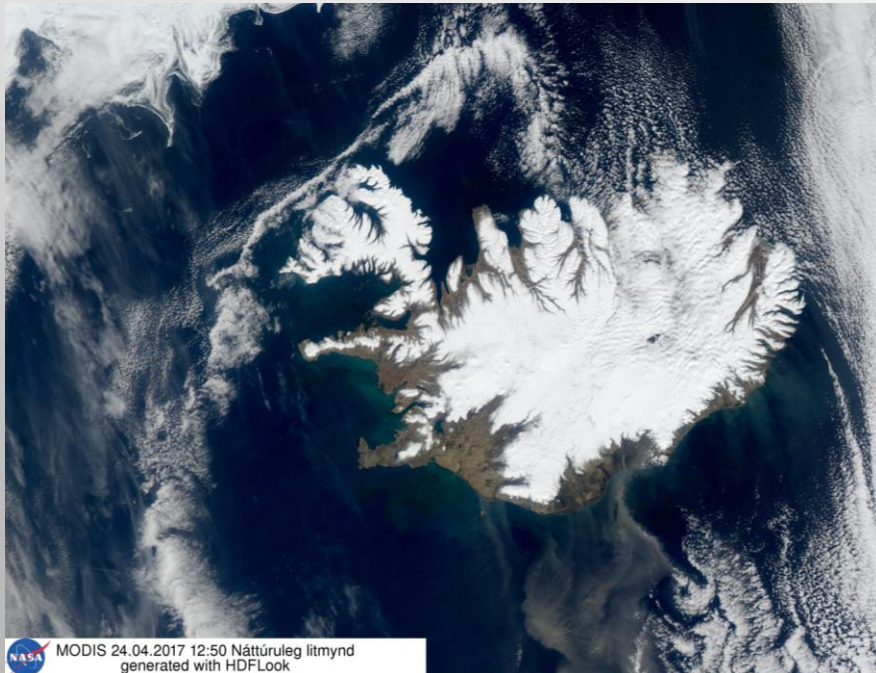




WINTER AND HIGH-ALTITUDE DUST SIZE DISTRIBUTIONS WITH BALLOON-BORNE LIGHT OPTICAL AEROSOL COUNTER (LOAC)



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THE 31ST NORDIC METEOROLOGICAL MEETING

REYKJAVÍK, 20.6.2018

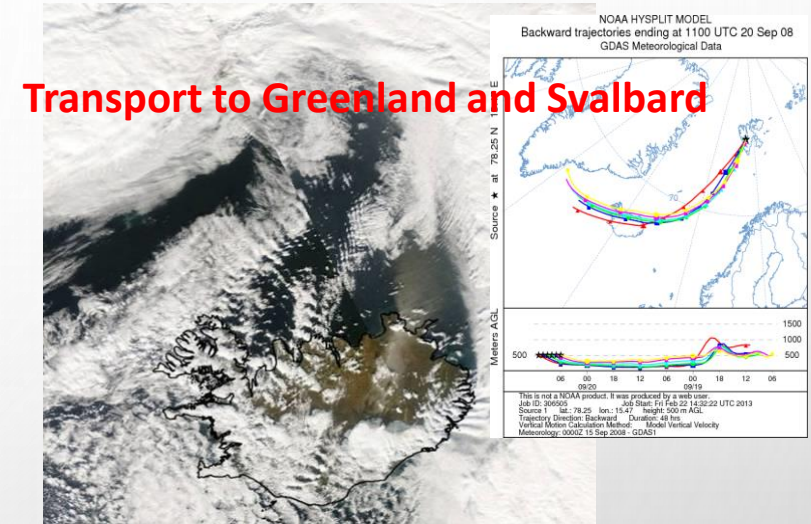
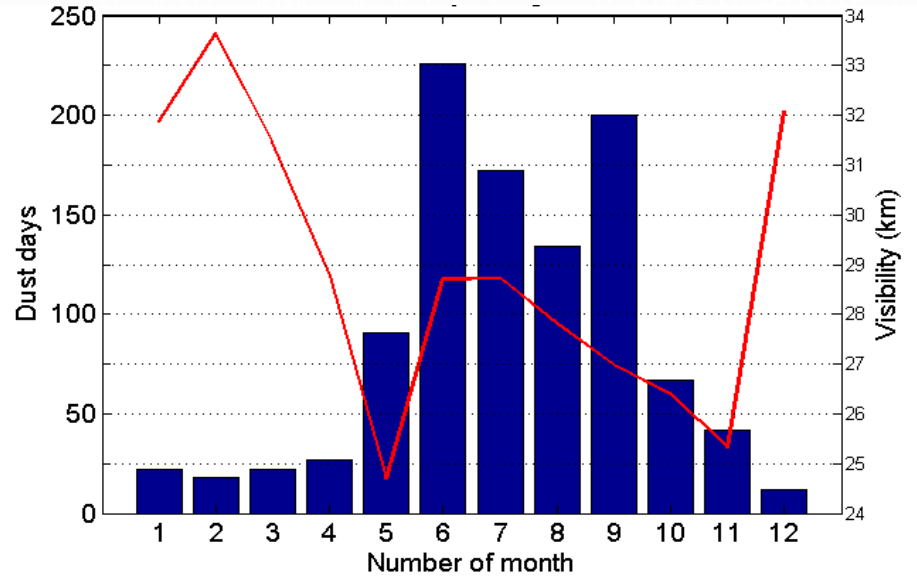
ICELAND – NATURAL OR ANTHROPOGENIC DESERT?

- **800 YEARS AGO:** DESERT AREAS WERE VEGETATED AND AT LEAST 25% OF THE COUNTRY WAS **A FOREST**
- **100 YEARS AGO:** WOODLANDS WERE REDUCED DUE TO MEDIEVAL AGRICULTURAL METHODS TO **ALMOST TOTAL ELIMINATION**
- COLD CLIMATE AND MASSIVE EROSION CAUSED A COLLAPSE TURNING VEGETATED ECOSYSTEM INTO DESERT
- **TODAY** ICELAND EXPERIENCES >130 DUST DAYS ANNUALLY AFFECTING THE AREA OF > 500,000 KM²
- **DUST EVENTS FREQUENTLY OCCUR IN THE WINTER AND DURING SUB-ZERO TEMPERATURES**

