

[Journal of Modern Optics](#) >Volume 63, 2016 - [Issue 13](#)392 | 11 | 0
Views | CrossRef citations to date | Altmetric

Research Articles

BER evaluations for multimode beams in underwater turbulence

Serap Altay Arpali , Yahya Baykal & Çağlar Arpali

Pages 1297-1300 | Received 20 Nov 2015, Accepted 17 Dec 2015, Published online: 09 Feb 2016

 Cite this article  <https://doi.org/10.1080/09500340.2016.1141251>

Sample our
Engineering & Technology
Journals
>> [Sign in here](#) to start your access
to the latest two volumes for 14 days

[Full Article](#) [Figures & data](#) [References](#) [Citations](#) [Metrics](#)
[Reprints & Permissions](#) [Read this article](#) [Share](#)

Abstract

In underwater optical communication links, bit error rate (BER) is an important performance criterion. For this purpose, the effects of oceanic turbulence on multimode laser beam incidences are studied and compared in terms of average BER ($\langle \text{BER} \rangle$), which is related to the scintillation index. Based on the log-normal distribution, $\langle \text{BER} \rangle$ is analysed for underwater turbulence parameters, including the rate of dissipation of the mean squared temperature, the rate of dissipation of the turbulent kinetic energy, the parameter that determines the relative strength of temperature and salinity in driving index fluctuations, the Kolmogorov microscale length and other link parameters such as link length, wavelength and laser source size. It is shown that use of multimode improves the system performance of optical wireless communication systems operating in an underwater medium. For all the investigated multimode beams, decreasing link length, source size, the relative strength of temperature and salinity in driving the

index fluctuations, the rate of dissipation of the mean squared temperature and Kolmogorov microscale length improve the $\langle \text{BER} \rangle$. Moreover, lower $\langle \text{BER} \rangle$ values are obtained for the increasing wavelength of operation and the rate of dissipation of the turbulent kinetic energy in underwater turbulence.

Keywords:

Oceanic optics

oceanic propagation

turbulence

bit error rate

underwater optical communication links

Acknowledgements

The authors acknowledge the support provided by Çankaya University and Tübitak under grant number 113E589.

Disclosure statement

No potential conflict of interest was reported by the authors.



Related research

People also read

Recommended articles

Cited by
11

Information for

[Authors](#)

[R&D professionals](#)

[Editors](#)

[Librarians](#)

[Societies](#)

Opportunities

[Reprints and e-prints](#)

[Advertising solutions](#)

[Accelerated publication](#)

[Corporate access solutions](#)

Open access

[Overview](#)

[Open journals](#)

[Open Select](#)

[Dove Medical Press](#)

[F1000Research](#)

Help and information

[Help and contact](#)

[Newsroom](#)

[All journals](#)

[Books](#)

Keep up to date

Register to receive personalised research and resources by email



Sign me up



Copyright © 2026 Informa UK Limited [Privacy policy](#)

[Cookies](#) [Terms & conditions](#) [Accessibility](#)

Registered in England & Wales No. 01072954
5 Howick Place | London | SW1P 1WG

 Taylor and Francis
Group