

Chemical composition and oxidative potential of atmospheric PM₁₀ over the Arabian Sea

(Anil Patel and Neeraj Rastogi)

Present study is the first report of oxidative potential (OP) of atmospheric PM₁₀ over the marine environments. PM₁₀ samples were collected onboard Oceanographic Research Vessel (ORV) 'Sagar Sampada' (SS#359) over the Arabian Sea during April–May, 2017, and analyzed for variety of chemical species and OP. PM₁₀ mass concentration, volume-normalized OP (represented as nmol DTT min⁻¹ m⁻³ or OP_V) and mass-normalized OP (represented as pmol DTT min⁻¹ μg⁻¹ or OP_M) over the study region varied from 61 to 184 μg m⁻³, 0.69 to 2.08 nmol DTT min⁻¹ m⁻³ and 6 to 26 pmol DTT min⁻¹ μg⁻¹, respectively. The study period was classified into two categories (Class-A and Class-B) based on five-day air mass back trajectories for each sampling locations. Mass fraction of mineral dust was ~ 2.5 times higher in Class-B samples (representing the Arabian Desert / marine air masses) in comparison to Class-A samples (representing continental air mass). Average OP_V and OP_M associated with Class-A showed ~ 1.5 times higher values as compared to those associated with Class-B. Furthermore, Class-A samples showed ~ 95% Cl⁻-depletion from sea-salt aerosol, which was also found to be significantly correlated with OP_M. These observations not only suggest the importance of free acidity in affecting the chemistry of marine atmosphere but also in catalytic generation of ROS.



Anil Patel

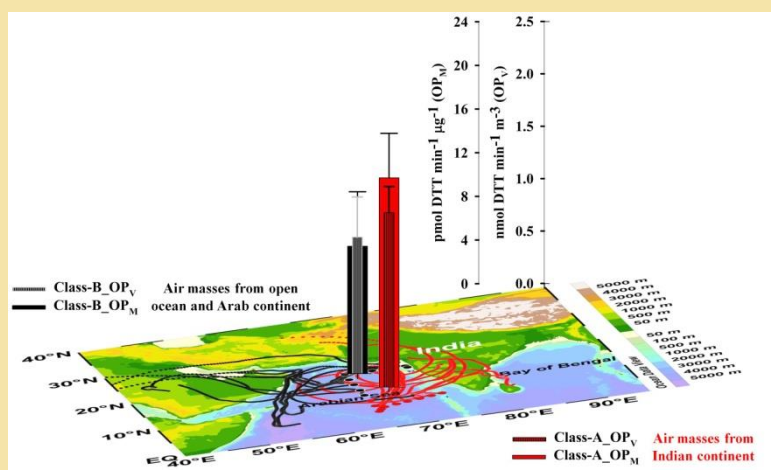


Figure: Oxidative potential of PM₁₀ for class-A (red bar) and Class-B (black bar) over the Arabian Sea

Moreover, water soluble organic nitrogen (WSO_N) contribute ~15% to total nitrogen and mass fraction of WSO_N were observed to be positively correlated ($R = 0.79$) with OP_M, suggesting water-soluble nitrogenous organics are highly DTT-active. Further, OP_M also exhibited a significant correlation ($R = 0.83$) with nss-K⁺, indicating the effect of biomass burning emissions on aerosol OP. In addition, mass fraction of water soluble (WS)-Mn, WS-Cu, and WS-Zn also correlated significantly with OP_M. Our results also infer that aerosol aging increases their OP. These results have important implications in assessing the effects of continental aerosol on marine atmospheric boundary layer and ocean biogeochemistry.

<https://doi.org/10.1021/acsearthspacechem.9b00285>

Lunar regolith and water ice escape due to micrometeorite bombardment

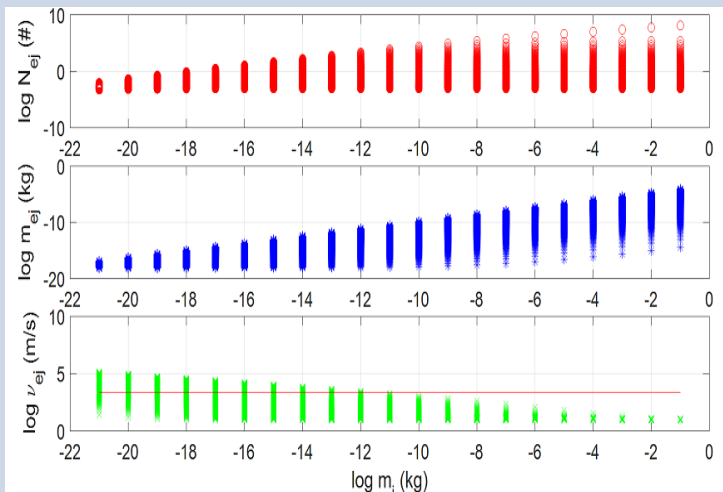
(J. P. Pabari, S. Nambiar, V. Shah and A. Bhardwaj)



