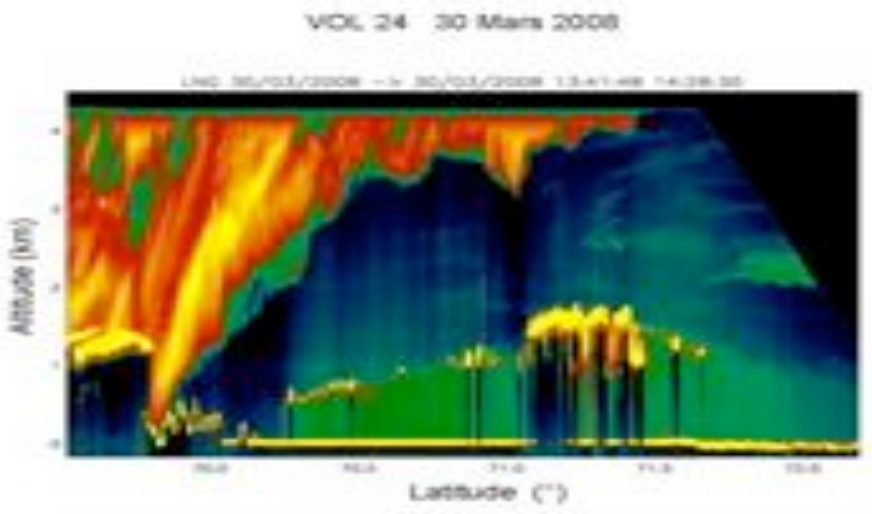
Airborne and Satellite aerosol data analysis: POLARCAT spring and YAK 2010/20



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POLARCAT SPRING LNG aerosol layer analysis for all the flights

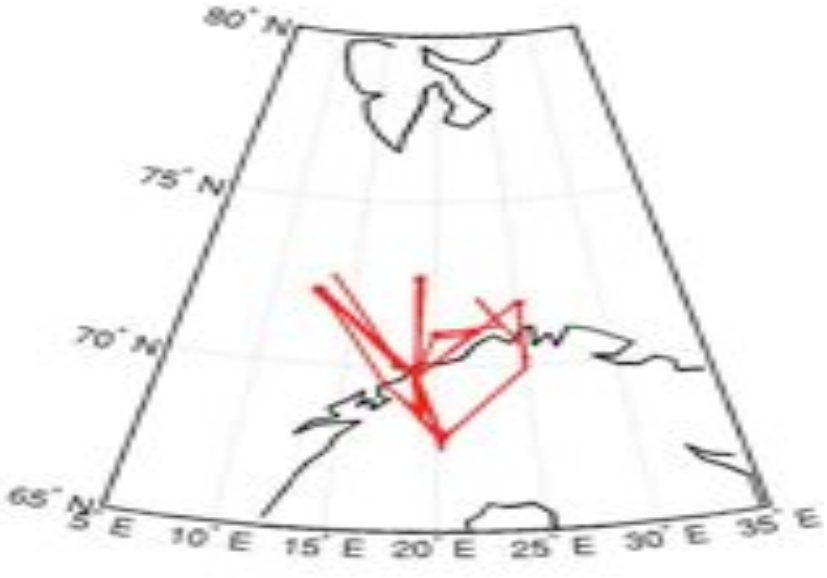
• cloud screening

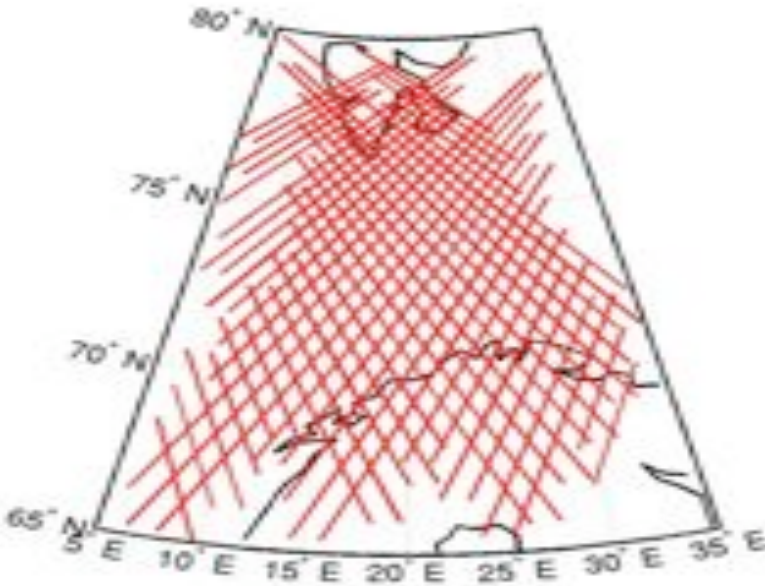
• 532 nm backscatter (aerosol concentration and scattering properties)

• 1064nm/532nm color ratio assuming weak aerosol
optical depth --> aerosol size (dust or aging of polluted aerosol)

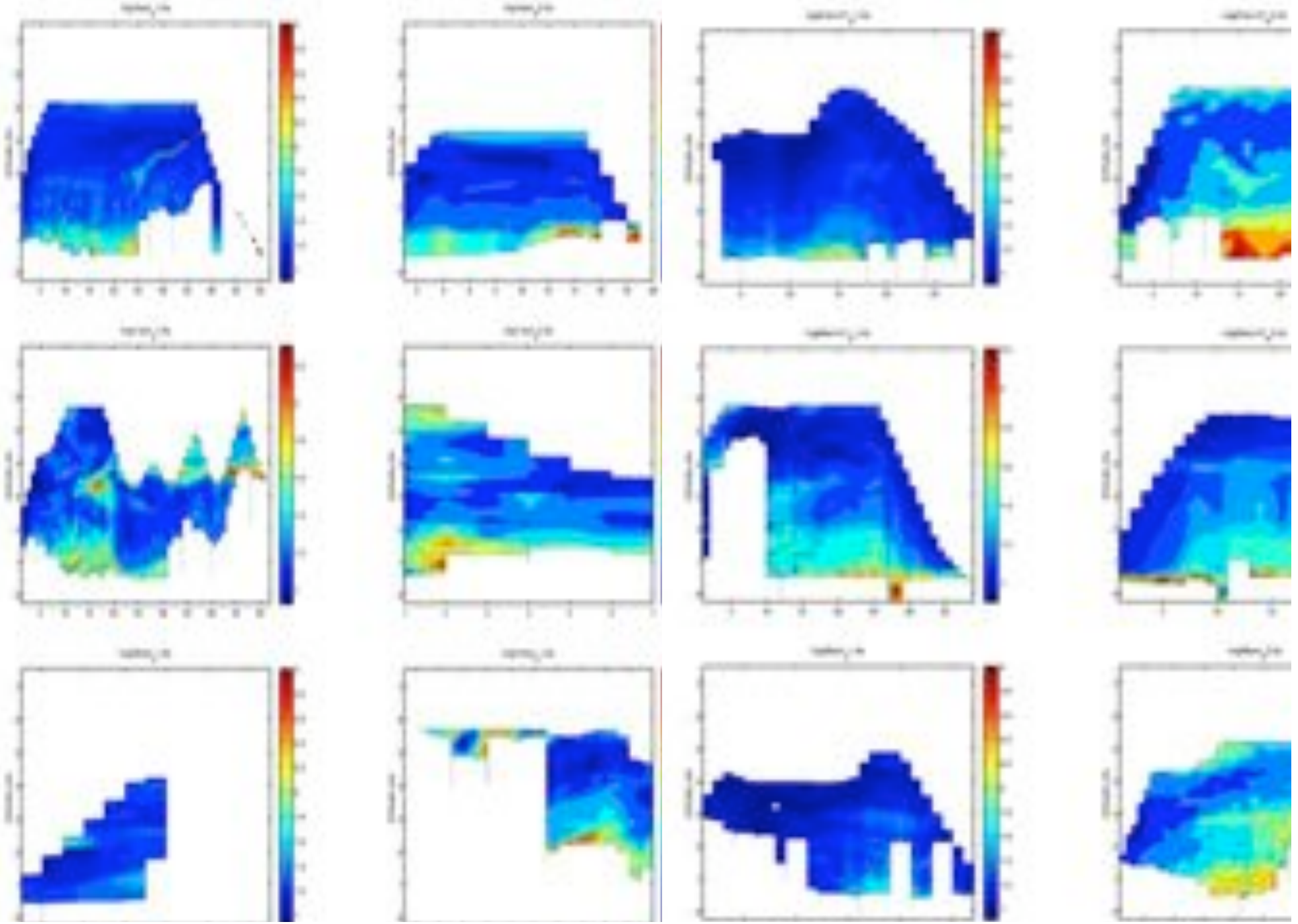
• 355 depolarization ratio --> presence of dust

→ **Comparison with CALIOP data for a 10 days period (March 31-April 11)**





Exemple of cross section of LNG scattering ratio 532 nm for the POLARCAT spring flig
With cloud screening