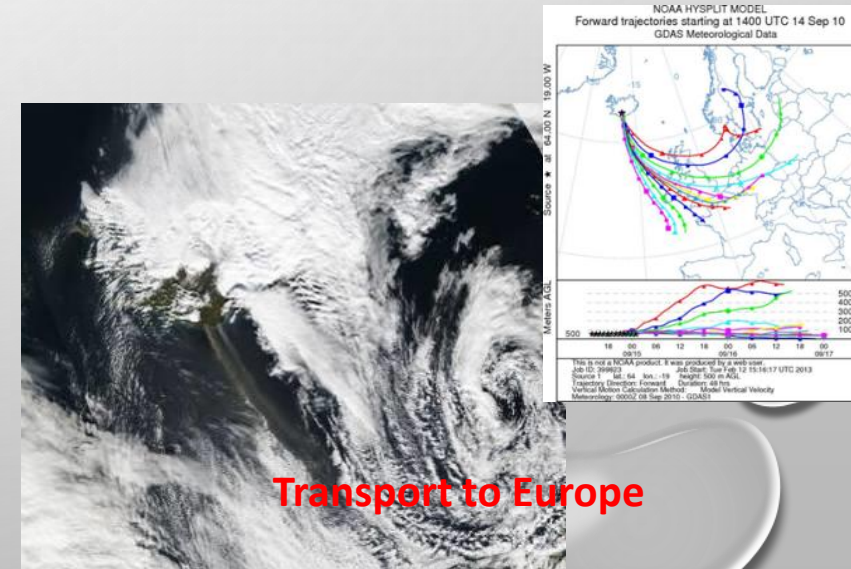
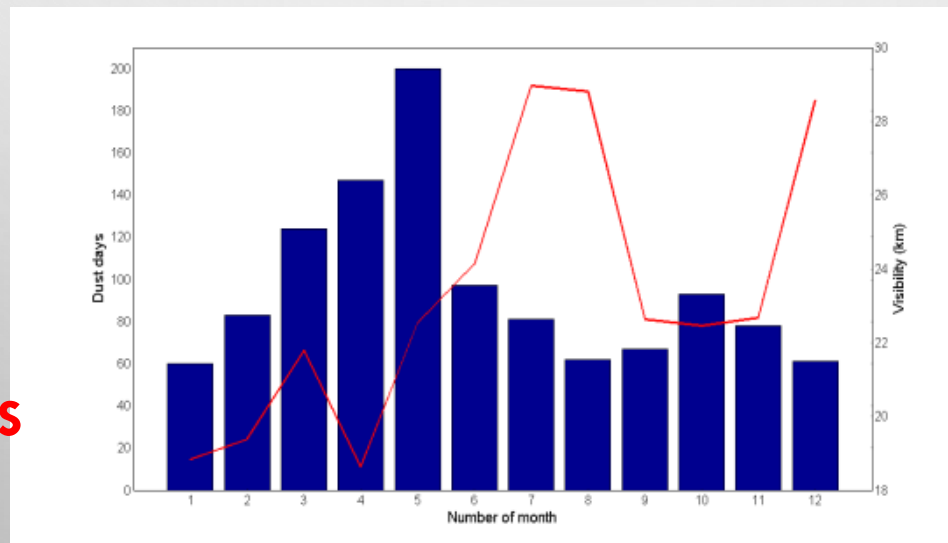


SEASONAL VARIABILITY OF DUST EVENTS

- NE ICELAND
“ARCTIC DUST EVENTS”
SUMMER



- S ICELAND
“SUB-ARCTIC DUST EVENTS”
WINTER-SPRING



⇒ **VERTICAL PROFILES
OF AEROSOL DISTRIBUTIONS**

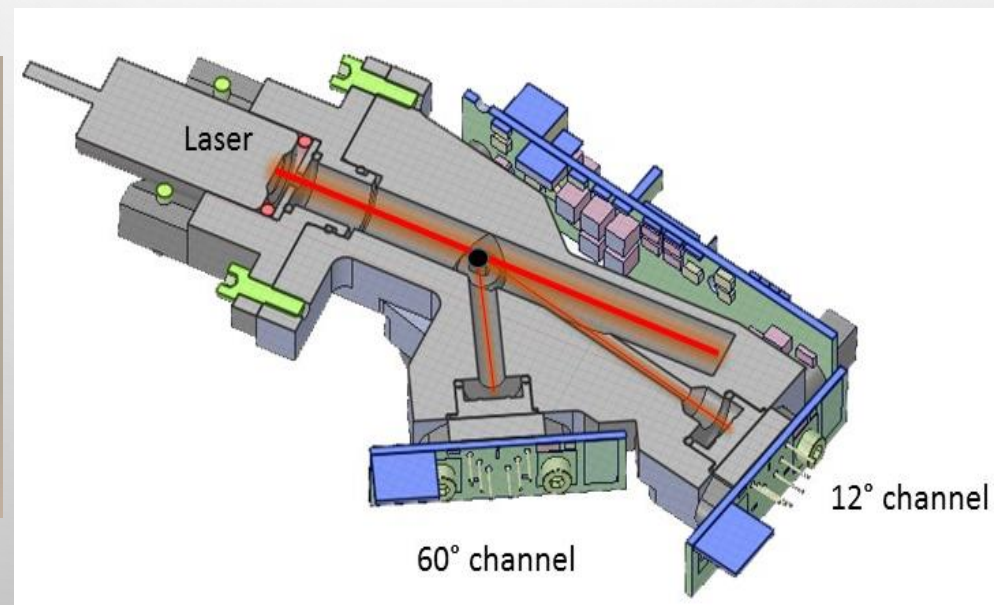
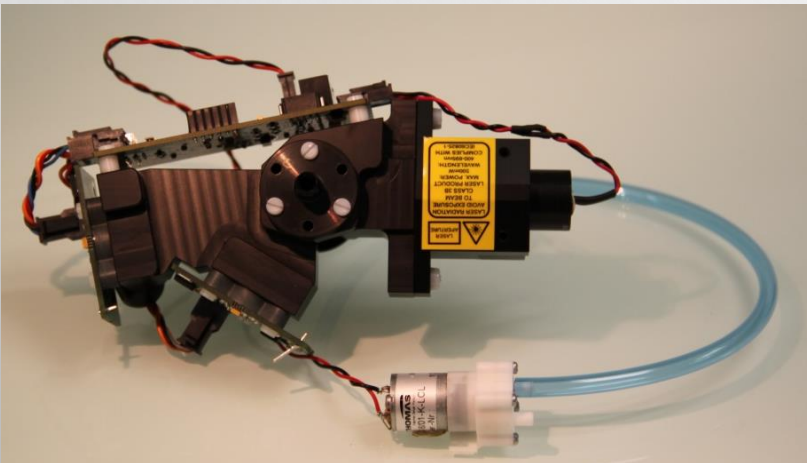


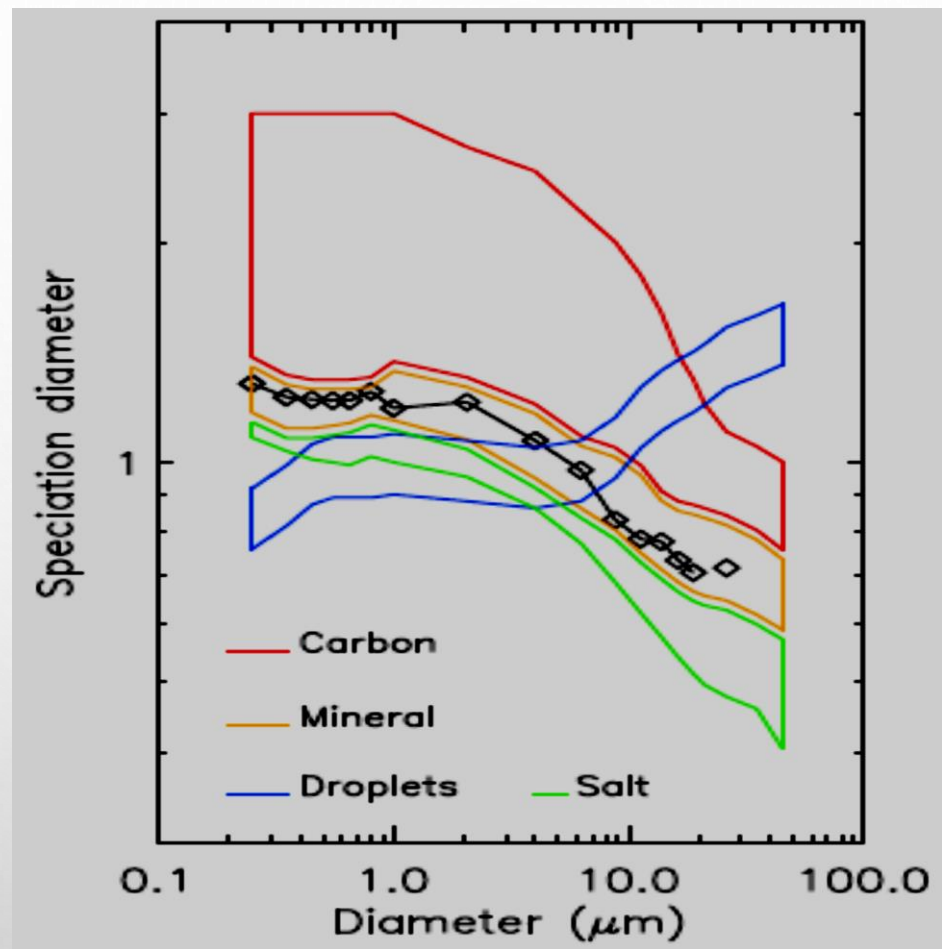
Typical dust storm (“orange horizon”)

