 where the data are collected mostly in the Seot Inland Sea of Japan. Fig. 2 gives the measure of the horizontal diffusivity in the coastal waters.

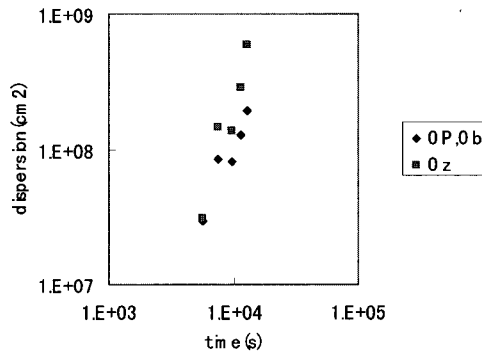


Fig. 2 Dispersion σ_r^2 versus time

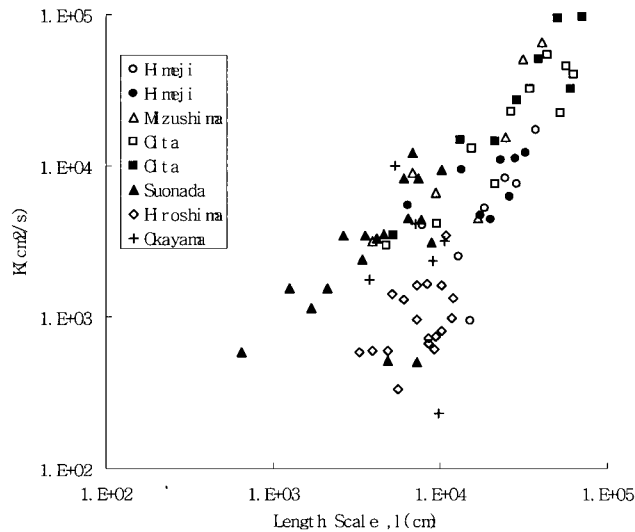


Fig. 3 Horizontal Diffusivity versus Length Scale