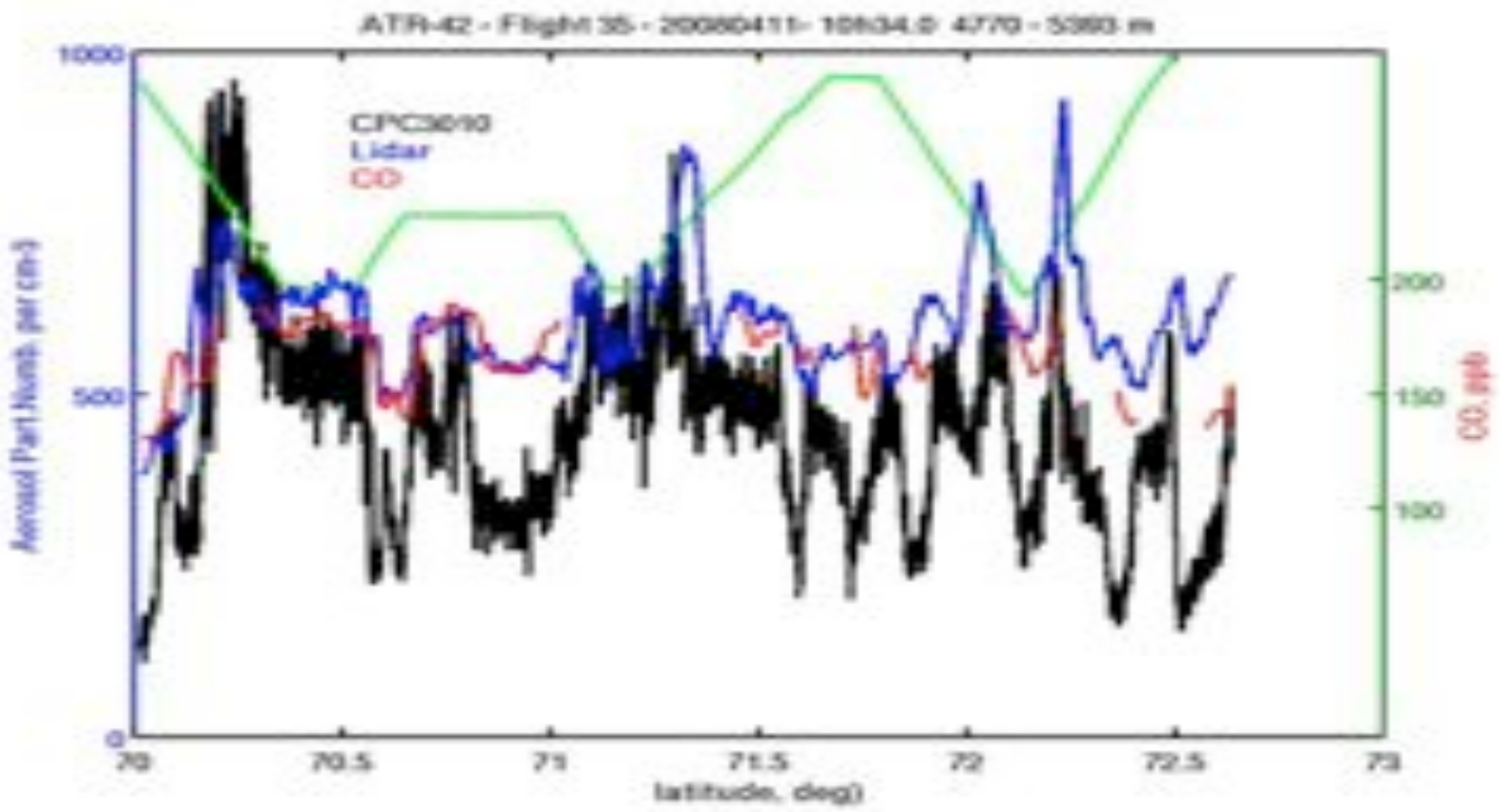


Comparaison données LNG et In-situ

Spectre aerosol: SMPS (20 – 467 nm, 88 canaux), GRIMM (0.1 -2 µm, 8 canaux)
PCASP (0.1-4 µm, 5 canaux) pas très fiable
Concentrations : CPC (D> 10 nm) ,CO

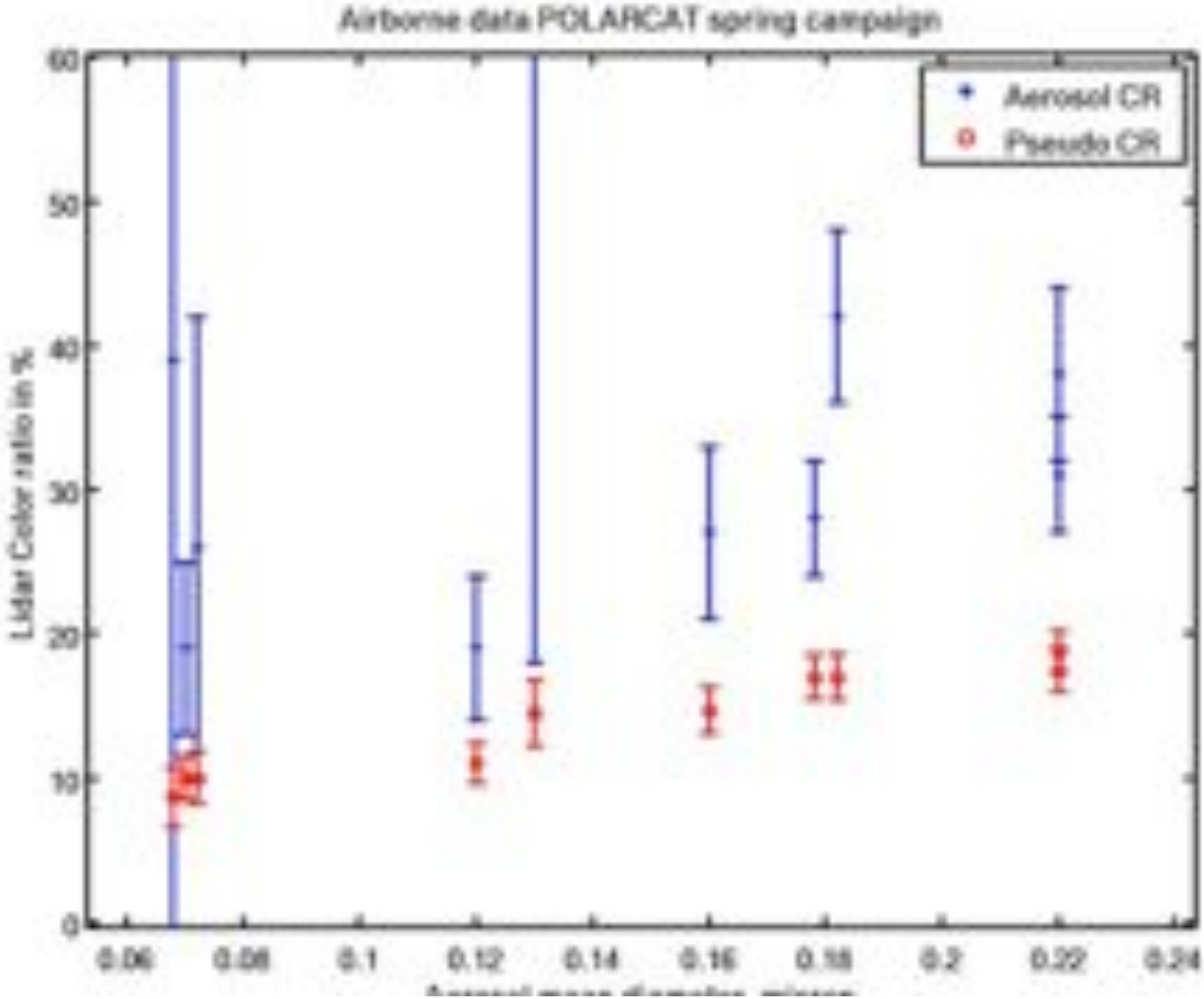
10 couches sur 6 vols avec coincidence

Exemple sur vol 35 comparaison b532 à z0-75m et CPC, CO



Backscatter color ratio (CR) and aerosol size

Airborne lidar pseudo color ratio and aerosol color ratios were compare
with in-situ airborne measurements of the aerosol spectrum (GRIMM +
SMPS



Methodology for the CALIOP analysis

Level 1 data total backscatter β reprocessing to optimize the analysis of the aero distribution in remote areas and complex aerosol mixture.

-Cloud filtering using the level 2 CALIOP cloud data with additional check to iden ambiguous cases (depolarization and color ratio of cloud layers, IR radiometer T12µm-T8µm) → more aerosol layer retrieved with this method

-No data considered below clouds -> next version estimation of attenuation by se transparent high altitude clouds

-Vertical (100 m) and horizontal averaging (80 km) of each profile

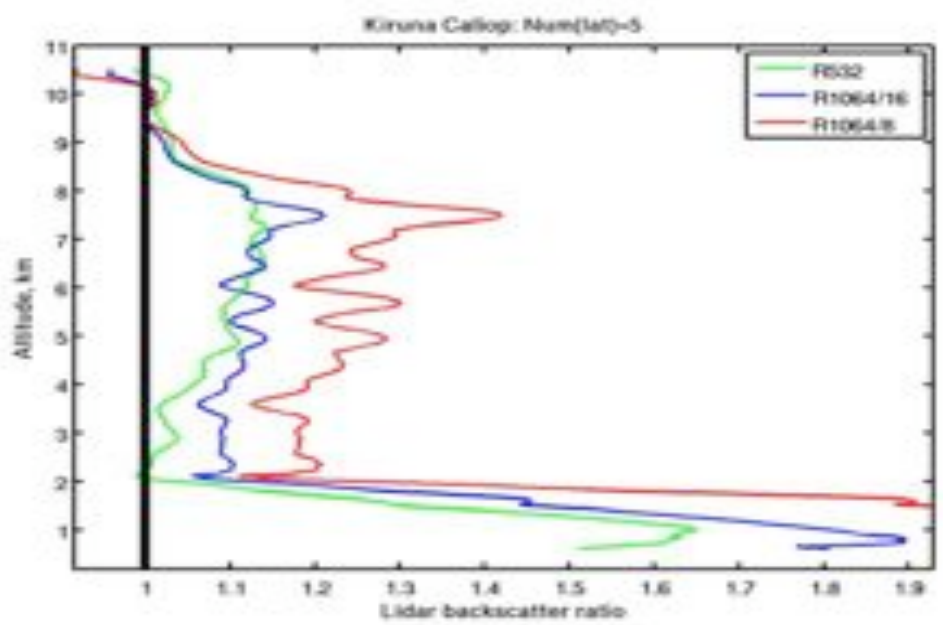
-10-day climatology for horizontal boxes of 100x100km