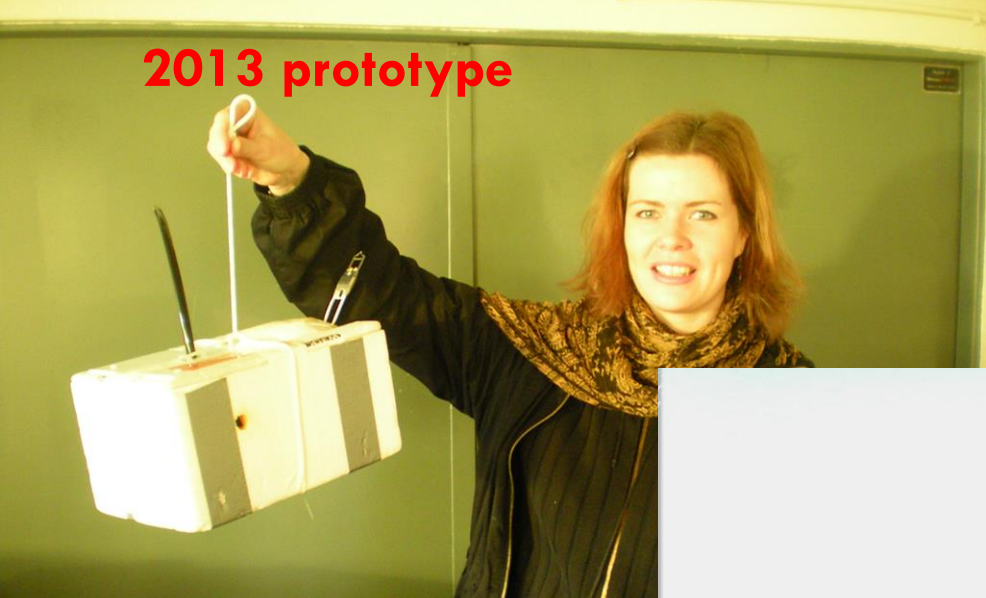
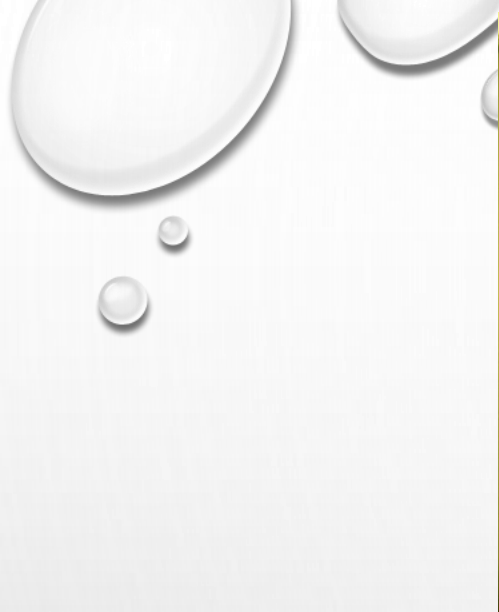


AIR BORNE MEASUREMENTS WITH LOAC 2013-2016 (LIGHT OPTICAL AEROSOL COUNTER)

- **LOAC** can determine **aerosol concentrations in 19 size classes (0.2 and 100 μm)** and to **estimate their typology** (Renard et al., AMT, 2016)
- **Measurements at 2 scattering angles :**
 - ~12°, insensitive to refractive index of the particles (mainly diffraction) => accurate size determination and counting
 - ~60°, strongly sensitive to the refractive index of the particles => indication of the nature of the particle (typology)







AIR BORNE MEASUREMENTS WITH LOAC 2013-2016 (LIGHT OPTICAL AEROSOL COUNTER)



Mismunandi aðgerðir gætu kostað 60-800 milljónir

Kynntar hafa verið í ráðgjörnum hugmyndir um aðgerðir í Kolgröfuförum Dað síð í hönnun.

Samkvæmt grófu mati er talið að kostnaður við að opna fjöðun og gera nýja brú á vegfyllingu myndi kosta um 800 milljónir. Lokun fjarhúrs er talin geta kostað 5-600 milljónir, en báðar þessar framkvæmdir tæku nokkuru tína.

Þriðja leiðin er um 1100 metra girðing utan brúar með veifum til að fæla aðilina frá. Síð lausan er talin kosta 60-80 milljónir. Fjórða leiðin er að deila súrefni í fjöðun þegar vart verður við súrefniskort. 1118

Fyrirtæki í Hong Kong með .is-lén

Greiðslumiðlunar fyrirtækið Perfect Money í Hong Kong er eitt af þúsundum erlendra aðila sem hafa kosið að skrá vefsíðu sína undir höfuðléninu .is.

Áð sögu Jens Péturs Jensen, framkvæmdastjóra Internets á Íslandi (ISNIC), völdu forsvarsmenn Perfect Money .is-lén fyrir greiðslugættina vegna traustans sem það nýtur. Síðan mun nýta DNSSEC-Þryggingarkerfið sem ISNIC er nýbýtt að að hljóða upp á fyrir .is-lén.

Aðilar með aðsetur erlendis eru réttihafar um fjórðungs allra .is-léna. Tekjur af úttalningu og lénun hafa komið í báku réttihafum til góða en unnt hefur verið að línka orðið fyrir lénin vegna þeirra. 1126

Loftbelgur ber tæki sem mælir agnir í andrúmsloftinu á leið hans upp í háloftin



Loftið mjög tært þegar komið var í 1.000 metra hæð

Unnið er að því að þróa nýjar aðferðir til að greina órsmáar rýk- og óskmagnir í andrúmsloftinu. Hér á landi starfa að verkefnum Pavla Dagsson Waldhauseirová doktorssemi og Haraldur Ólafsson, veðurfræðingur og próffessor.

Loftbelgur ber á loft lítið tæki. Það dregur í sig andrúmsloft, lýsir á það með leysigreina og mælir endurkast frá ögunum. Loftmælitæki var sent á loft í gær og var reiknað með að það færi í 30-35 km hæð. Ísling olli því að belgurinn

fór ekki nema 122 km hæð og féll svo í miðjan Hvalfjarðina. Tækið sýndi dálítið af rýki upp í um 200 metra hæð en fyrir ofan 1.000 metra var mjög tært loft. Binaðinn má nota til að mæla ósku frá eldgosum og aðrar agnir í loftinu.



