# Hybrid Optical/Radio Frequency Communication Channel Model

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**Abstract**

A hybrid Radio Frequency/Free Space Optical (RF/FSO) communication system exploits the benefits of diversity by using two communication channels operating in radio and optical frequencies to improve data rate and link availability. It will be used in future wireless communication systems including satellite communications. Hybrid RF/FSO satellite communications has been specifically identified in the Australian Space Agency's roadmap for communications technologies and services and is an area of interest to NASA. Although it has potential benefits in terms of both channel capacity and system robustness, its performance is affected by weather conditions. For example, rain can cause channel attenuation, i.e., a reduction in the received signal power. The impact of weather effects on channel attenuation is the focus of this project.

The aim of this project is to develop channel attenuation models for a hybrid RF/FSO communication system. Synthetic data including RF and FSO channel attenuation and weather parameters including temperature, humidity, visibility, etc. will be provided. The synthetic data is based on real empirical data obtained from a hybrid system operating in six cities around the world. The data includes a comprehensive list of weather conditions including clear, dust storm, fog, drizzle, rain, snow and showers. Students will be guided to construct models and compare their performance.

## 1 Rough project outline

- Week 1-3: Literature review.
- Weeks 4-7: Construct models based on random forest.
- Weeks 8-12: Improve models by removing redundant variables.
- Weeks 13-18: Improve models by exploring the correlation among the weather parameters.
- Weeks 19-24: Model comparison, further analysis and report-writing.

## 2 Skills required

Data analysis, statistical modelling and regression analysis.