nature COMMUNICATIONS

ARTICLE

Received 7 May 2014 | Accepted 11 Dec 2014 | Published 14 Jan 2015

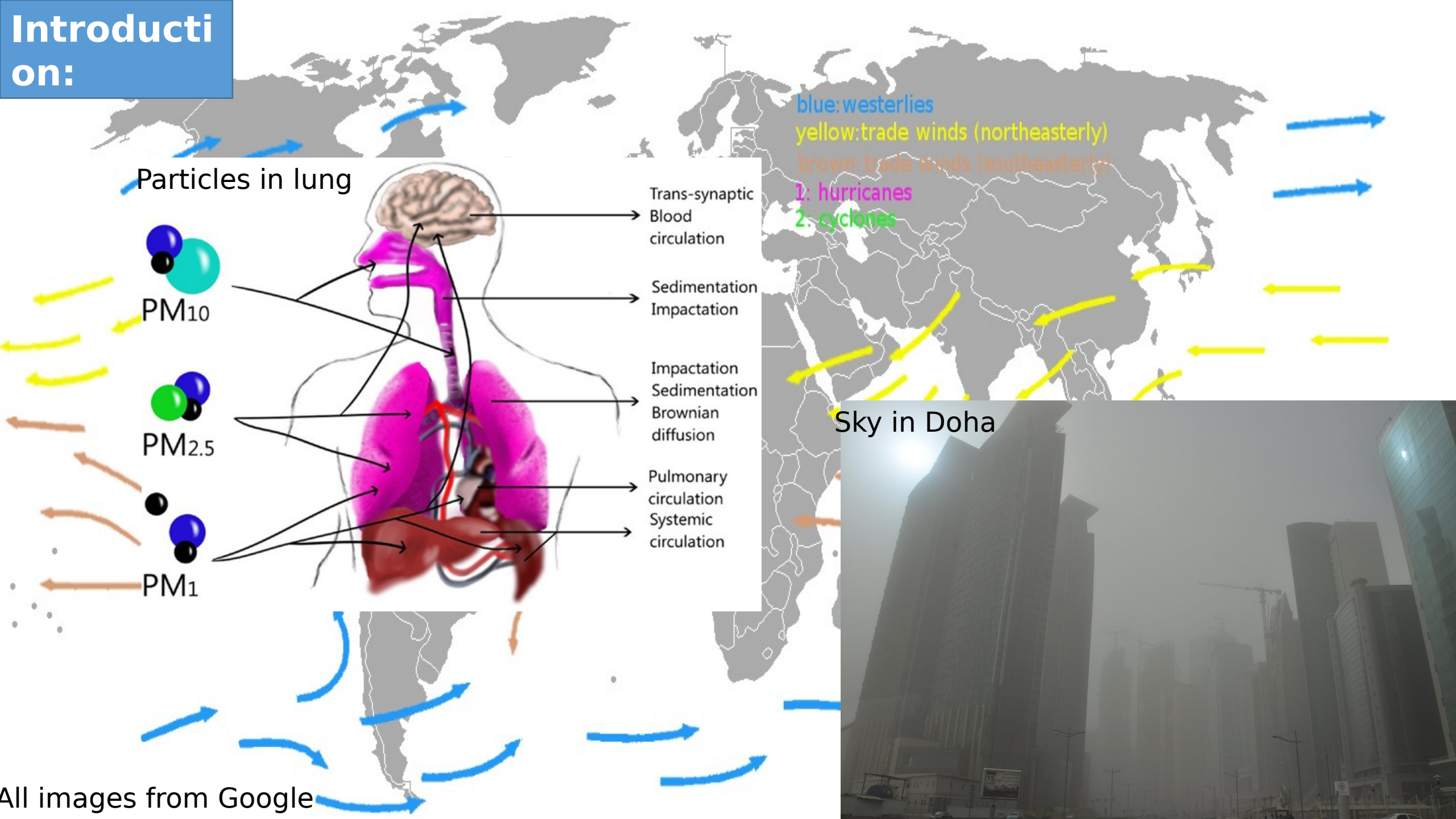
DOI: 10.1038/ncomms7083

Aerosol generation by raindrop impact on soil

Young Soo Joung[1] & Cullen R. Buie[1]

P. Srikrishnarka

Introduction:



Particles in lung

Sky in Doha

All images from Google

xperimental section:

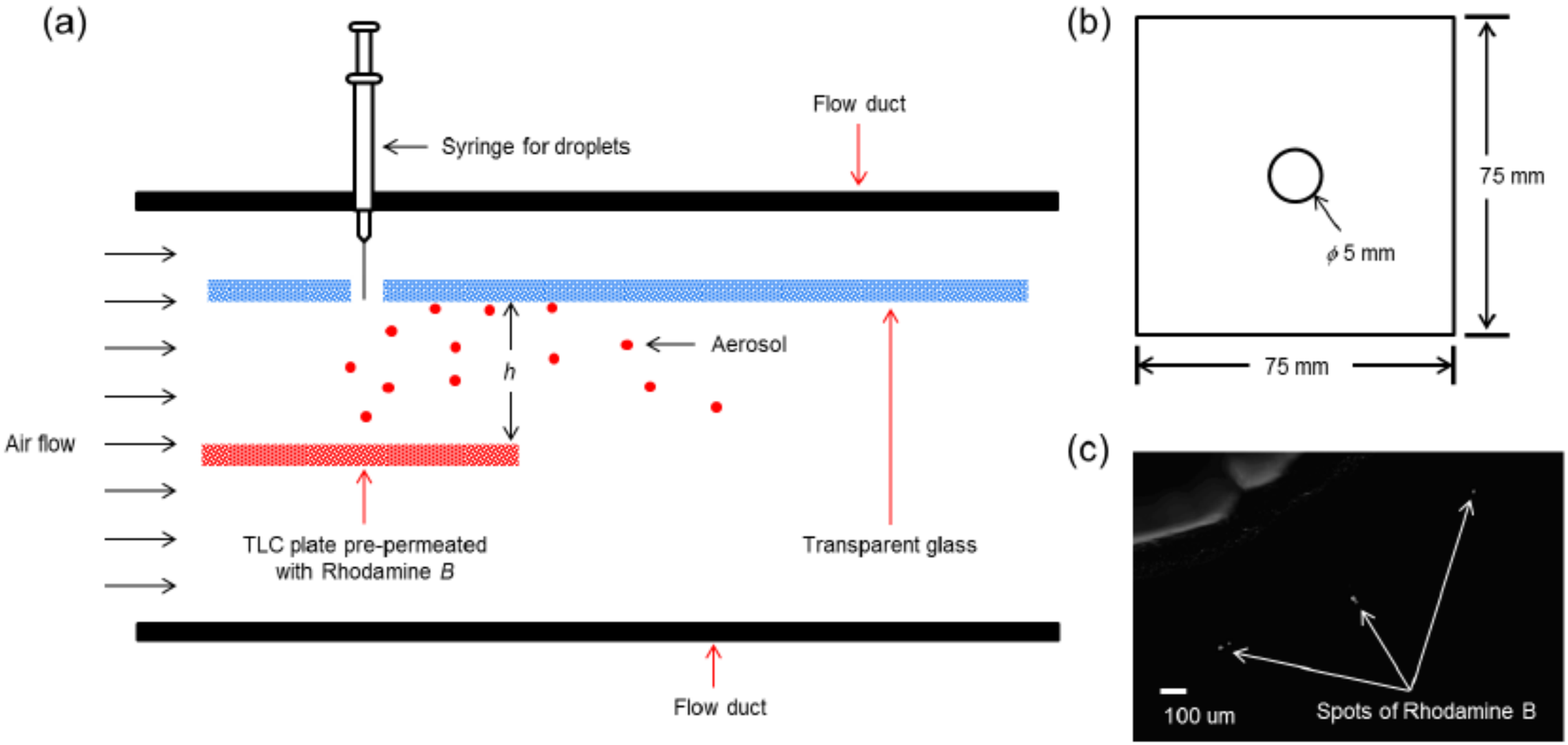