AIR BORNE MEASUREMENTS WITH LOAC 2013/2016 (LIGHT OPTICAL AEROSOL COUNTER)

SIX FLIGHTS – FOUR detected dust

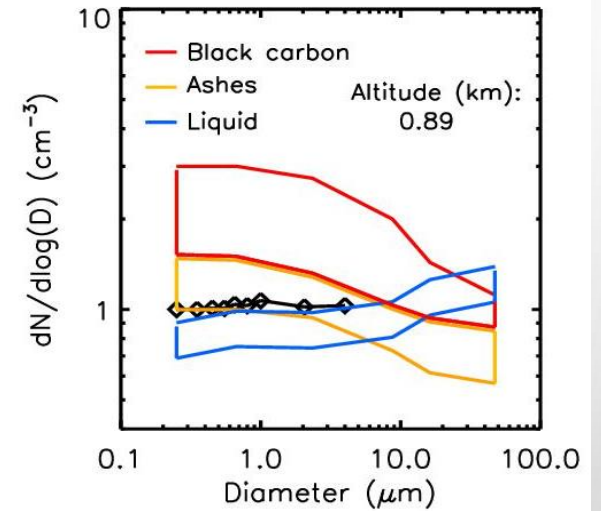
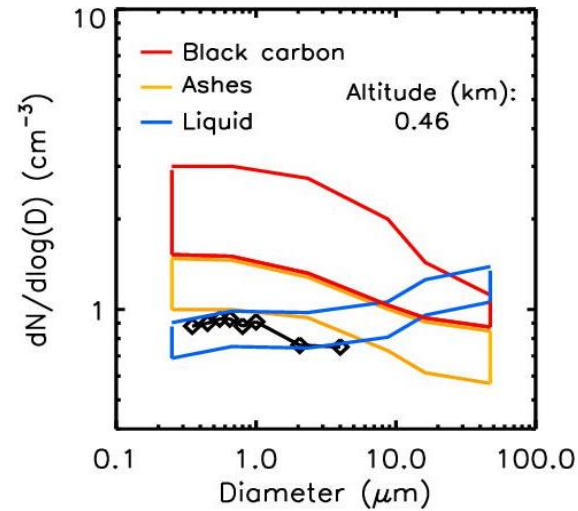
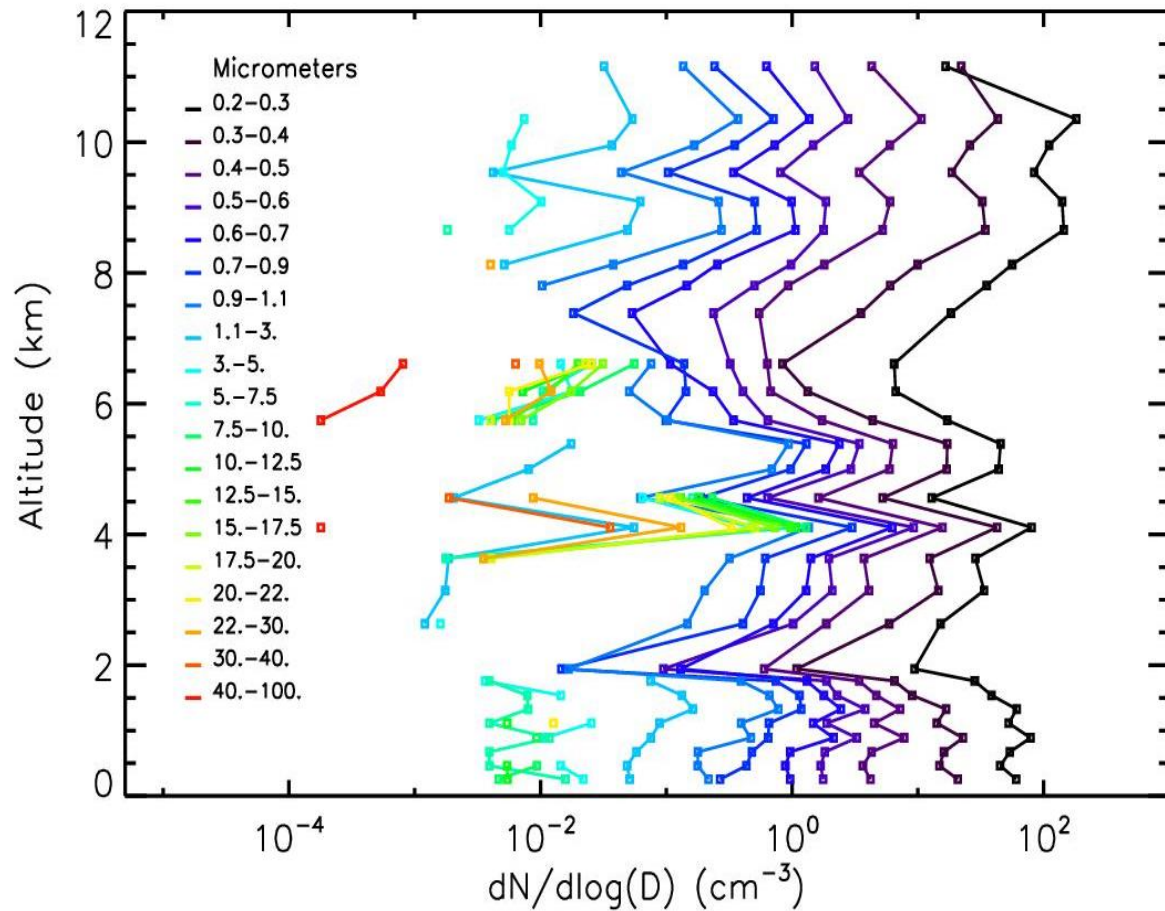
Date	Time of measurements (TU)	Launch location	Altitude range (km)	Tropopause (km)	Dust event
7 Nov. 2013	11:23 – 12:01	64.127°N, 21.911°W	0.1 – 11.2	8.0	Yes
28 Jan. 2015	10:43 – 12:48	64.346°N, 21.436°W	2.8 – 32.6	Not measured	No
9 Jan. 2016	15:08 – 16:12	63.856°N, 20.229°W	0.1 – 14.6	10.5	Yes
10 Jan. 2016	12:11 – 13:44	64.329°N, 21.652°W	0.1 – 26.5	11.5	Yes
12 Jan. 2016	11:33 – 12:47	64.337°N, 21.614°W	0.1 – 18.9	9.0	Yes*
13 Jan. 2016	10:34 – 11:40	64.337°N, 21.615°W	0.1 – 14.6	8.0	Yes*

*not detected by LOAC

Only one LOAC found

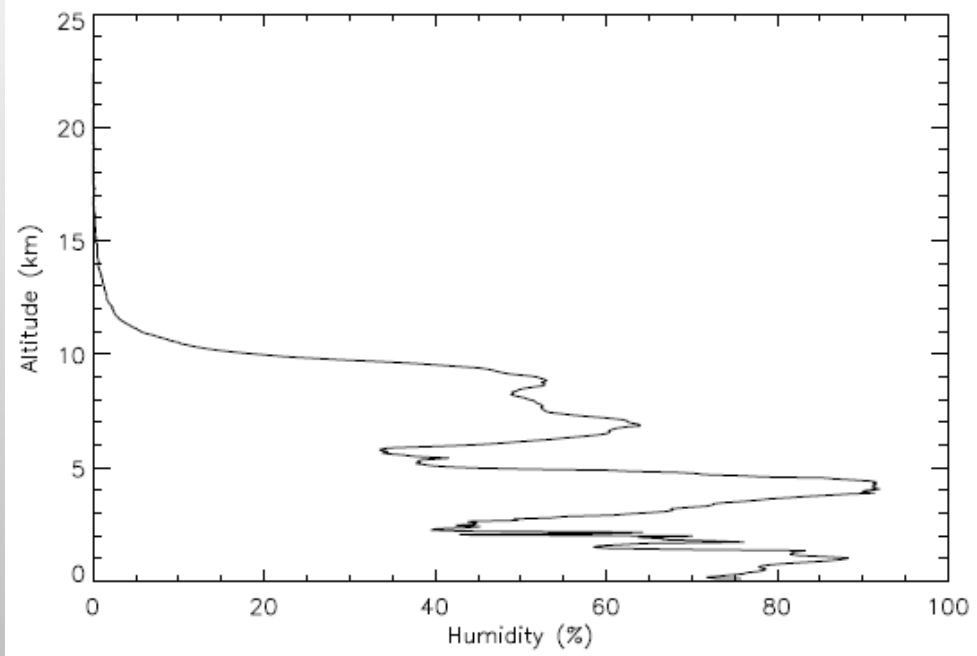
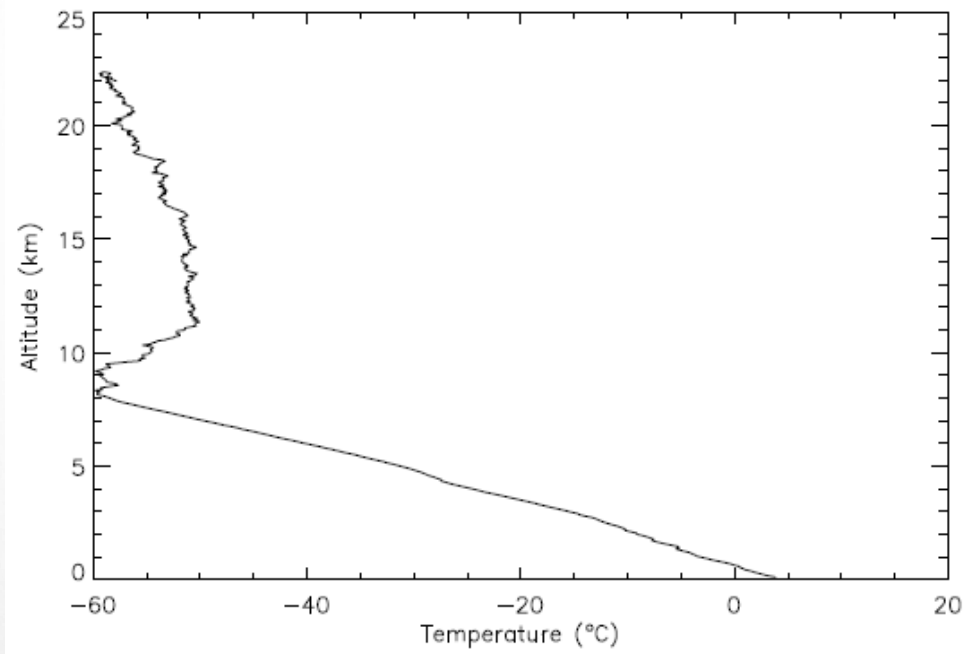


