Study on free-space optical communication shows experimental evidence of a unique atmospheric effect

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Three members of the faculty at Stevens Institute of Technology recently collaborated on a paper focusing on free-space optical communication, which appears in the latest issue of *Optics Express*.

Dr. Paul Corrigan, a research associate at the MIRTHE Foundation and a Visiting Assistant Professor at Stevens, working along with Stevens Associate Professor Rainer Martini and Professor Edward Whittaker, spent months researching and writing the study as part of their free-space optics test-bed established in the Physics Department at Stevens.

Free-space optical communication is line-of-sight laser communication through the air. To date, the primary barrier to commercial uptake of this technology has been the limitations imposed by adverse weather, particularly fog, which restricts conventional near-infrared laser systems throughput in the air. The quantum cascade laser (QCL) provides key optical emission wavelengths in the mid-infrared that are thought to overcome many of these problems and thereby increase communication robustness, data security and deployable range.

However, in the optics community there has been a debate as to whether a mid-infrared source really is a better physical layer solution than near-infrared light. Much of the debate hinged on the shortage of good data that compares systems side-by-side in a fair way.

At Stevens, the free-space optics group created a world leading multi-wavelength test bed with "off-the-shelf" telecom systems and QCLs. They found that in adverse conditions such as haze, fog and rain, a mid-infrared QCL system truly is stronger, delivering up to 300% greater throughput than conventional systems.

What makes the paper special is that the professors also present the first experimental evidence - to their knowledge - of a unique atmospheric effect called "scavenging," where the composition of fog changes with respect to QCL light in a previously unmeasured way due to the presence of rain.

"The application of this study extends not only to industrial development of free-space optical systems for fast high bandwidth deployment, but also to military applications in targeting, as well as possibly to understanding the formation and lifetime of fog, something that has not been very well understood up to now," said Dr. Corrigan.

More information: The full text of the article may be found at: www.opticsinfobase.org/oe/abst … cfm?uri=oe-17-6-4355

Source: Stevens Institute of Technology