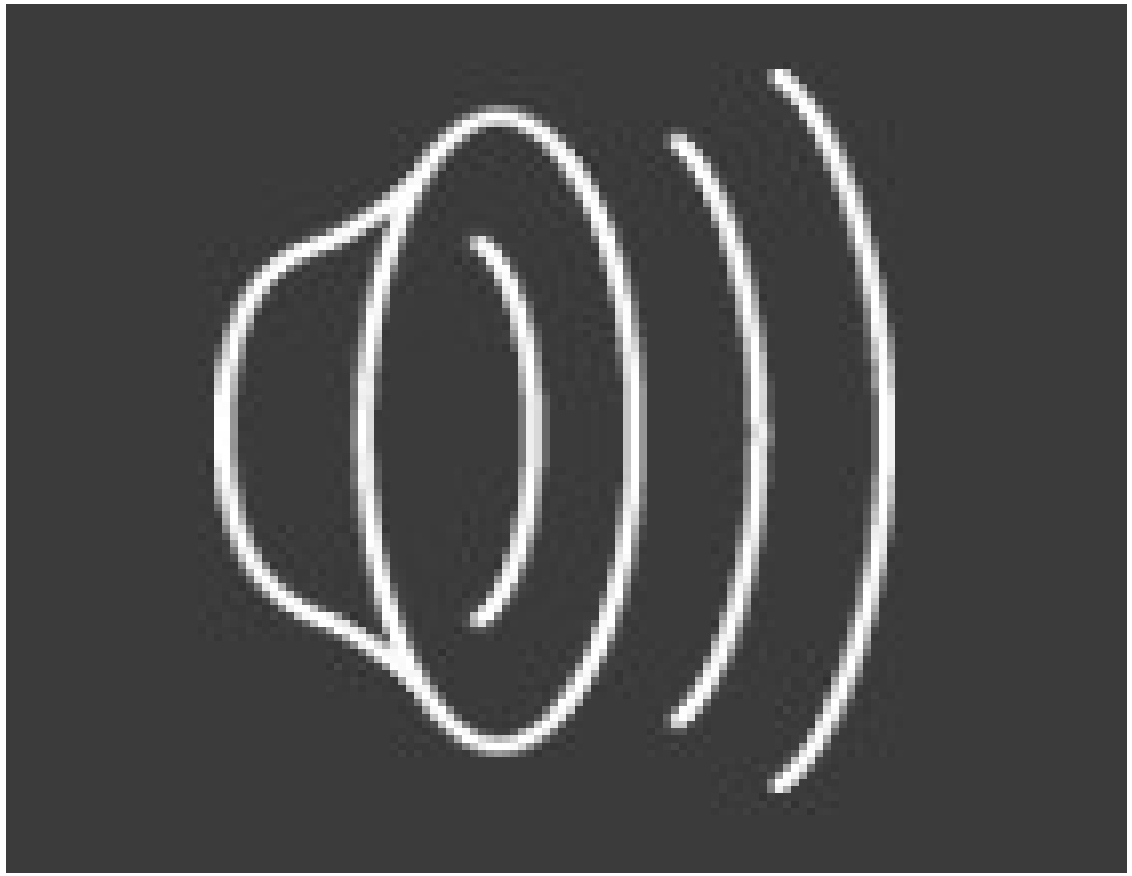
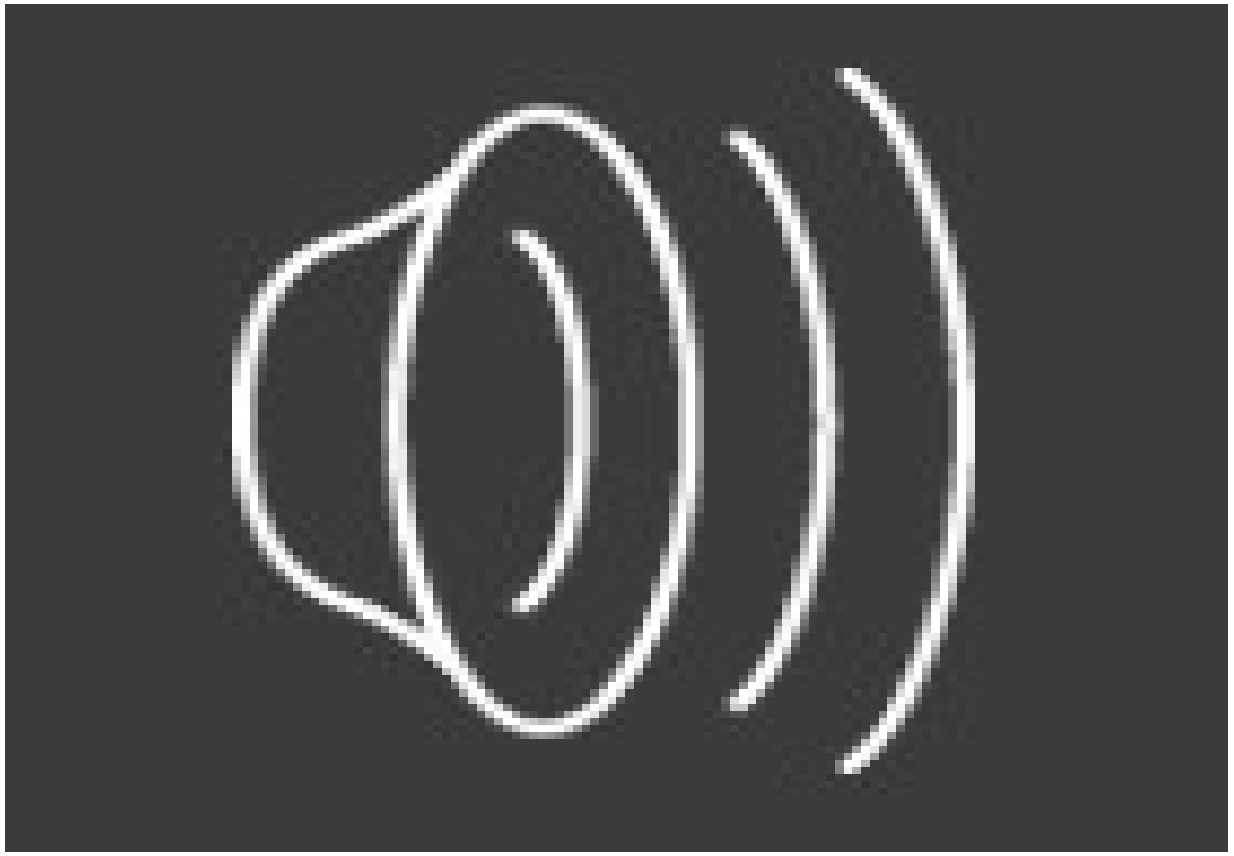