Jayesh P. Pabari

Dust particles exist everywhere in interplanetary space and they evolve dynamically after their origination from the sources like Asteroid belt, Kuiper belt, comets or space debris left during the formation of solar system. These micrometeorites can reach the lunar surface without ablation owing to the absence of atmosphere. Due to the hypervelocity impact of these particles, ejecta come out in the lunar environment. A portion of the ejecta could escape from Moon due to its velocity larger than the escape velocity. Whenever an impact occurs in the water ice bearing area near the poles, the escaping ejecta may carry water ice (volatiles) along with the regolith. We have computed the ejecta parameters and estimated the possible escape of volatiles from Moon, using Galileo observations of the dust particles near Moon. The upper limit of regolith escape rate is found to be $\sim 2.218 \times 10^{-4}$ [1.662×10^{-4} , 10.232×10^{-4}] kg/s and the upper limit of water ice escape rate is found to be $\sim 1.988 \times 10^{-7}$ [1.562×10^{-7} , 7.567×10^{-7}] kg/s. On one side, Moon is found to be gradually becoming heavier due to its one order higher incoming dust particles than those escaping from it. While on the other side, Moon could be depleted of water ice (volatiles) resources over a period of time, because of the escape due to

micrometeorite impact. The results presented here could be useful to understand the impact process as well as the dust and volatile escape from Moon.



<https://doi.org/10.1016/j.icarus.2019.113510>

Figure: Logarithmic plot of number (red, circle) of ejected particles, mass (blue, asterisk) of ejected particles and velocity (green, cross) of ejected particles versus mass of the normally incident projectile. Each value of incoming particle gives fifteen hundred points, taken as number of bins and the points are clustered due to nearby values. The threshold in velocity is also shown as straight (red) line in the lower plot.

Preflare Processes, Flux Rope Activation, Large-scale Eruption, and Associated X-class Flare from the Active Region NOAA 11875

(Prabir K. Mitra and Bhuwan Joshi)

We present a multiwavelength analysis of the eruption of a hot coronal channel associated with an X1.0 flare (SOL2013-10-28T02:03) from the active region NOAA 11875. EUV images at high coronal temperatures indicated the presence of a hot channel (indicated by the red arrow in Figure 1) at the core of the active region from the early preflare phase evidencing the preexistence of a quasi-stable magnetic flux rope. The hot channel underwent an activation phase after a localized and prolonged preflare event occurring adjacent to one of its footpoints (shown by the yellow arrows in Figure 1). Subsequently, the flux rope continued to rise slowly for ≈ 16 minutes during which soft X-ray flux gradually built-up characterizing a distinct precursor phase. The flux rope transitioned from the state of slow rise to the eruptive motion with the onset of the impulsive phase of the X1.0 flare. The eruptive expansion of the hot channel is accompanied by a series of type III radio bursts (Figure 2) in association with the impulsive rise of strong hard X-ray nonthermal emissions that included explicit hard X-ray sources of energies up to ≈ 50 keV from the coronal loops and ≈ 100 keV from their footpoint locations (see Figure 1). Our study contains evidence that preflare activity occurring within the spatial extent of a stable flux rope can destabilize it toward eruption. Solar eruptions are closely associated with metric and DH type II radio bursts. In this view, the CALLISTO spectrograph stationed at the USO/PRL campus is expected to provide useful information regarding solar eruptions. <https://doi.org/10.3847/1538-4357/aaed26>