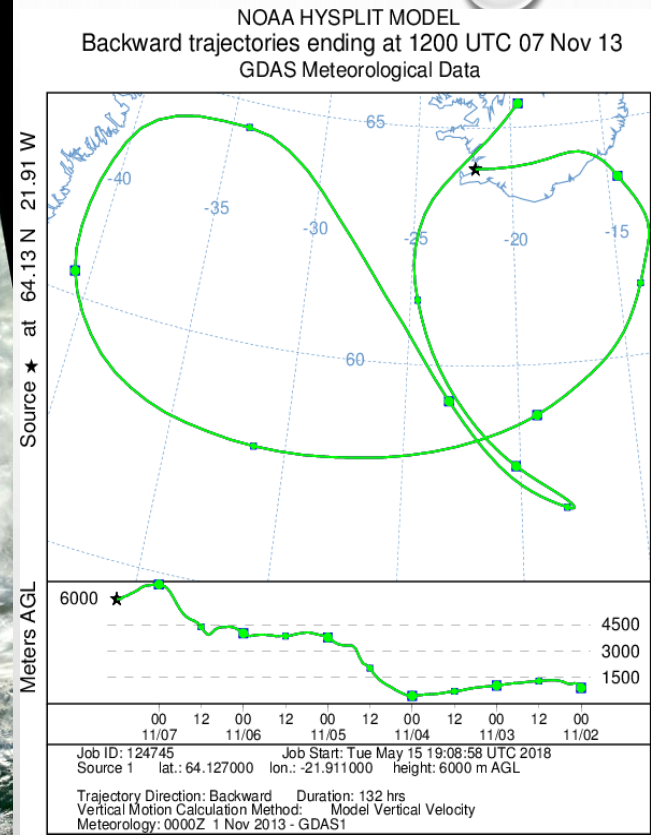
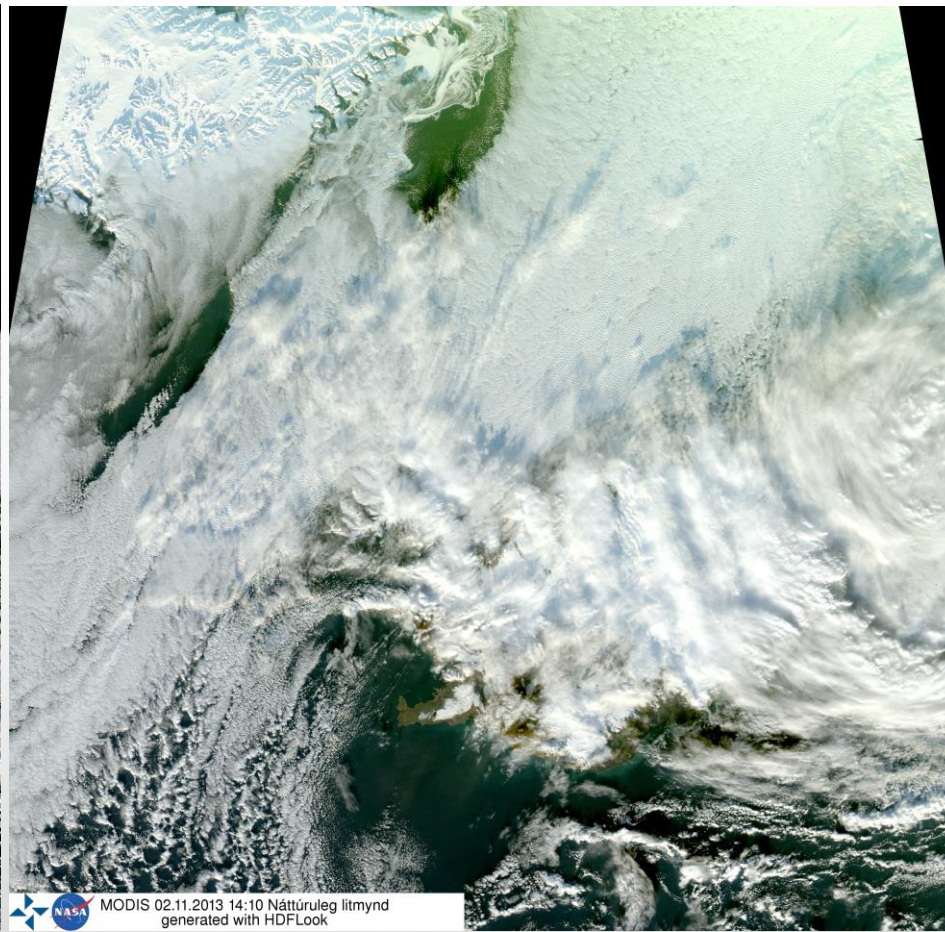
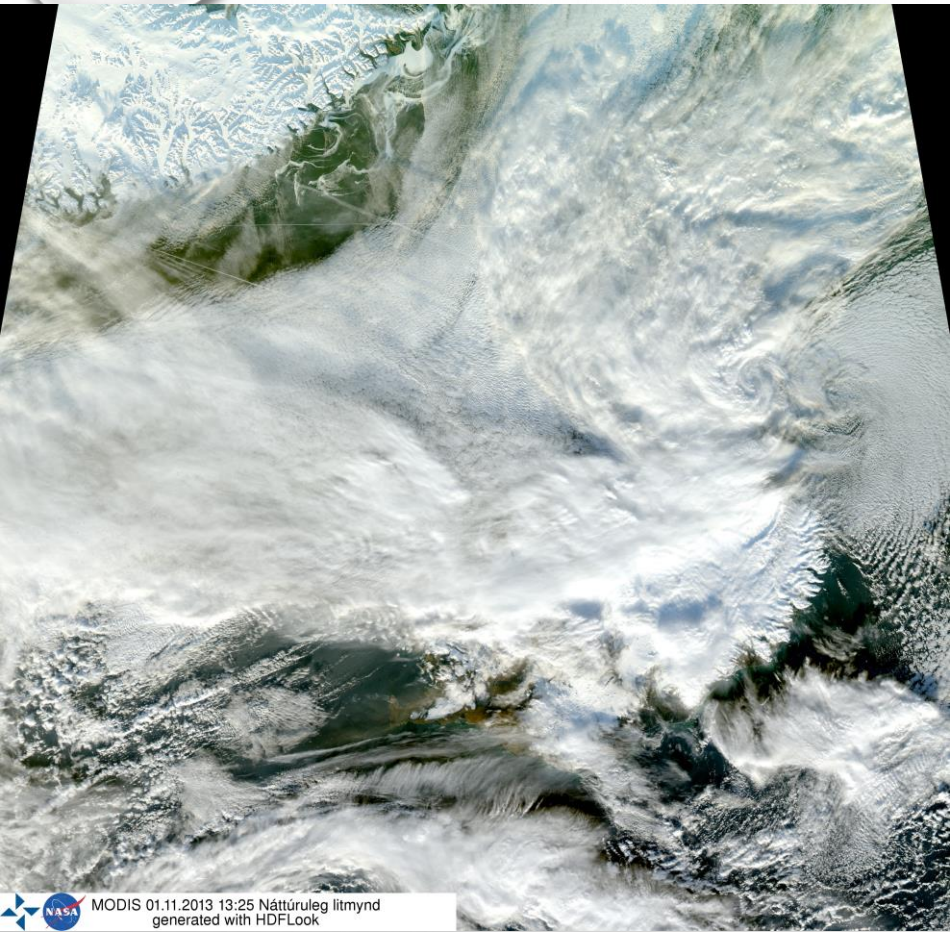
7 NOV 2013