Fig.1 (a) Schematic of experimental setup (b) Glass slide to collected the aerosol (c) slide under a UV filter to view Rhodamine spot (bright spots)





Vid. 1. Droplet and aerosol generation in presence of air flow

Vid. 2. Droplet and aerosol generation in absence of air flow

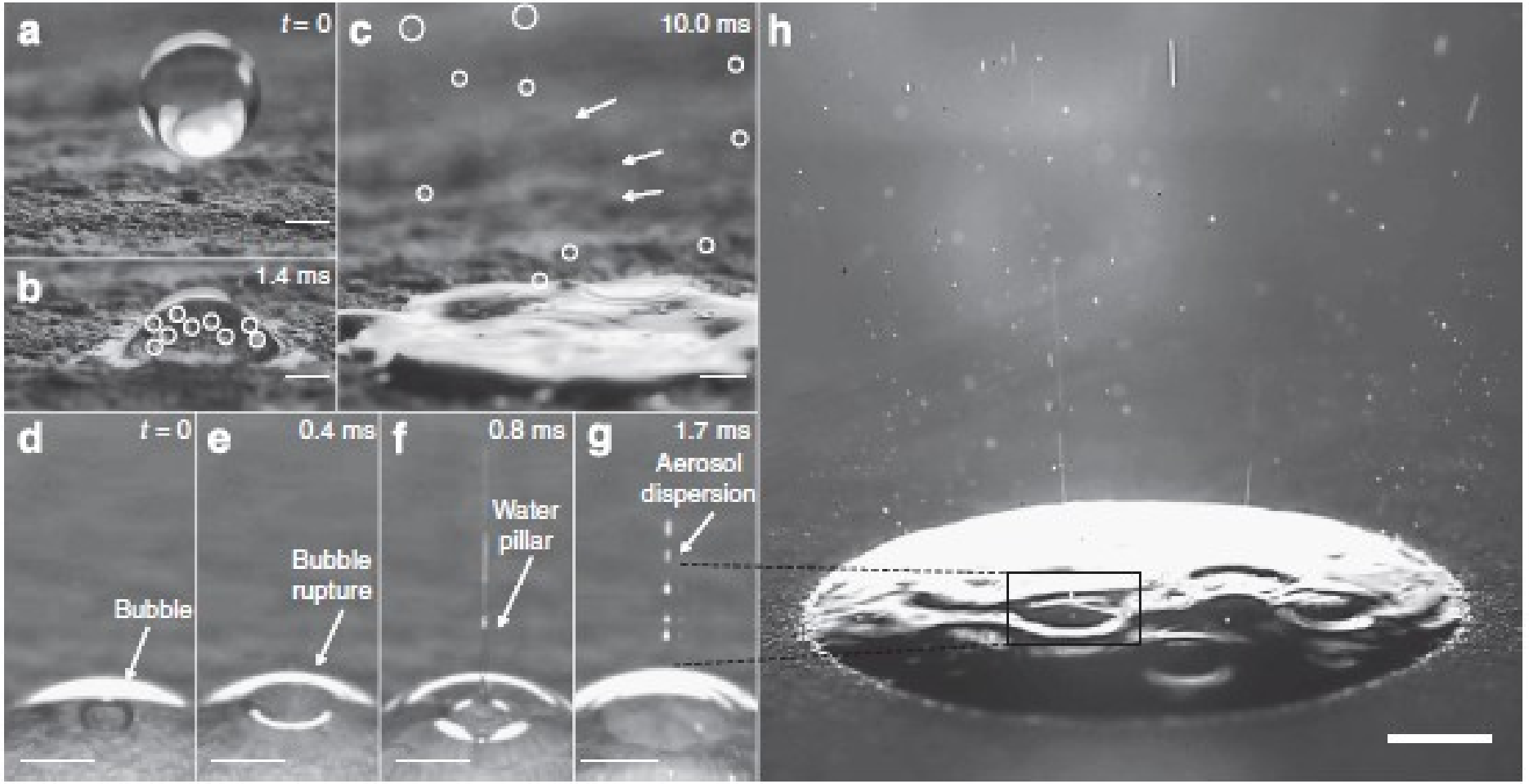


Fig.2. (a) Clay loam with a rough surface before impingement with a droplet travelling at a speed of 2ms^{-1}. (b) Tiny bubbles form under the droplet after impact). (c) Tiny water jets are ejected from the droplet after impact. (d–g) High-speed images of the aerosol-generation process when a single bubble breaks inside the droplet. (d) A bubble is trapped inside the droplet. (e) The bubble breaks at the droplet/air interface. (f) A water jet emanates from the droplet. (g) The jet breaks up into tiny droplets.(h) Frenetic water jets and associated aerosols are

Table 1 | Characteristics and wetting properties of the media used to examine aerosol generation.