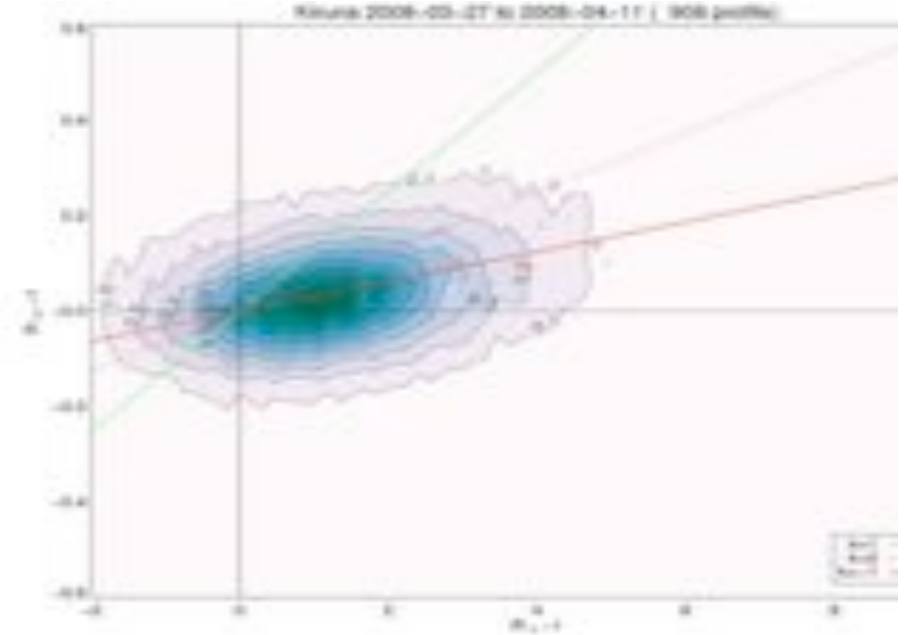
-Identify an overestimate of the IR signal calibration in the arctique (apply a correction

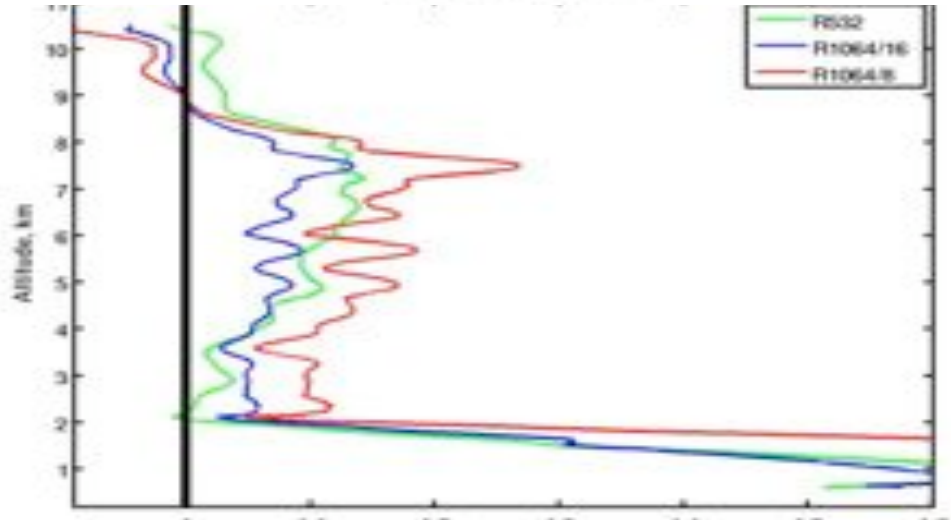
-Calculation of scattering ratios ($R=\beta/\beta_{Ray}$) at 532 nm and 1064 nm and color rati ($CR=\beta_{1.06}/\beta_{0.53}$, $Cr_a=\beta_{a1.06}/\beta_{a0.53}$)

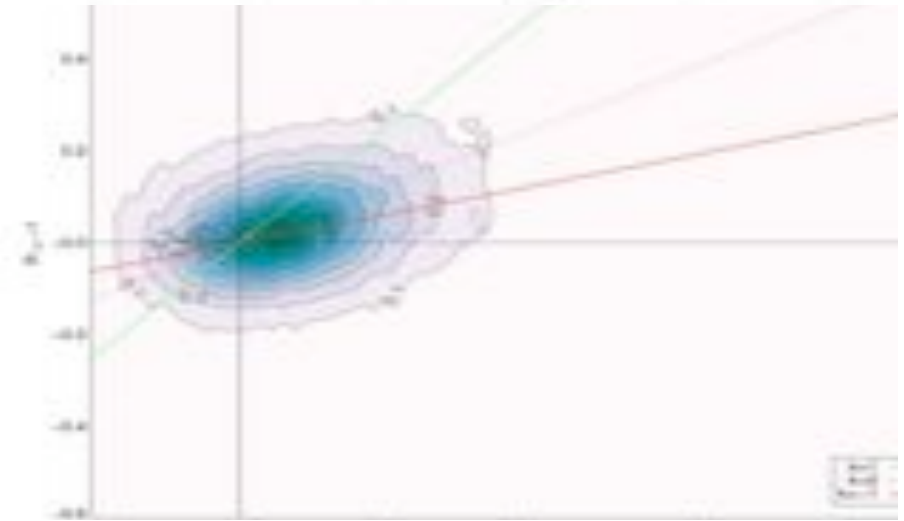
IR Calibration

IR Calibration done in operational CALIOP data assuming a cloud color of 1 on cirrus clouds when available on the orbit. It is recognized that it uncertain especially at high latitudes (Vaughan et al. 2012)



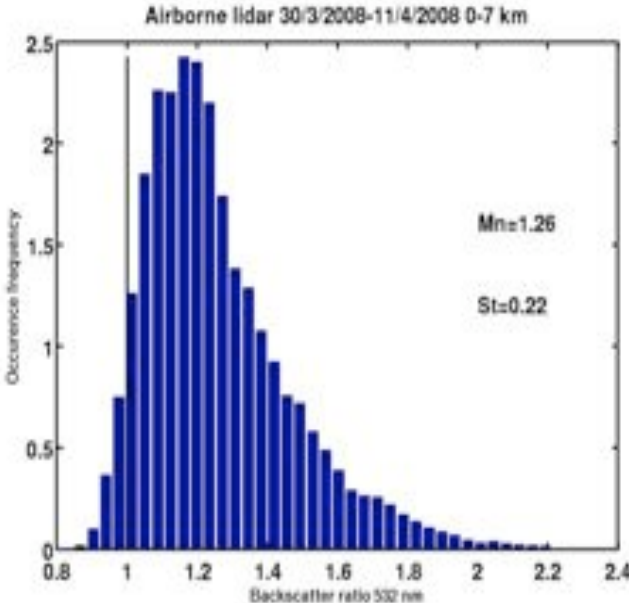


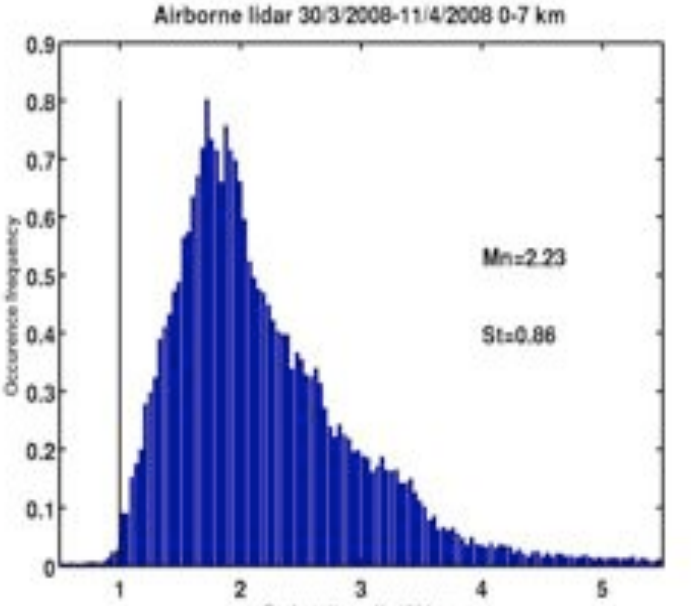


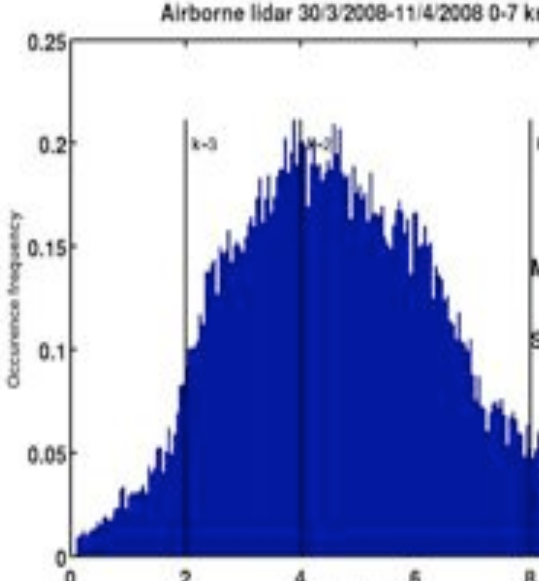


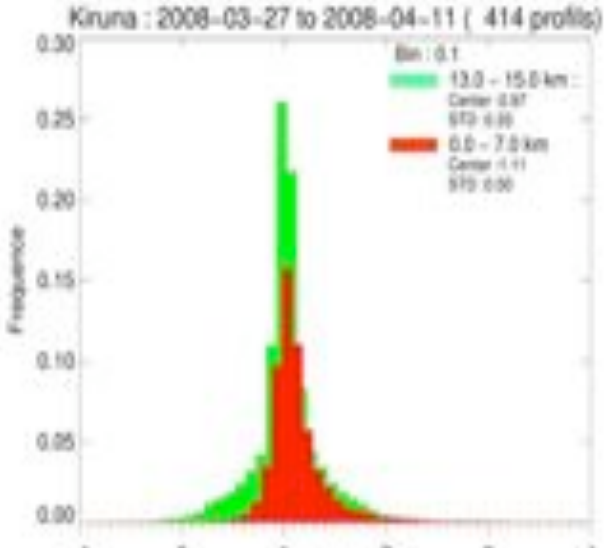
Range of CALIOP aerosol observations in the Arctic: polarcat spring airborne campaign in April 2008