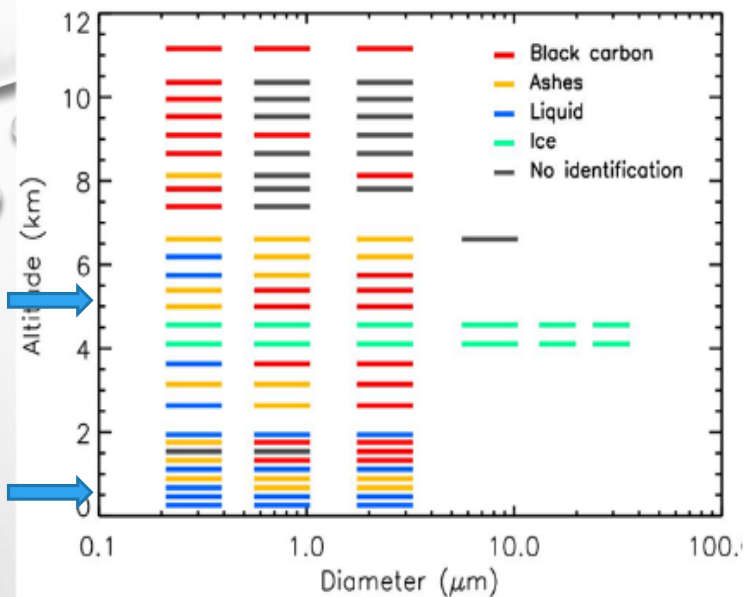
Surface wind 8 ms^{-1} , surface $\text{PM}_{10} > 100 \mu\text{g m}^{-3}$, mixed showers

- The number concentration exceeded $40 \text{ particles cm}^{-3}$ ($10 \mu\text{g m}^{-3}$) at altitude of 1 km
- Liquid particles at 500 m
- 4-5 km cloud
- Another dust layer at 6 km altitude

