

Research Support Fund Application (2017/2018)

Research Title:

Diurnal measurement of particulate matters (aerosols) concentration at the AERONET sites in Nepal by using different monitor sensors and comparison of aerosol optical properties with the aerosol concentration at the surface level.

Applicant:

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1. Project Description:

1.1 Conception and Definition:

The objectives of this proposal is to provide the comparison of aerosol (particulate matters) concentration, aerosol size distribution, with the aerosol optical data (AOP) in different cities of (Cappucci, M. et al., 2016, <https://agu.confex.com/agu/fm16/meetingapp.cgi/Paper/153989>) Nepal and India. In the developing countries like in Nepal, maintaining the standard ambient air quality is one of the major challenging that the society is facing today. The polluted particles embedded in the atmosphere (particulate matter) are the major pollutants in the atmosphere, which are produced by naturally and artificially, which are causing serious environmental problems along with climate change (Aryal, R.P. et al., 2014). Comparison of aerosol concentration and AOP such as aerosol optical depth (AOD), aerosol scattering and absorption components, obtained from the AERONET (Aerosol Robotic Network) sites of Nepal, is a very important to identify the source of pollution in the atmosphere. An Automated CIMEL sun and Sky radiometer is used to collect the diurnal aerosol optical data and different air quality monitor sensors (section 2) will be used to measure the particulate matters.

1.2 Relevance of our Previous Study:

Along with my previous research accomplishments of observations, data analysis and publication of aerosol study [Aryal, R.P. et al., 2014], currently we are working to study the air-pollution over Nepal based on the aerosol data provided by AERONET. It has provided an opportunity of analyzing the aerosol data by using different statistical modelling and obtaining aerosol data along with meteorological parameters. In this last year's project we were only comparing the aerosol optical data from different AERONET sites, however in this proposed project we are looking to compare the aerosol concentrations and size distribution of particulate matters with the AOP.

2. Plan and Methodology:

Students from Franklin Pierce University will be strongly encouraged to participate in this research project. This project will also be collaborated with the researchers from Indian Institute of Technology (IIT India); Statistic and Mathematics Department of Sam Houston State University, TX; Engineering Institute of Technology, Thapathali, Kathmandu Nepal; ICIMOD Nepal and Environment and Science Department, Keene State College, Keene, NH. It will give us an opportunity to work in a group, to observe the data also analyze the pollution data with different statistical techniques.

To measure the concentration of particulate matters in the air, we will be using commercially available low- cost three different air quality monitor sensors.

- (i) A true Laser Particle Counter with 2 size ranges (<http://www.dylosproducts.com/dc1700.html>) that provides two different size ranges of particule, small (>0.5 micron) and large (>2.5 micron) particle concentrations along showing instantaneous particle activity.
- (ii) PurpleAir Particulate Sensor with dual laser (<http://www.purpleair.org/welcome-to-purple-air>)
- (iii) the AirAssure™ PM2.5 Indoor Air Quality (IAQ) Monitor (<http://www.tsi.com/airassure-pm2-5-indoor-air-quality-monitor-en/>)

In the summer of 2017 the PM concentration will be measured at near towns of Franklin Pierce University such as Jaffrey and Keene of NH. It will provide an opportunity to calibrate and test these instruments. The data from these three different instruments will be compared and used to test the accuracy of measurement and for publication.

In December of 2017, these instruments will be taken to Nepal for measuring the PM (<10 micron) concentration at different cities, which have AERONET sites, and obtain the simultaneous concentration to compare with aerosol optical data. Aerosol Column data will be obtained from the AERONET website (we have already communicated with the principal investigators of those observation sites and have received permission of using aerosol data).

3. Significance of the Project:

This work will be important on providing a reliable basis of measuring the different characteristic of particulate matter such as particle concentration and particle size and comparing with aerosol optical data. Based on these measurement we can characterize the accuracy of low cost air quality monitor sensors that are commercially available for measuring the particles. Particulate emissions affect directly to the Human health. For example, ultrafine particles penetrate the pulmonary alveolus breathing problems. Therefore study of particulate matters of small sizes is very important to report the air quality in the region and climatic impact of air pollution.

In summary, in this research project, we:

- involve students from our University.
- submit the progress report at the Natural Science Department/University.
- present the research findings at national and international level scientific conventions, such as American GeoPhysical Union (AGU), American Physical Society (APS), American Association of Aerosol Research (AAAR).
- publish our research outcome in a peer review scientific journal.

References:

Aryal, R. P., Voss, K. J., Terman, P. A., Keene, W. C., Moody, J. L., Welton, E. J., and Holben, B. N.: Comparison of surface and column measurements of aerosol scattering properties over the western North Atlantic Ocean at Bermuda, Atmos. Chem. Phys., 14, 7617-7629, doi:10.5194/acp-14-7617-2014, 2014.

3. Itemized Budget

Name of Items	Cost
1.a. DC 1700 Battery Operated AQM (Quantity: 1)	\$600
1.b. Purple air Monitor Sensor (Quantity: 3)	\$800
1.c TSI: Airassure PM 2.5 Indoor AirQuality Monitor (Quantity:1)	\$1100
2. Travel Expenses (transportation, room and board, etc)	\$1000
3. Course Release amount	0
4. Student Assistants (and other support personal)	\$1000
5. Consultant /Publication cost	\$500
Total amount	\$5000
requested	