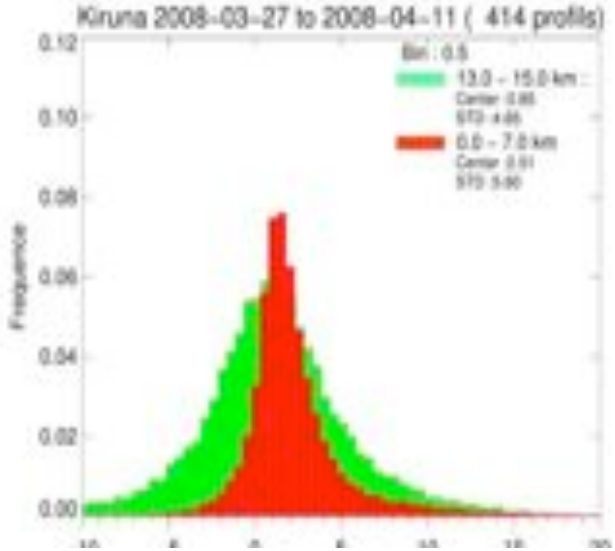
Caliop 532, 1064 nm and color ratio are compared with airborne lidar observations in spring 2008 over Scandinavia

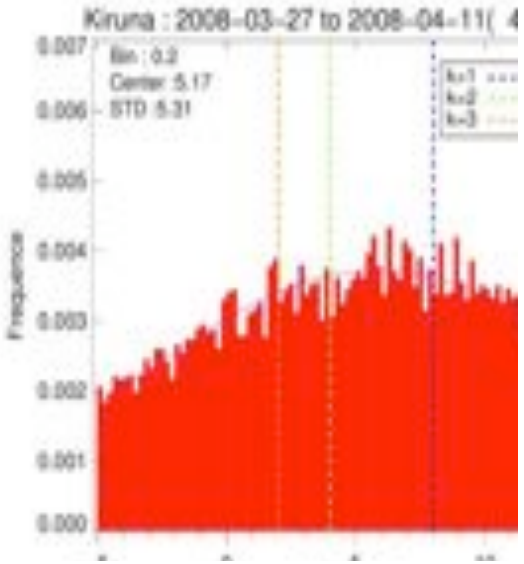






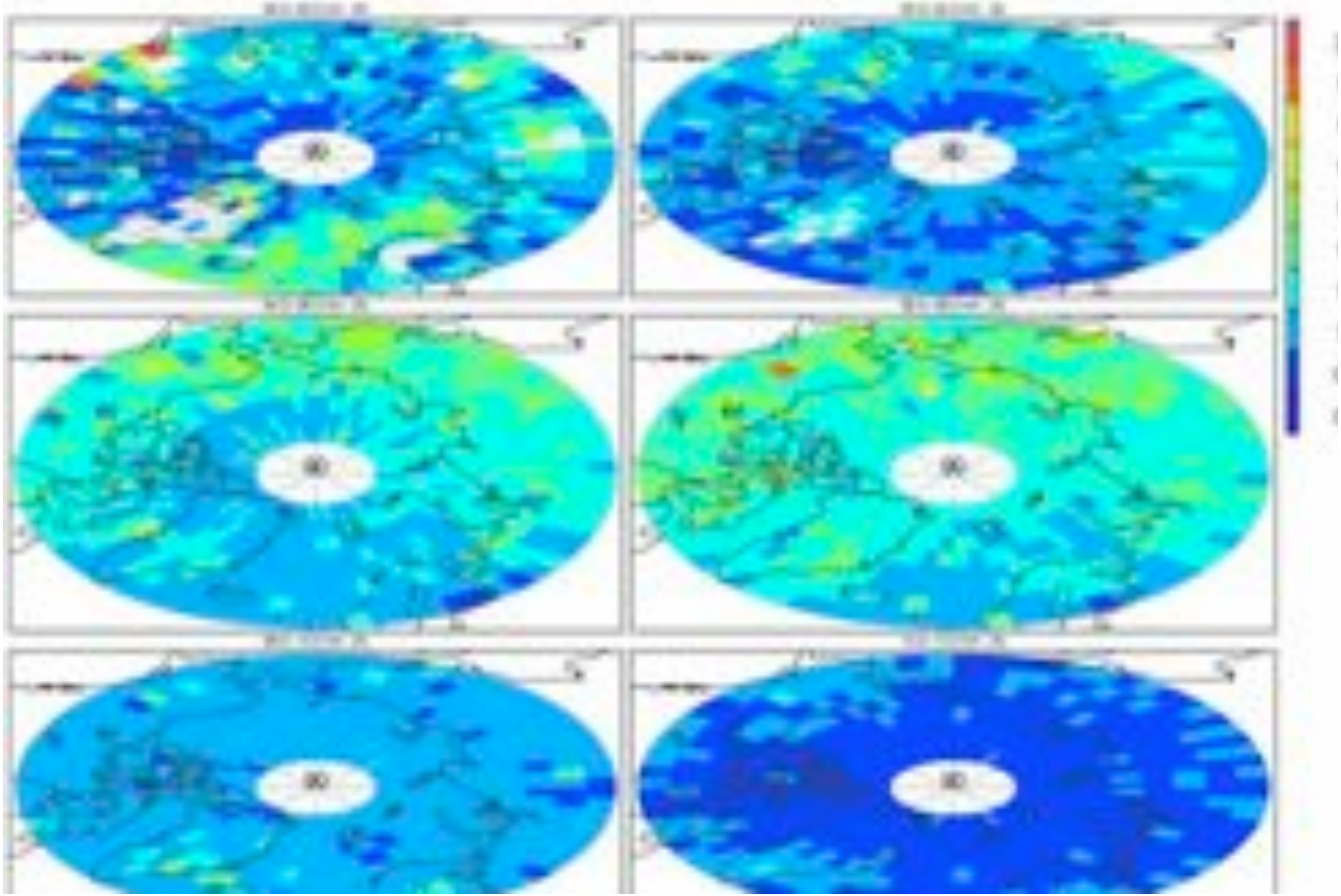






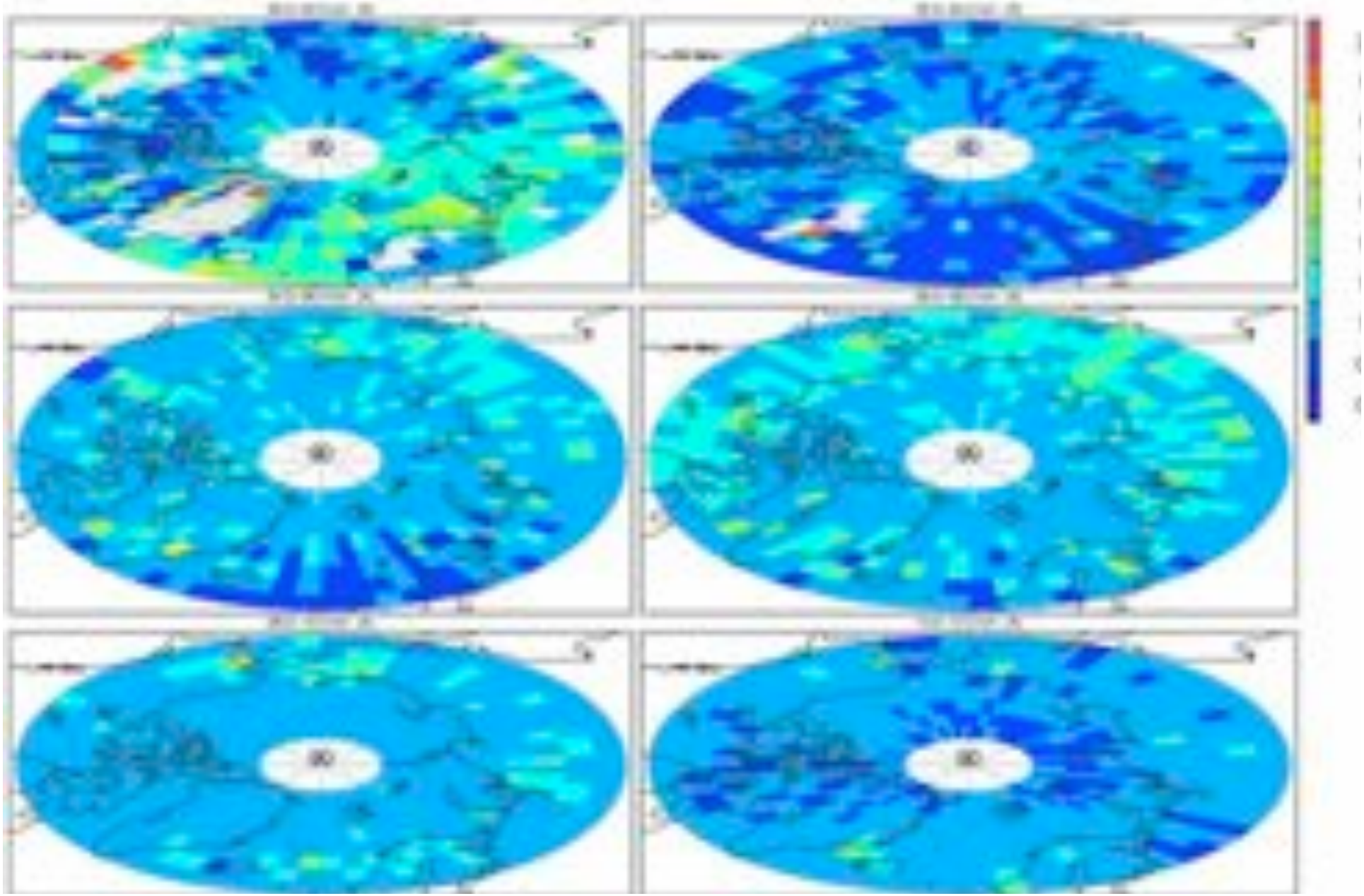
Regional distribution of the aerosol in the Arctic in April 20

Distribution of R_{532} scattering ratio: significant enhancement over European Arcti
the lower levels but over Siberia in the mid-troposphere (4-8 km)