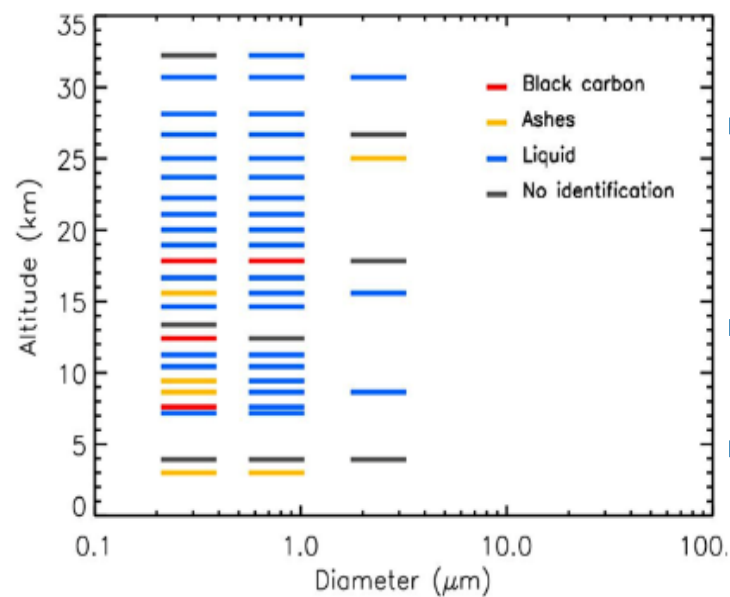




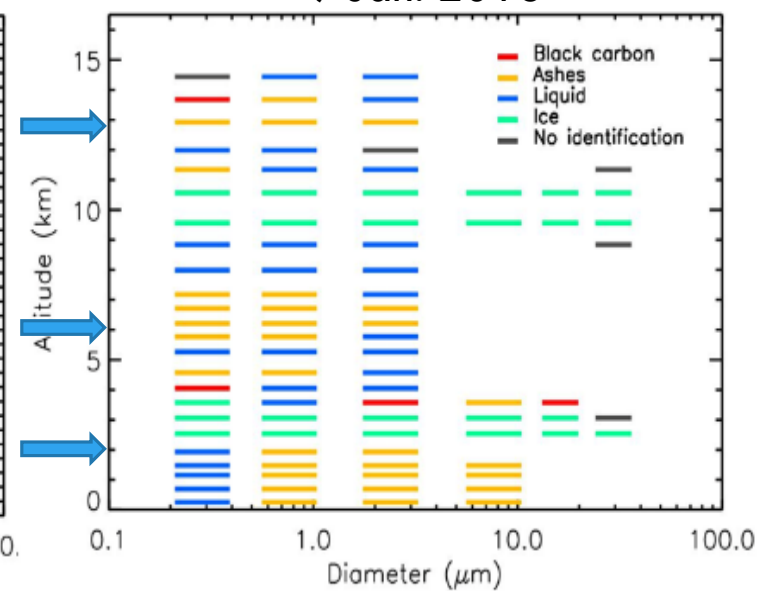
7 Nov. 2013



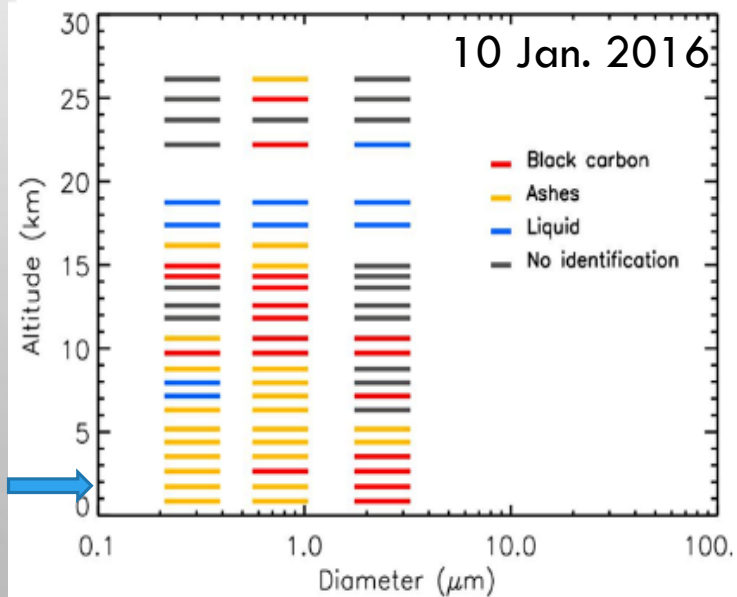
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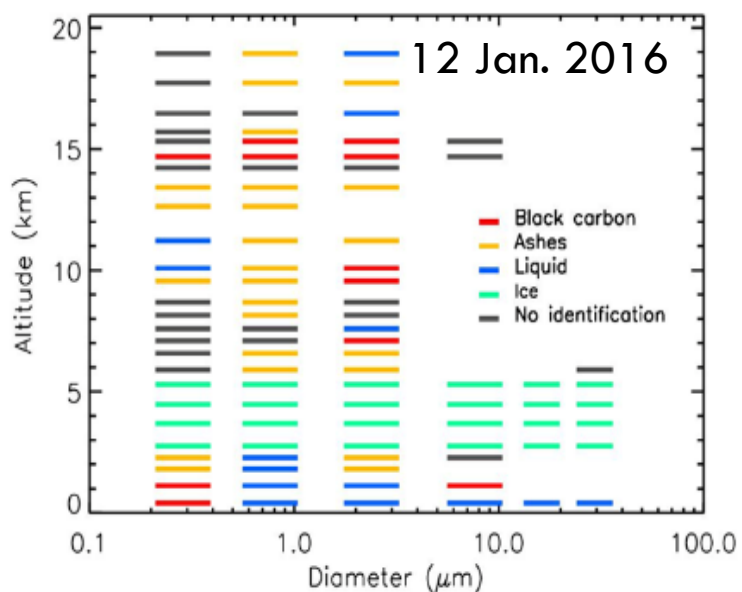
9 Jan. 2016



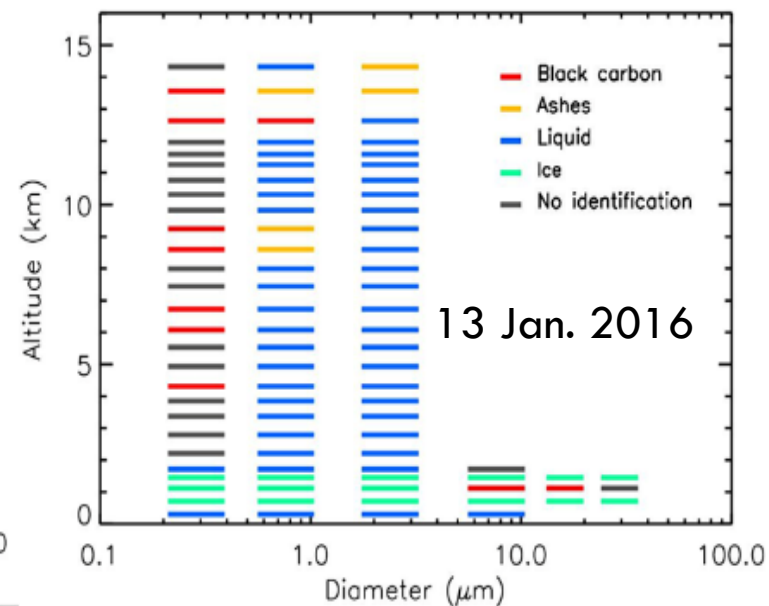
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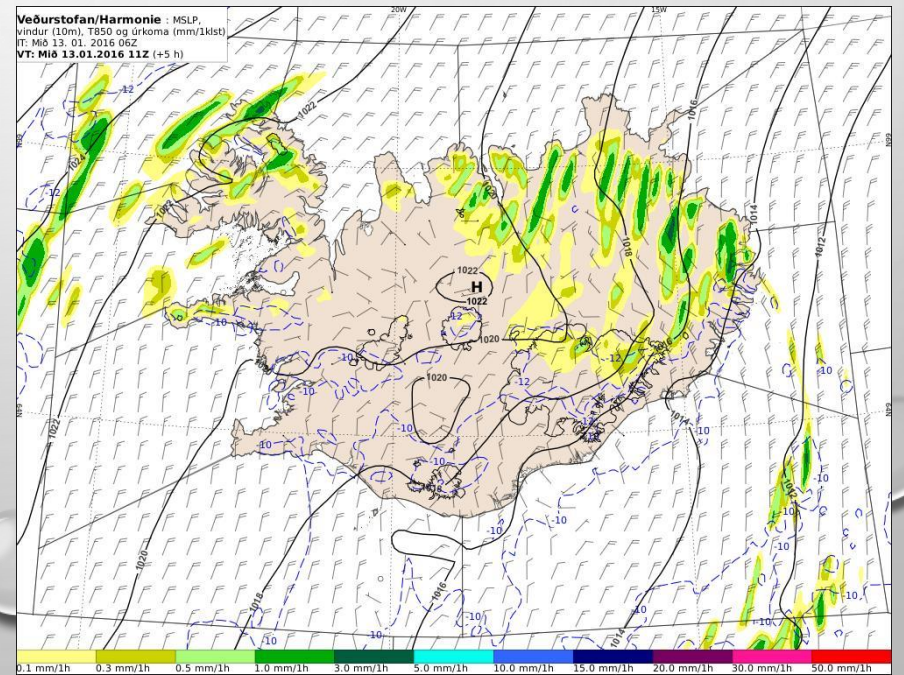
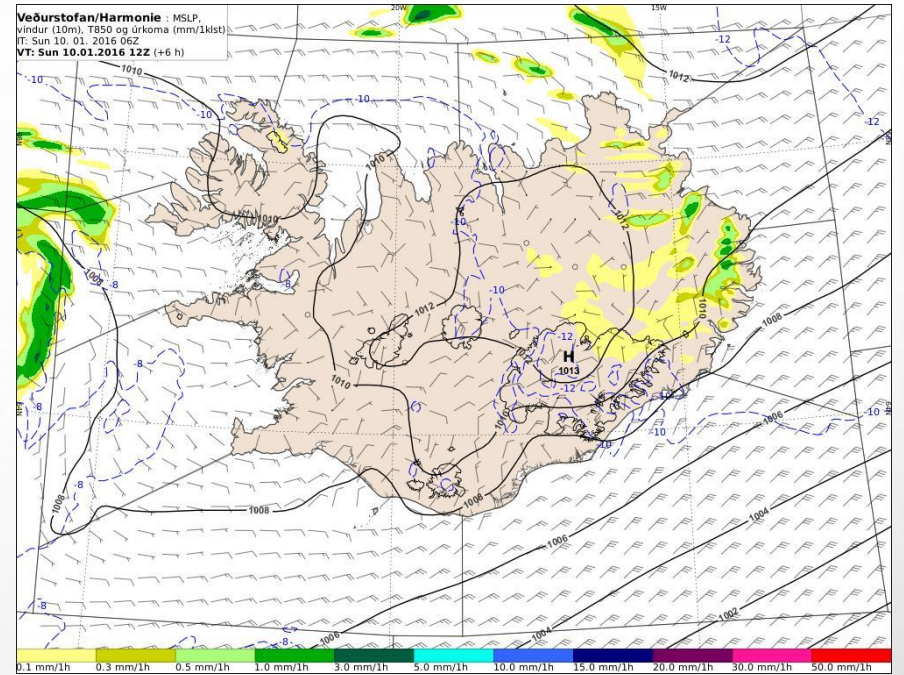