Sample	Layer thickness (μm)	Particle size (μm)	Surface roughness (RMS, μm)	Liquid	Hydraulic diffusivity ($mm^2 s^{-1}$)
Clay loam soil	>104	<500	16.9	Water	4.80
Loam soil	>104	<300	27.2	Water	3.11
Sandy soil	>104	300-600	35.4	Water	127.64
Clay soil	>104	<100	9.4	Water	2.61
Muck	>104	<500	62.1	Water	0.05
Sandy loam soil	>104	200-500	54.7	Water	24.58
Silt loam soil	>104	<400	26.8	Water	4.53
Peat	>104	<500	20.7	Water	0.13
Soil A (clay loam)	>104	<600	22.9	Water	4.58
Soil B (peat)	>104	<1,000	39.2	Water	0.04
Soil C (loam)	>104	<1,500	31.0	Water	4.89
Soil D (sandy loam)	>104	<1,000	46.2	Water	15.68
Soil E (sandy clay)	>104	<300	11.1	Water	12.01
Soil F (sand gravel)	>104	100-5,000	47.0	Water	32.83
Soil G (silt loam)	>104	<500	23.6	Water	4.20
Soil H (beach sand)	>104	100-400	30.3	Water	68.98
TLC-A (silica)	250	10	1.7	Water	9.5
TLC-B (cellulose)	100	2-20	5.0	Water	20.4
TLC-C (aluminium)	250	11-14	2.3	Water	22.4
TLC-D (silica)	200	25	1.6	Water	24.0
TLC-E (cellulose)	250	50	10	Water	37.0
TLC-A (silica)	250	10	1.7	Ethanol	2.3
TLC-B (cellulose)	100	2-20	5.0	Ethanol	14.7