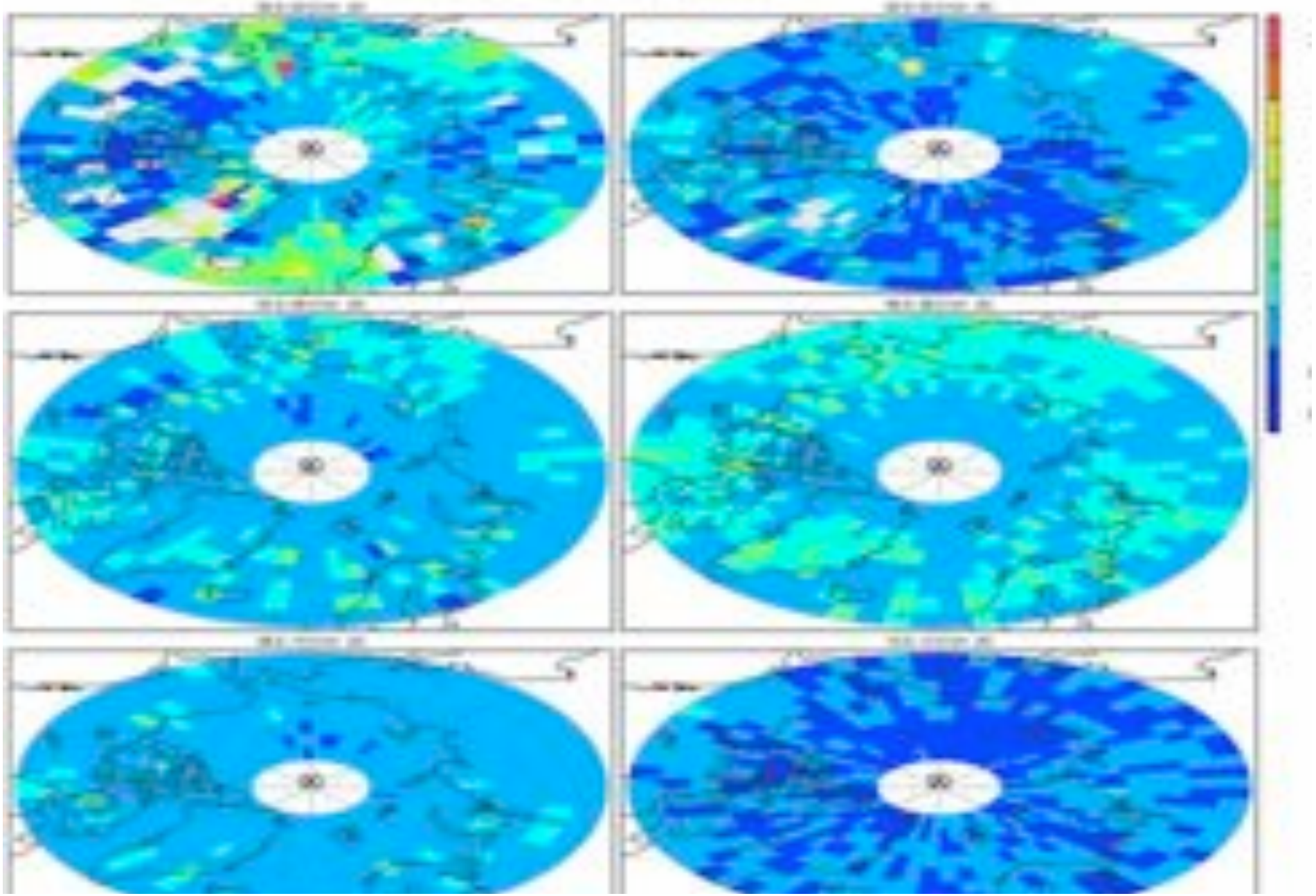
Regional distribution of the aerosol in the Arctic in April 20

Distribution similar to 2008 over the Atlantic ocean but less aerosol in mid troposp
between 4 and 8 km

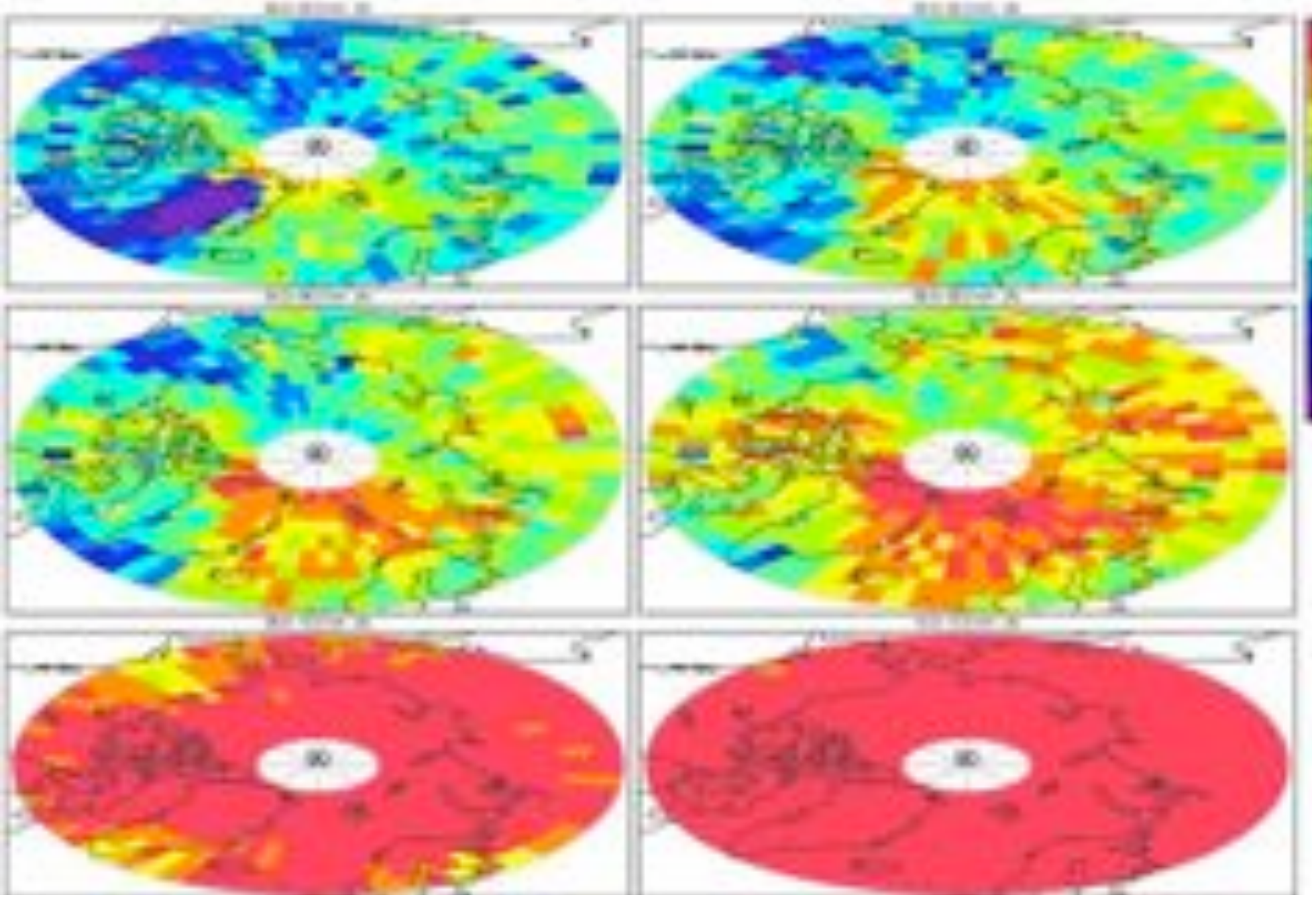


Regional distribution of the aerosol in the Arctic in April 20

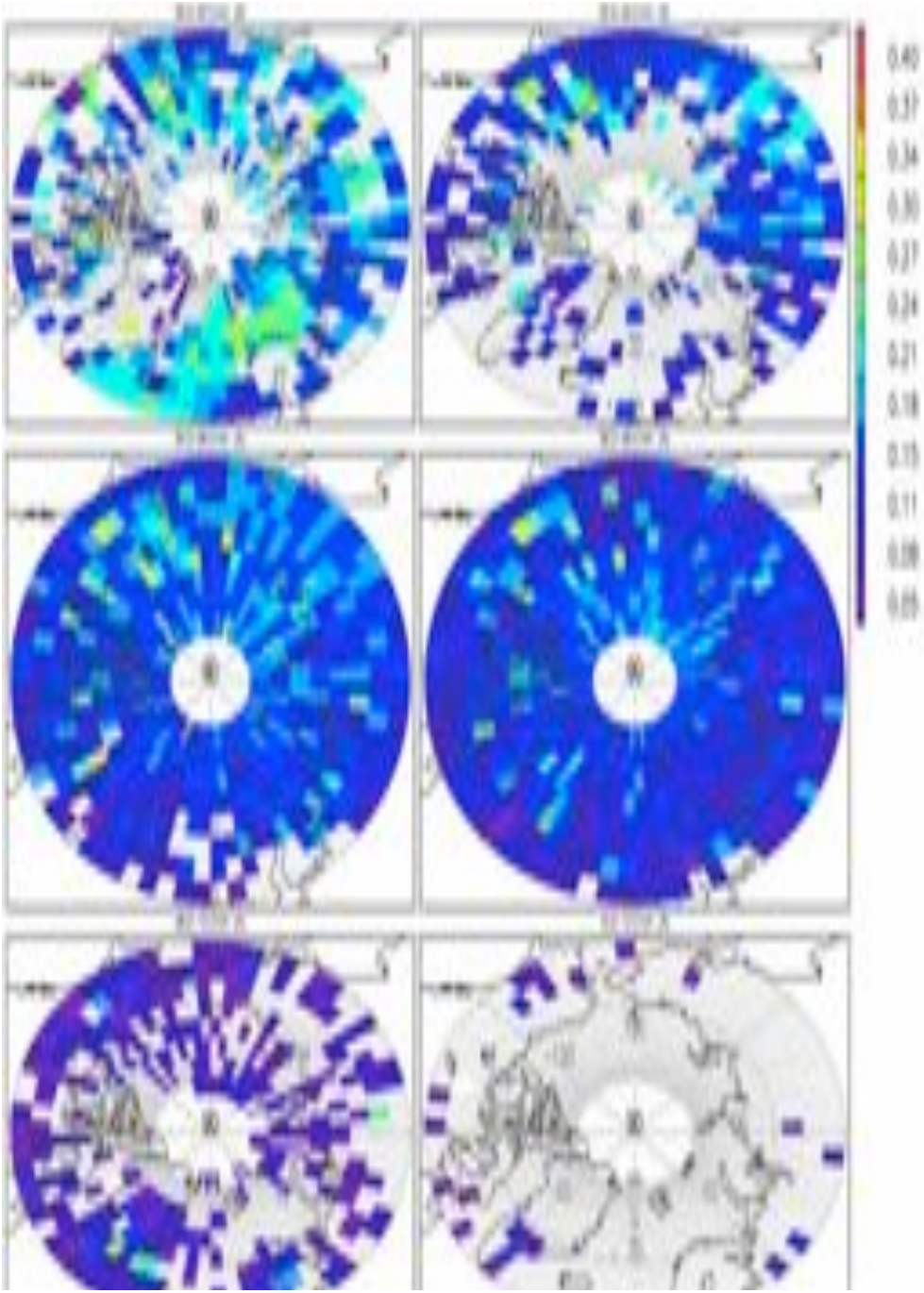
Distribution similar to 2009 but even less aerosol in mid troposphere between 4 a
km especially over Siberia