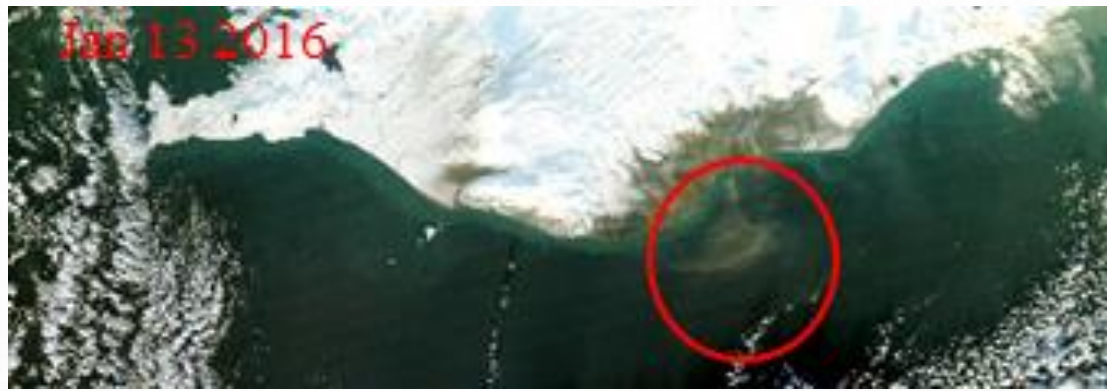
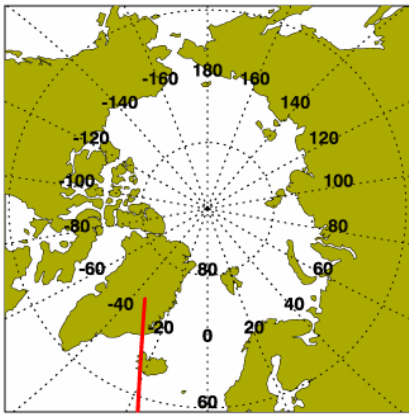
12 Jan. 2016



13 Jan. 2016

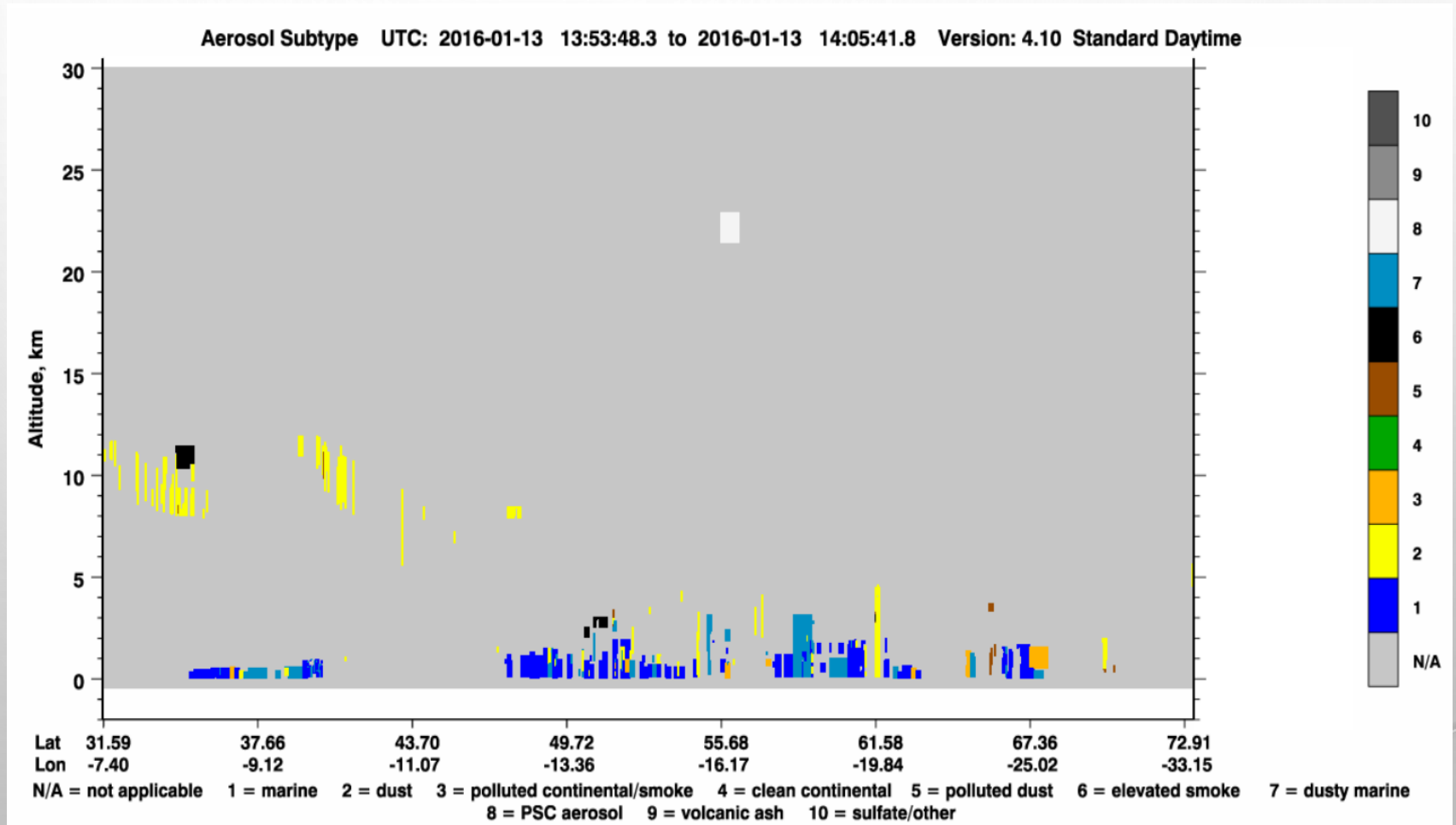






Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO)

Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) instrument that operates at two wavelengths (532 nm and 1064 nm)



Particle Number Concentrations

Clean profiles PNC < 5 particles cm⁻³ Clean Arctic conditions

Polluted profiles PNC > 250 particles cm⁻³ Dirty Saharan dust layer

Particle sizes

Surface	up to 20 μm
900 m	submicron + few 10 μm (or aggregates)
3,5 km	< 5 μm
6 km	submicron

CONCLUSIONS

- **WINTER DUST STORMS OCCUR FREQUENTLY AT HIGH LATITUDES SUCH AS ICELAND**
- **DUST SOURCES SUCH AS SEDIMENTS FROM JÖKULHLAUPS ARE IMPORTANT**
- **FIRST HIGH ALTITUDE VERTICAL AEROSOL DISTRIBUTION PROFILES IN ICELAND**
- **LOAC WORKED WELL IN HARSH CONDITIONS AND DURING MAX-LEVEL WIND SPEEDS FOR LUNCH**
- **VOLCANIC DUST IS FINE, OFTEN OF SUBMICRON SIZE**
- **DUST PROFILES IN ICELAND SHOWED SIMILAR CONCENTRATIONS AS MEASUREMENTS DURING SAHARAN DUST OUTBREAKS**

QUESTIONS – HOW COULD POLAR VORTEX AFFECT THE AEROSOL SIZE DISTRIBUTIONS?

- EFFECTS OF LOCAL TOPOGRAPHY ON DUST DETECTED IN HIGH ALTITUDES?

22-07-2017 21:29:54

Thank you for your attention!

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IPC

COMPARISON WITH LIDAR AND SUNPHOTOMETER MEASUREMENTS (LESS THAN A FEW TENS OF KM IN DIFFERENCE FOR THE LOCATIONS)

LOAC DATA CONVERTED TO EXTINCTION AT 350 NM (MINERAL PARTICLES $N=1.66+0.06i$), AND TO INTEGRATED VOLUME CONCENTRATIONS

GOOD AGREEMENTS

