Near-ground Hyperspectral Imaging for Urban Scale Remote Sensing of Aerosols During Nighttime

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Monitoring size-resolved concentrations of <u>ambient</u> aerosols over spatial segments *near the ground* is essential for public health risk assessment. **PM <2.5µm, urban scale**

Application: assessment & management, source apportionment, informationbased decision-making, fast response to emergency events



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Bi-modal size distribution over vertical atmospheric columns

solar radiation \Rightarrow <u>daytime</u>, sun elevation angle, cloud cover

(Wang et al., 1996)

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Ground hyperspectral imaging



Hyperspectral Remote Sensing

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Nighttime spectral remote sensing	
Spectral range	Application
Vis- NIR (400nm- 1100nm)	Near Ground fine PM mixture up to 4km open path

Advantage of ground based camera ⇒ spatial & temporal data at high resolution grid

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Research Plan

Laboratory scale

Image well characterized aerosols

Up scaling

Develop imaging procedure for urban scale open path

Computational

Algorithms for signature analysis

Case studies

temporal dynamics

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Hyperspectral Aerosol Optical Thickness Mono-modal Lognormal –Polystyrene Spheres









(2002) Mari - maritime Urb - Urban BG - background HW - highways



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CCD Response to Light Sources









Lab Scale – Generated Aerosol Size Distributions









Sensor Sensitivity







Indication of larger particles































<u>Summary</u>

Hyperspectral imaging provides offers high spatiotemporal resolution and better identification of fine PM modes.

Imaging of artificial light sources was applied as a novel solution for nighttime RS of fine PM concentrations.

Feasibility and sensitivity at laboratory scale were studies – gaps remain.

Field nighttime imaging procedure was developed

Challenges of pixel selection for analysis were dealt.

Spectral depended attenuation in the presence of extreme PM concentrations was measured.

THANK YOU FOR LISTENING!