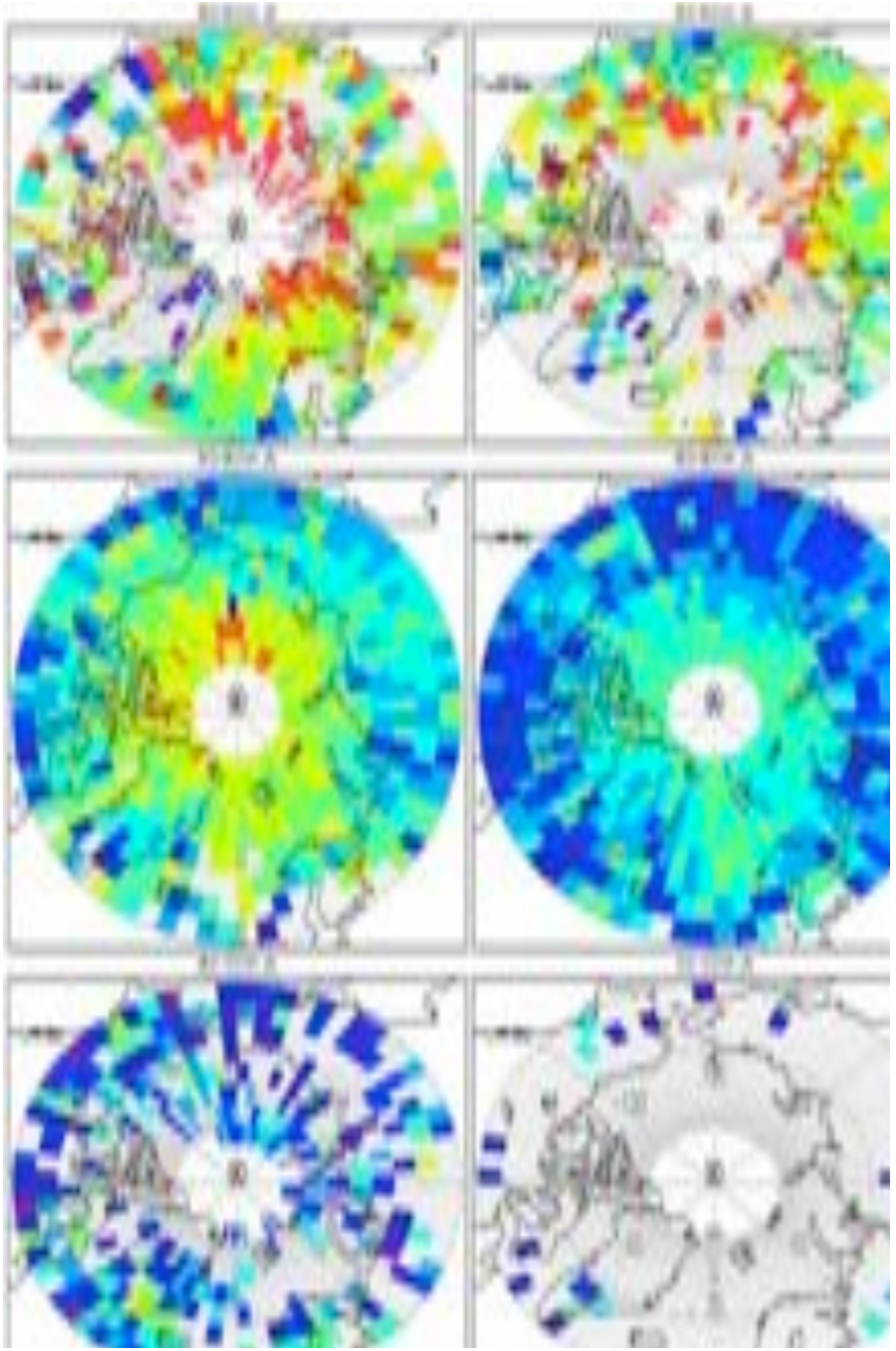
Fraction of possible observations for the 850 profils: impact of cloudiness



Pseudo Color ratio (depends on scatt.Ratio)



Aerosol Color Ratio (noisy when scatt Ratio too weak)



YAK flights using CALIPSO observations: Methodology

- Trajectory calculation using FLEXTRA

- Selection of the best matches with calipso orbits

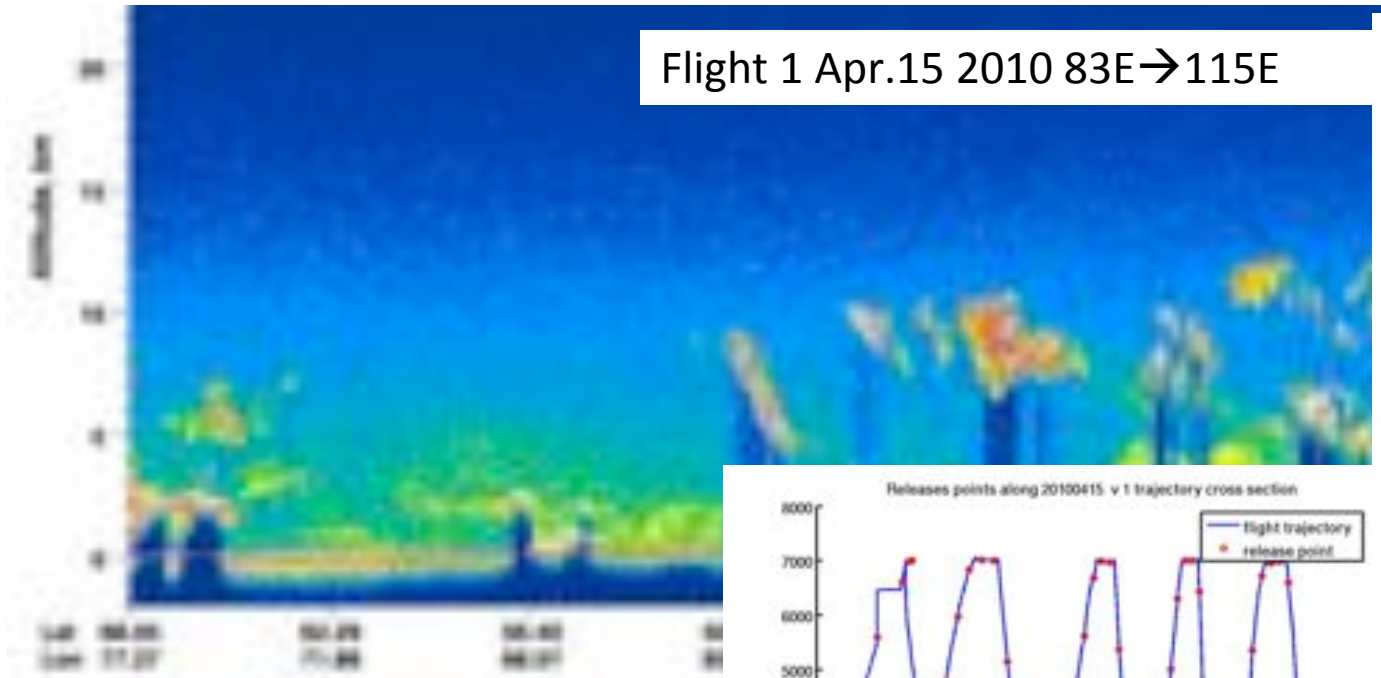
-Lagrangian analysis

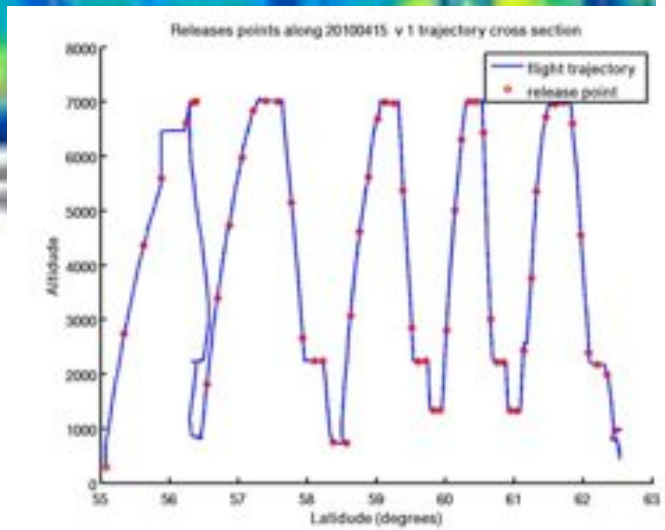
-CALIOP validation

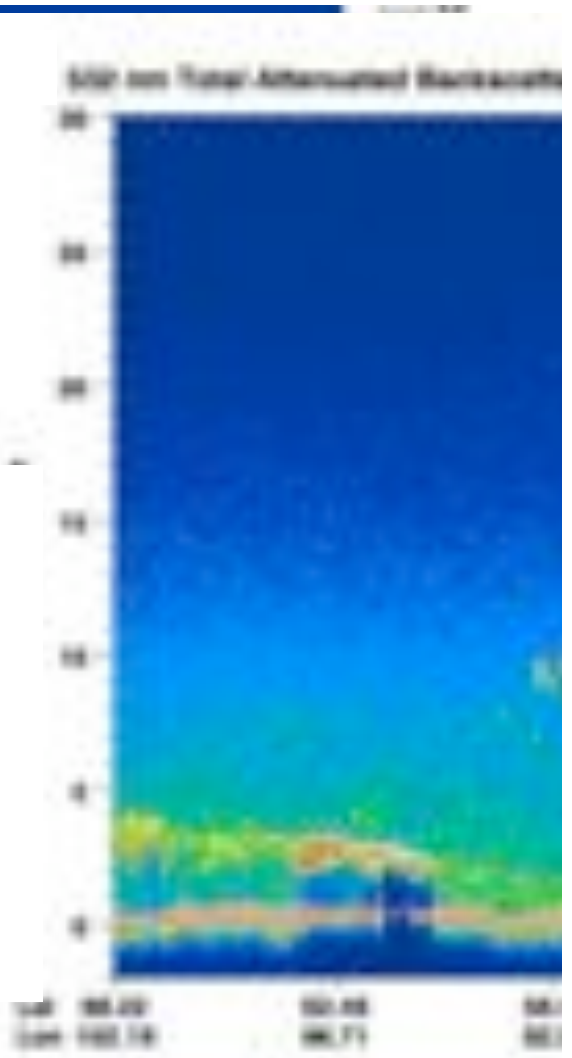
Some examples of CALIOP track identification with the YAK -2010 campaign