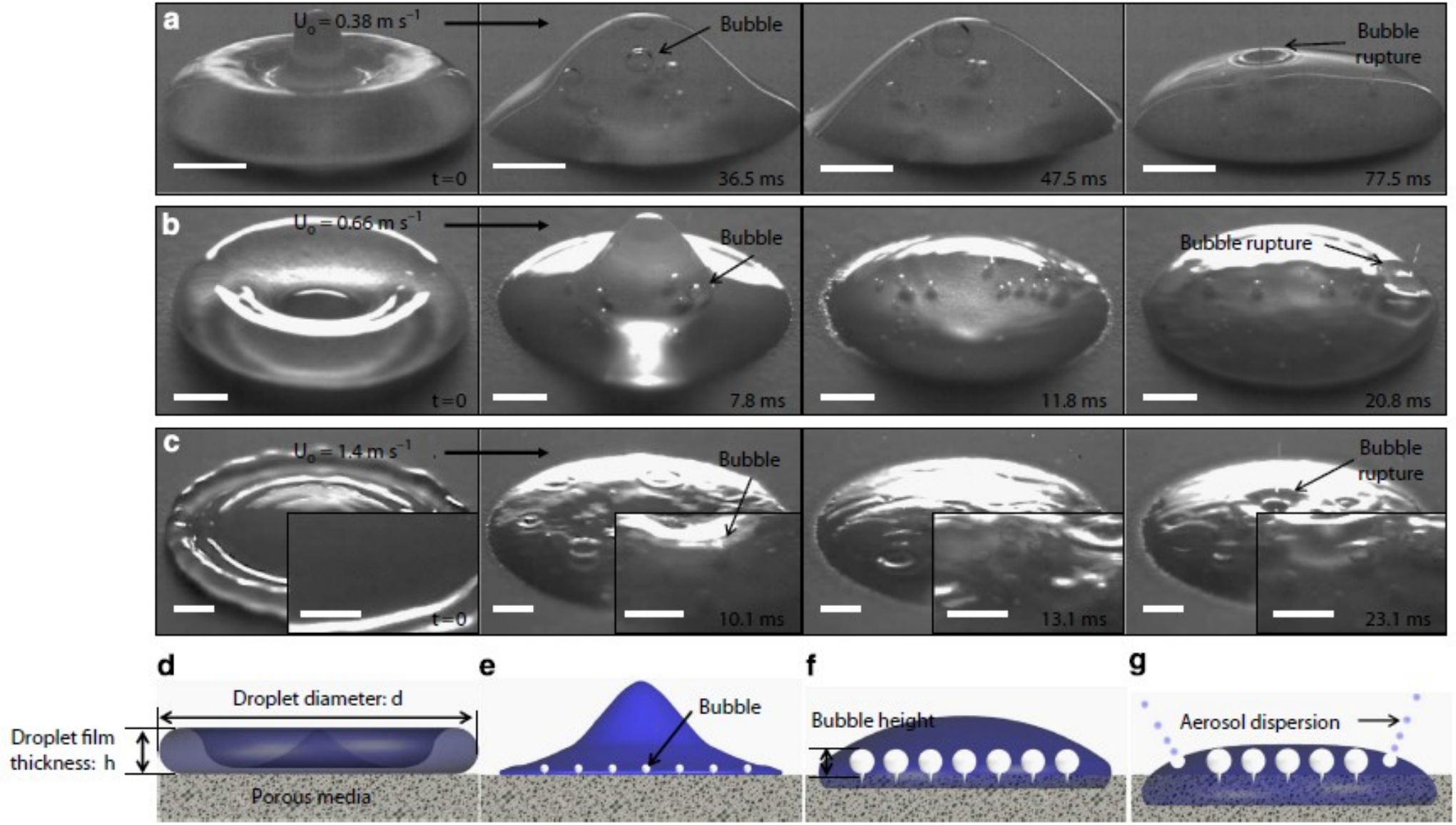


Fig.3 Three-step process of aerosol generation after drop impingement on porous media. (a–c) High-speed images of bubble formationinside water droplets on a thin layer chromatography plate, composed of aluminium oxide particles (11–14 mm), with respect to impact velocity (Uo). (d–g) Schematic illustration of the aerosol-generation process.