Prabir K. Mitra

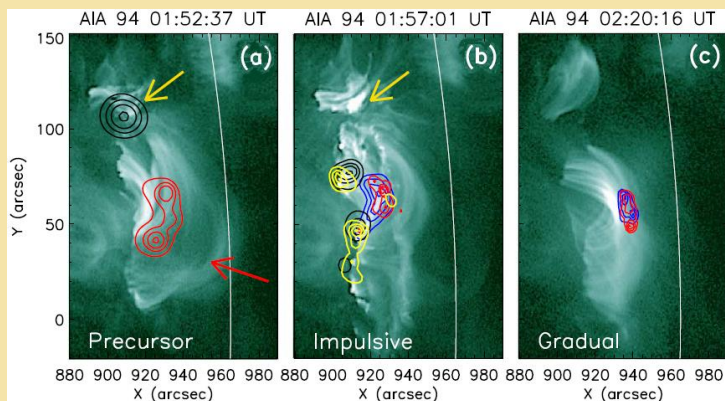


Figure 1

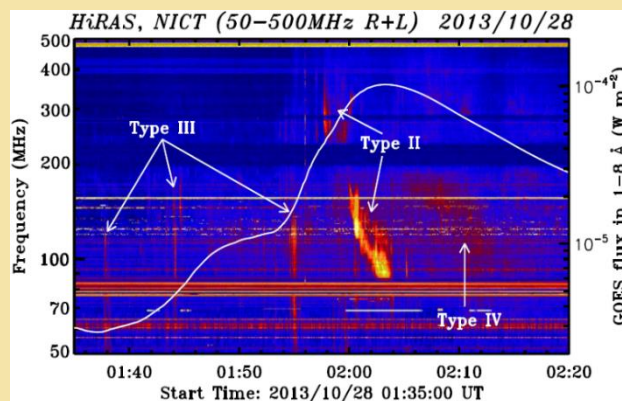


Figure 2

Visit of Dr. Anil Kumar, Indian Institute of Remote Sensing

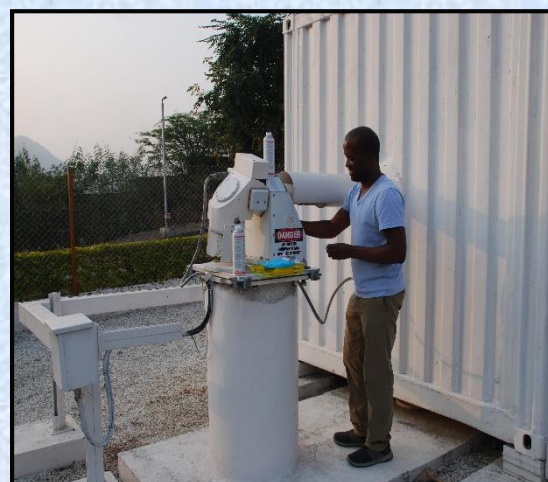
Dr. Anil Kumar, Scientist/Engineer 'SG' and Head PRSD at Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun, gave a seminar entitled Machine learning and its application in remote sensing data classification at USO on 12th December 2019.



Visit of Preventive Maintenance from Gong Program, Boulder, USA to USO



The Udaipur Solar Observatory (USO) / Physical Research Laboratory has an MoU with the Global Oscillation Network Group (GONG) program of the National Solar Observatory, Association of Universities for Research in Astronomy, Boulder, USA. GONG comprises a six-site network of solar telescopes around the globe aimed at continuous observations of the Sun, with Udaipur being one of the observing sites that has been operational since October 1995. The telescope provides full-disk observations of the Sun in continuum intensity, photospheric Doppler and magnetic fields, and chromospheric H-alpha intensity. Recently, during the period 1 December – 12 December, 2019, a team of engineers comprising of Mr. Sang Nguyen (Electronics engineer) and Mr. Detrick Branston (Optics engineer) visited USO for the annual preventive maintenance of the GONG telescope. The scientists, engineers, and technical support personnel from USO, viz., Dr. Brajesh Kumar, Mr. Naresh Jain, Ms. Ramya Bireddy, Mr. Kushagra Upadhyay and Mr. Sudarshan Jain coordinated the maintenance work of the GONG telescope along with the team of engineers from GONG Program.



Memory competition organized by Space Applications Centre (SAC), Ahmedabad and Town Official Language Implementation Committee (TOLIC), Ahmedabad



Space Applications Centre (SAC), Ahmedabad and Town Official Language Implementation Committee (TOLIC), Ahmedabad organized a Memory Competition on 26th November 2019 at Space Applications Centre (SAC), Ahmedabad. TOLIC is the only Committee which is spread over two cities i.e, in Ahmedabad and Gandhinagar. At present 150 central Govt. Offices and Undertakings situated in Ahmedabad and Gandhinagar are the Members of the Committee. Ms. Sneha Nair, Ms. Amarjass Sekhon and Ms. Jyoti Limbat were nominated from PRL to participate in this competition. It was an excellent opportunity to gather together, interact and exchange views during the competition.