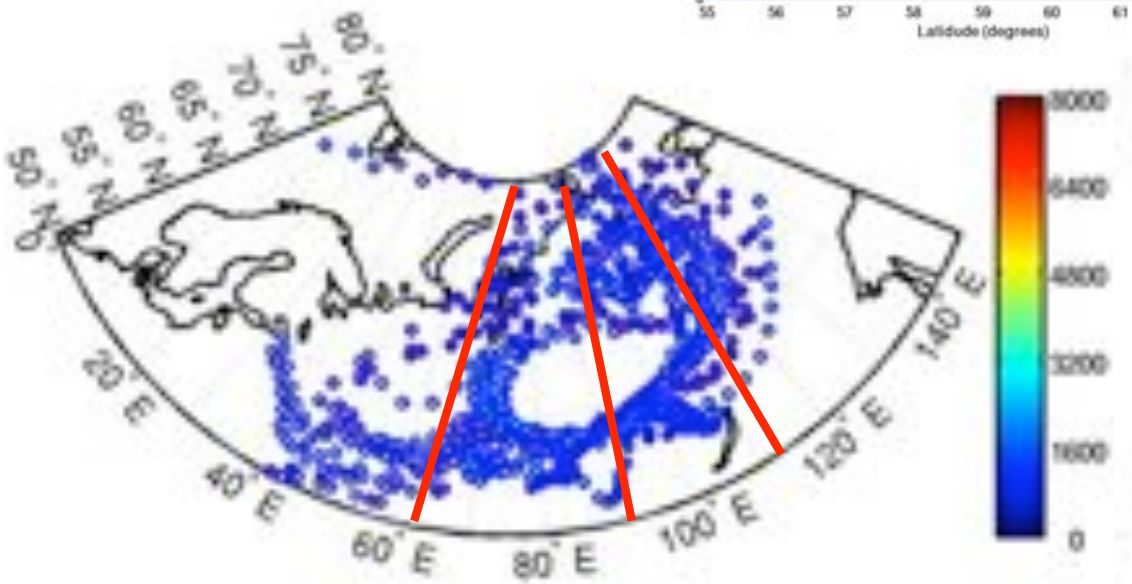
but to be done with 2008 and 2012 where aerosol data are available

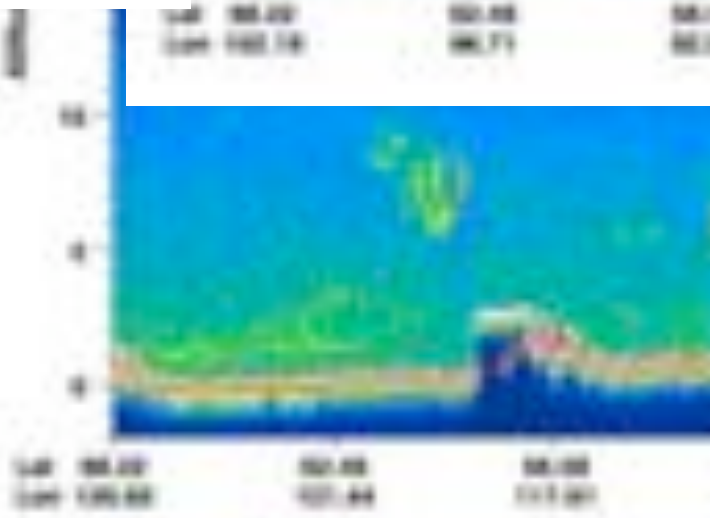
Flight 1 Apr.15 2010 83E→115E





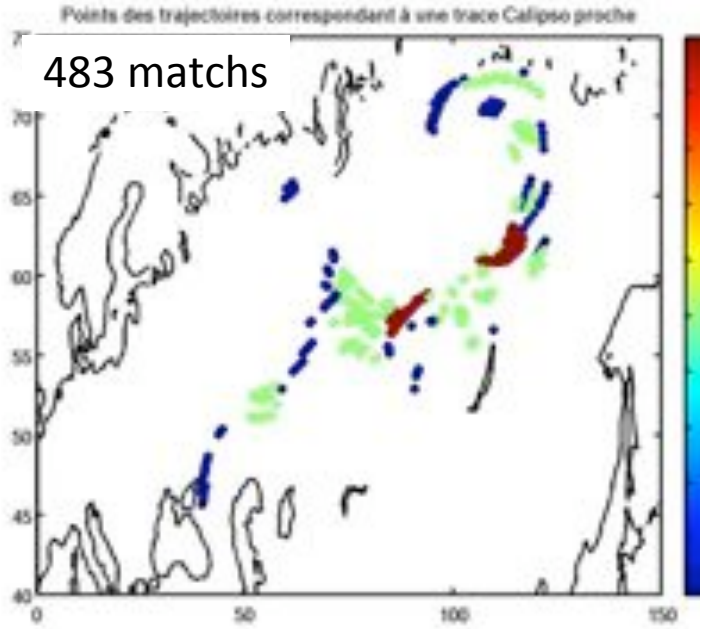


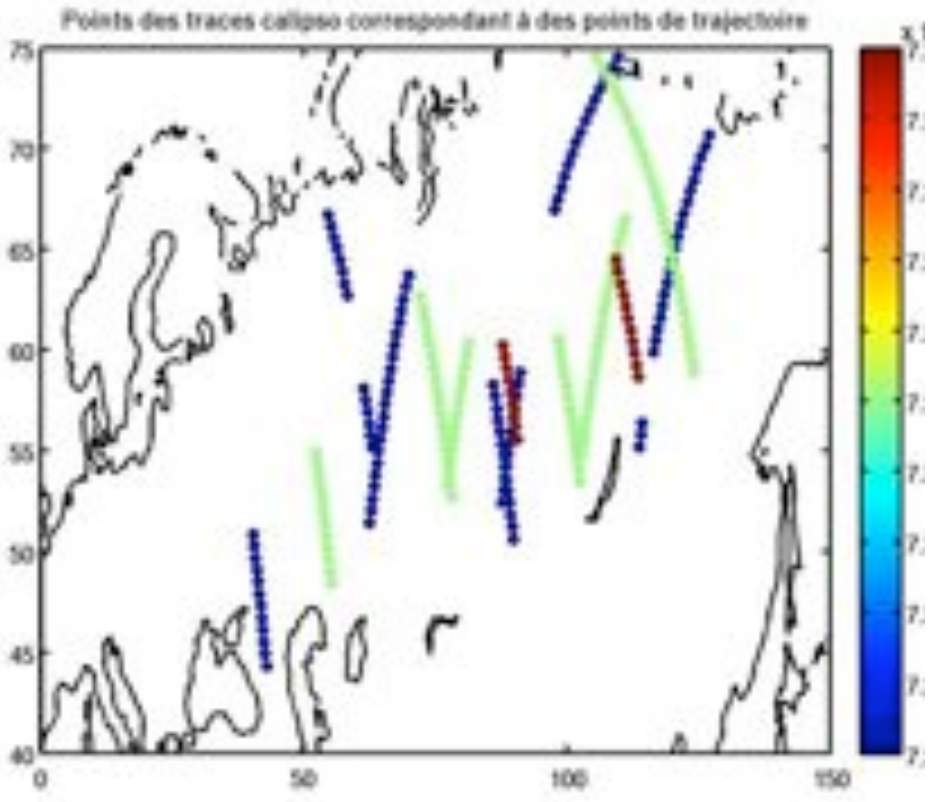


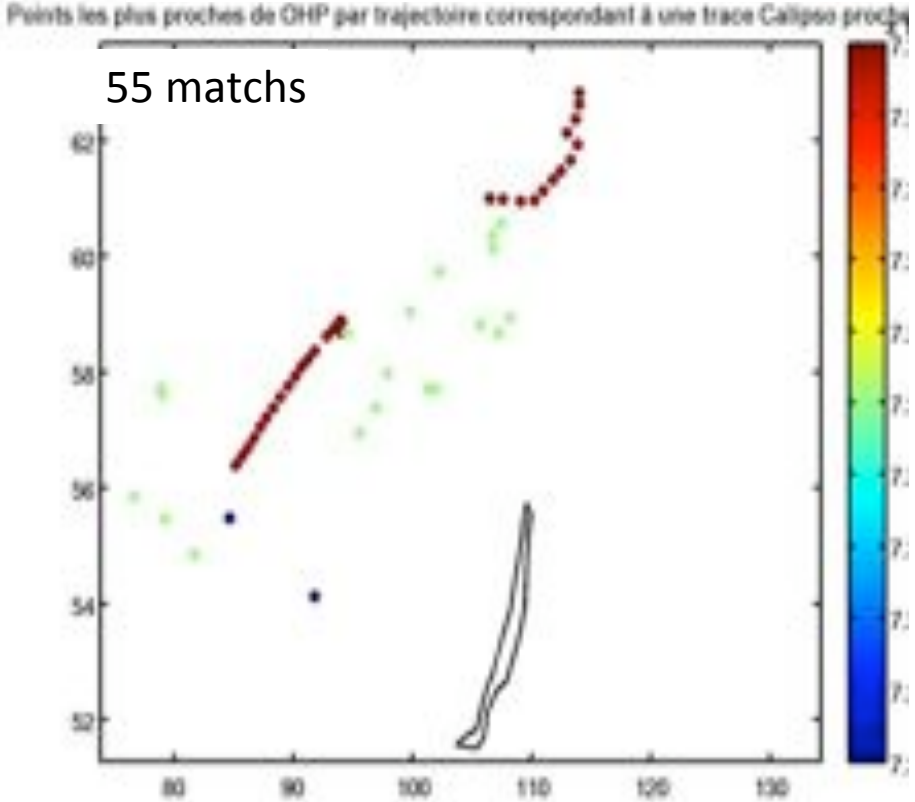


Selection of Calipso orbits for flight YAK 2010: Apr. 15

Selection of air masses with dt=2 hours and dx=300 km for the 55 trajectories calculated along the flight track