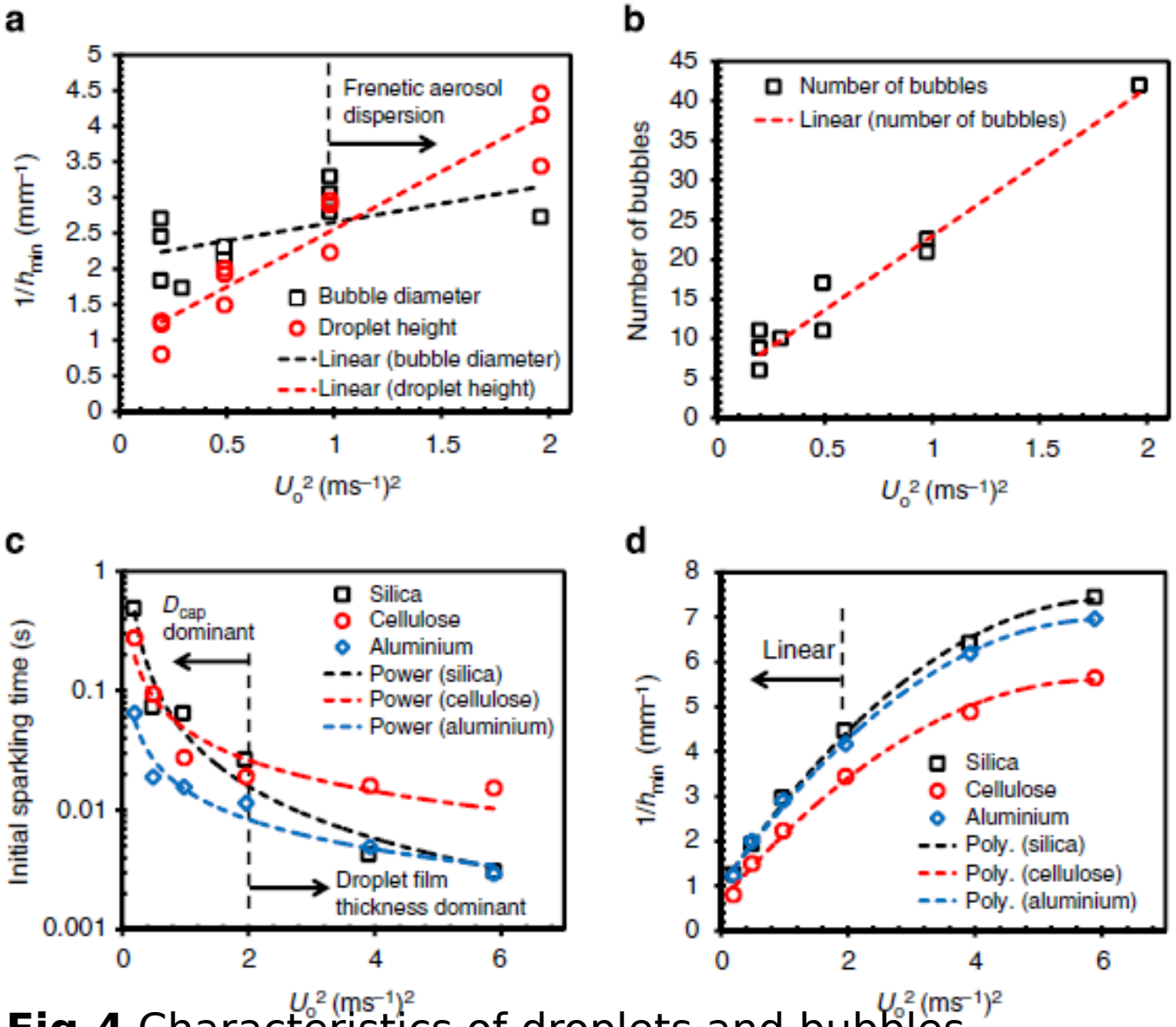


Fig.4 Characteristics of droplets and bubbles generated after impingement on TLC plates. (a) average droplet film thickness is inversely proportional to Uo. (b) The maximum number of bubbles inside the droplet linearly increases with

