

# OCEAN OPTICS XXIV

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<https://oceanopticsconference.org>

Monday, October 8

Poster Session 1

16:00–18:00

## Poster 141

### THE MYSTERY OF SECCHI DISK DEPTH RELATIONSHIPS

Secchi disk depth (ZSD) is a measurement of water clarity via visual observations and there have been roughly a million of ZSD measurements of the global oceans, lakes and rivers since its invention in the 1860's. This data is critical to evaluate the change of oceanic environments in century-long timeframes. However, there have been long-standing mysteries that the widely observed and consistent relationship between ZSD and the diffuse attenuation coefficient of photosynthetic available radiation (KPAR) could not be explained with the theoretical Secchi depth model adopted by the community in the past six decades. There are also puzzles about the appropriate "constant" for the product of ZSD times KPAR. Here, we use both numerical simulations and historical data, along with a new theory and model regarding ZSD, to resolve these long-lasting mysteries regarding the Secchi depth relationships. The results not only resolve these long-standing puzzles associated with these observations, but also unify the relationships published in the literature. In particular, the ratio of euphotic-zone depth (Zeu) to ZSD is found  $\sim 3.5$  for all waters, which is  $\sim 45\%$  greater than the consensus value of  $\sim 2.4$  suggested in the past for clear waters. In addition, the new model validates an empirical relationship between ZSD and chlorophyll concentration (Chl) developed for global oceanic waters. These results provide a strong support for the interpretation and application of ZSD data for the study of global oceans under a changing climate.

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