Analysis of IAO, TOMSK aerosol Lidar data:

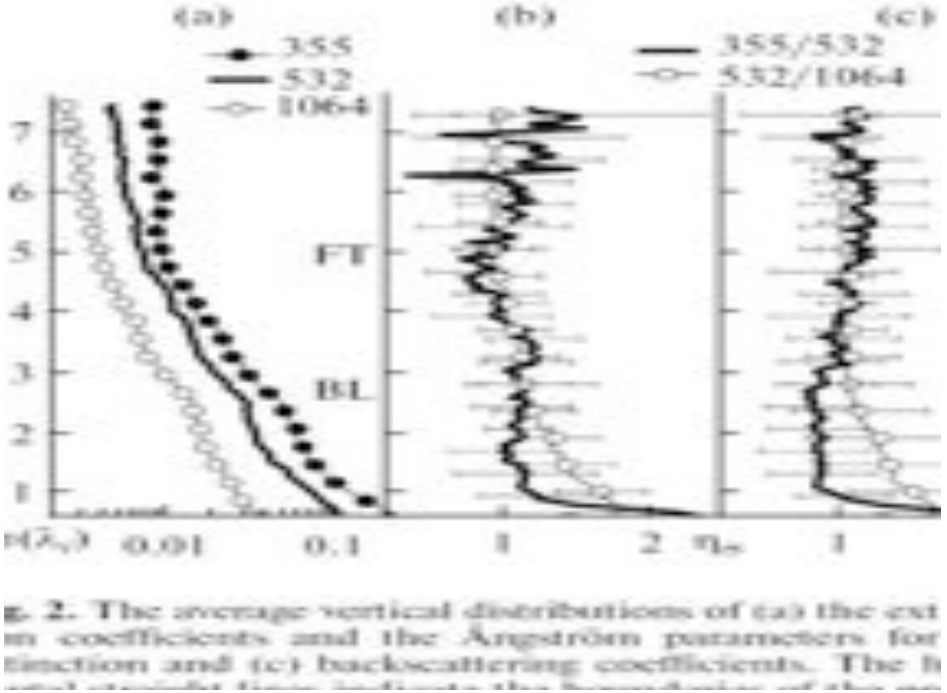
Workshop with Russian IAO team in Paris Oct. 2012

-Comparison caliop/ground based lidar
-Source apportionment for IAO lidar data (2010/2012) with Lagrangian analysis (trajectory+CALIOP)
-Installation of a new IR microlidar in TOMSK

List of lidar (LOSA-S) measurement in TOMSK (56.47N, 85.05E)

Year 2010-2011.

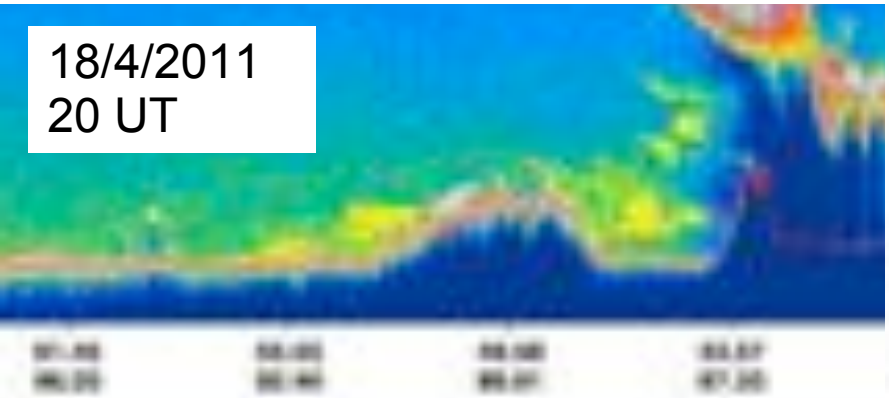
Year	Month	Day	Time (UTC)	
			begin	end
2010	03	25	06:37	08:17
2010	03	30	03:40	04:45
2010	04	05	06:56	07:49
2010	04	06	10:16	11:05
2010	04	07	03:50	11:33
2010	04	08	07:07	08:30
2010	04	09	03:50	10:34
2010	04	13	10:00	12:40
2010	04	14	06:10	11:36
2010	04	15	07:08	09:25
2010	04	23	10:13	11:15
2010	04	26	10:24	11:20
2010	04	27	04:24	10:56
2010	04	28	15:07	16:14
2010	04	29	02:40	11:50
2010	05	04	12:05	16:50
2010	05	05	08:50	10:30
2010	05	07	07:54	08:50
2010	05	13	07:23	08:20
2010	05	25	10:01	11:29

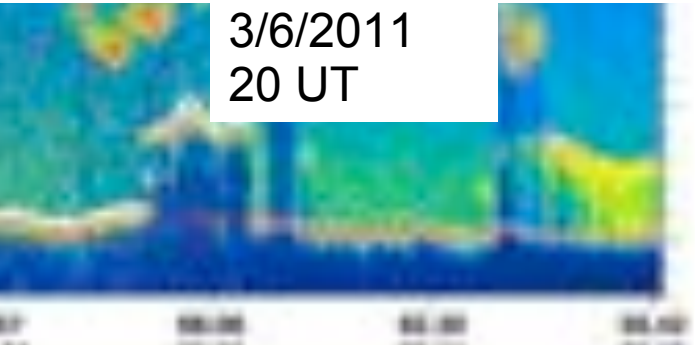


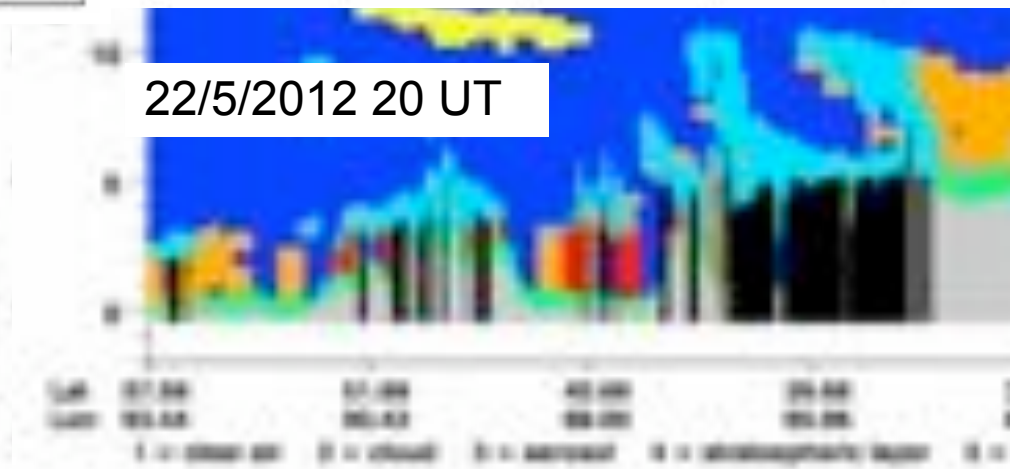
g. 2. The average vertical distributions of (a) the ext
n coefficients and the Angström parameters for
tinction and (c) backscattering coefficients. The h

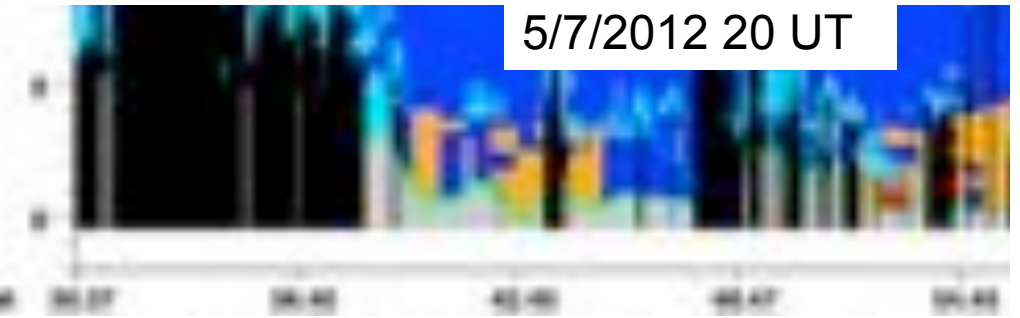
Year	Month	Day	Time (UTC)	
			begin	end
2011	04	18	14:00	16:55
2011	04	19	14:30	17:15
2011	05	12	04:04	19:04
2011	05	13	02:59	06:55
2011	05	19	02:28	18:35
2011	05	20	01:54	08:42
2011	05	25	11:24	14:10
2011	05	31	00:08	18:25
2011	06	02	08:00	20:40
2011	06	03	00:01	19:40

Year	Month	Day	Time (UTC)	
			begin	end
2012	05	14	14:27	21:55
2012	05	20	15:58	21:33
2012	05	22	16:10	20:49
2012	05	26	17:10	19:05
2012	05	29	04:05	23:59
2012	05	30	00:00	19:30
2012	06	02	08:00	19:45
2012	06	03	00:05	19:40
2012	06	10	16:42	19:55
2012	06	28	06:20	08:15
2012	06	28	16:58	21:40
2012	07	05	06:40	09:30
2012	07	05	17:20	21:50
2012	07	06	03:28	07:10









Conclusion

- Submit the paper on Caliop/LNG comparison for POLARCAT Spring

- Prepare a short paper on CALIOP climatology for the Arctic based on our L1 data analysis scheme (interannual variation of spring data)

- Start a Lagrangian analysis for Siberia using CALIOP, YAK flight (2008 and 2012) and TOMSK lidar data.

also if we have time....

-Summer 2010/summer 2012 comparison of the aerosol distribution from biomass burning in Russia