Answer to Electromagnetism Example Question 11

The skin depth is given by $\delta = \left(\dfrac{2}{\mu\sigma\omega}\right)^{1/2} = \left(\dfrac{2}{\mu_o\sigma\omega}\right)^{1/2}$ as we may consider seawater to be a good, non-magnetic conductor at 3 MHz.

Therefore, $\delta = \left(\dfrac{2}{4\pi\times10^{-7}\times5\times2\pi\times3\times10^{6}}\right)^{1/2}$ [The value of $\sigma = 5\ \Omega^{-1}\ m^{-1}$ for

seawater being given in lectures.]

$= \underline{0.13\ m}$

Both E and B decay proportional to $e^{-z/\delta} = e^{-2/0.13}$ which means that they will have decayed by a factor of $e^{2/0.13} = \underline{4.8 \times 10^{6}}$ in a distance of 2 m. In practice, this means that there is effectively no significant penetration of the EM wave to this depth.