Ms. Amarjass Sekhon secured 1st position and **Ms. Sneha Nair** secured 4th position in their respective Language categories.



Influenza Vaccination Camp



The Flu vaccination camp was arranged for CHHS beneficiaries at PRL dispensary Navrangpura on 16th and 17th December. The aim of the camp was to protect our CHHS beneficiaries from influenza virus infection. Prevention is better than cure. According to WHO and CDC recommendation flu vaccine should be taken every year because different new strains of the flu virus emerge frequently and different vaccines are developed. Prior registrations were done by canvassing. Our health-aware beneficiaries had taken an advantage of camp. More than 300 beneficiaries had taken vaccination and made the camp successful. We are thankful to all the beneficiaries who have protected themselves against influenza viral infection by taking the vaccine. We hope to cover more and more

beneficiaries as a part of prevention of preventable diseases.

Visit of Students And Faculty Members From Rabindra Nath Tagore College, Kapasan Udaipur



A group of 30 students pursuing B.Sc. at Rabindra Nath Tagore College, Kapasan, which is located in a remote area of Udaipur, visited USO on 29th November 2019 along with their faculty members. Prof. Nandita Srivastava, welcomed the group and briefly summarized the research activities at USO. This was followed by a talk on “Introduction to the Sun and Observational facilities at USO” by Mr. Hirdesh Kumar, SRF at USO. The talk remained quite interactive between the speaker and the students /faculty members visiting USO. Later, this group was shown the GONG and E-CALLISTO observational facilities of USO coordinated by Dr. Brajesh Kumar, Mr. Kushagra Upadhyay, Mr. Hirdesh Kumar, and Mr. Sudarshan Jain. The students and faculty members showed keen interest in understanding the principle and working of these instruments. The USO outreach team is privileged with this activity of sharing knowledge with such students, hailing from a remote location, which would create interest in their minds towards Space Science.



Colloquia @ PRL

- ✚ **Haranath Ghosh** (Scientific Officer, RRCAT, Indore) gave a colloquium on the title “High temperature Superconductivity in Fe-based materials; role of electronic structure studies” on 4th December 2019.
- ✚ **Jyotiranjana S. Ray** (Professor, GSDN, PRL) delivered a colloquium entitled “Retracing Saraswati: the lost river of the Harappan Civilization.” on 11th December 2019.

- ✚ **Nandita Srivastava** (Professor, USO), has been invited by the Editor of Publications, Indian Academy of Sciences, to serve on the Editorial Board of the Journal of Astrophysics and Astronomy for the period Jan. 2020 – Dec. 2022
- ✚ **Bhuvan Joshi** (Associate Professor, USO), PRL has been felicitated during the Youth Festival on 7th November 2019 in Almora, Uttarakhand organized by the Hindustan Times (HT) Media Group with active support from the Government of Uttarakhand for contributions in the field of Solar Physics and Space Sciences. The Chief Minister of Uttarakhand Mr. Trivendra Singh Rawat honored the awardees.
- ✚ **Prabir Kumar Mitra** (SRF, USO), has won the first prize for his poster entitled “Solar Physics: Importance, Current Understanding and Yet Unanswered Problems” at the 31st Research Methodology Workshop on Physics & Electronics, Gujarat University, Ahmedabad, 21st November, 2019.
- ✚ **P Kalyana Srinivasa Reddy** (Scientist/Engineer - SC, PSDN) has been awarded the Best Poster Award for his paper entitled "A 3D Surface Thermophysical Model for Mars - Implications for Mars Landing Missions" at the COMSOL Conference 2019, Bangalore, 28-29 Nov. 2019.

PRL Congratulates all the colleagues conferred with these awards and honours

A Hearty Welcome to the New Entrant



Dr. Satyajit Seth
Reader, THEPH

The Editorial Team



Bijaya Sahoo



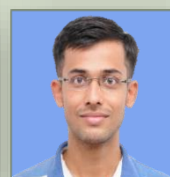
Pragya Pandey



Deekshya Sarkar



Garima Arora



A. Shivam



Prashant Jangid

Happy New Year
2020