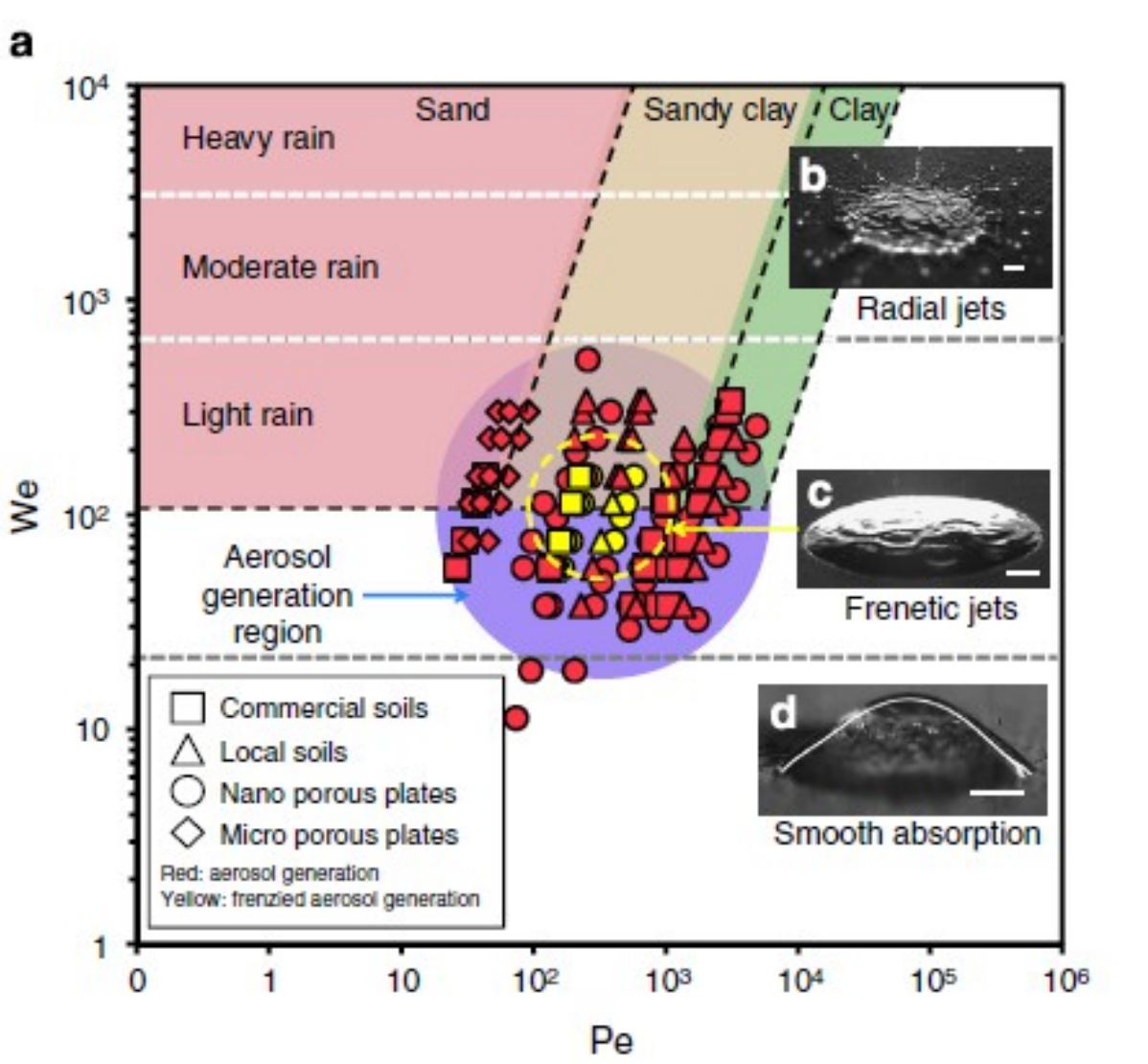


Fig.5 Characterization of aerosol generation wher droplets hit soils and porous surfaces. (a) The x axis indicates a modified Pe´clet number the y axis indicates the Weber number mainly varied by the impact velocity.

Conclusions:

✓This work present a visual proof of generation of aerosol by rainfall on soil

✓Time scale for bubble formation(ms) is much lower than the hydraulic diffusivity(s)

✓If the pores are filled with liquid, aerosols are not formed. However, once they are dried aerosols are generated again

✓Effect of successive rain drop and stability of aerosols have to be studied

Future Work:

Effect of droplets on hydrophobic porous media

Mode of generation of aerosol on angled surfaces

Thank you