Ocean Sci. Discuss., 8, C856–C858, 2011
www.ocean-sci-discuss.net/8/C856/2011/

Ocean Science
Discussions

Interactive comment on "Modeling of wave-induced irradiance variability in the upper ocean mixed layer" *by* M. Hieronymi et al.

Anonymous Referee #1

Received and published: 27 December 2011

General comments:

In this manuscript, "Modeling of wave-induced irradiance variability in the upper ocean mixed layer", by M. Hieronymi, A. Macke, and O. Zielinski, the authors reported a 2-D radiative transfer model optimized for calculations of spatial variations of underwater irradiance. Using a combination of a Monte Carlo radiative transfer model and a superposition procedure, the proposed model shows a great capability in providing high spatial resolution irradiance field for depths up to 100 m in clear waters. Generally, the manuscript is well-written. The proposed model is described in great details, and is properly validated against field measurements and other radiative transfer models. Simulation results are presented for both regular and irregular wave profile. One interesting observation is that the spatial distribution of irradiance shows similar feature to

that in the temporal distribution (Fig. 6). Also, it is somewhat surprising that considerable variation is possible at as deep as 100 m.

Specific comments:

Page 2113, line 23: "The horizontal extension of the model domain has to be large enough to ensure that the horizontal losses due to domain-leaving rays are negligible." This statement is correct but not the key point here. The authors are interested in the irradiance at individual spatial locations, not over the whole domain. In this case, the horizontal extension is not the key. As explained later, the authors had to cut off the edge of the domain for statistics calculations (take into account 400 m out of a 500 m domain).

Page 2113, line 25: "typically below 0.01% of the total downwelling irradiance per depth level". The word "depth level" needs to be better defined.

Page 2114, line 6: "N_max is selected to be 40". How was this selected? Did the authors make this selection by looking for a 10ˆ{-6} residual intensity?

Page 2119, line 15: ". . . and equivalent HydroLight (HL) runs". In what sense are they equivalent runs? It is mentioned later in this section that there are inherent differences in the diffuse sky light, the scattering properties of the water, and sea surface realizations. Then what are the same?

Page 2120, line 3: "the bias continuously grows to less than 20% in 100 m depth". Apparently, a 20% bias is not negligible. As explained later, although this can be a result of different model parameters, it is an indicator that the build-up of lateral losses of diffuse radiation is showing up. It remains unknown how much this lateral losses may have affects the simulated variability at depths. For example, will it cause an underestimation or an overestimation of the flash count? By how much?

Page 2122, line 27: "(MC model)". The simulation results were not really from a direct MC model, but from a combination of MC and superposition. Referring it to "MC model"

may cause unnecessary confusion.

Page 2126, line 6: “normalized per one metre”. This is true for the top panel, but not for the middle and bottom panels, where it says “per 100 m” in the figure.

Page 2126, line 17: “which is much deeper than so far observed”. As far as I know, all observations of irradiance variability were on temporal variations not on spatial variations. If so the authors are comparing “spatial flashes” to “temporal flashes”. Can the authors clarify on this?

Interactive comment on Ocean Sci. Discuss., 8, 2101, 2011.