

Update on the radar/lidar algorithm (MS)

Input data

$$Z(r) \quad \beta_a(r)$$

Hypotheses :

No radar attenuation

$$N_0 i^*(r) = 10^{10}$$

Intégral constraint : $\int_{r_1}^{r_0} \alpha(p) dp = s \int_{r_1}^{r_0} N_0(p)^{*1-t} Z(p)^t dp$

→ $\alpha_i(r_0) = f(\alpha_i(r_0))$ which depends on $\int_{r_1}^{r_0} \beta_a(p) dp$

Klett

$$\alpha_{i+1}(r_0)$$

$$\alpha_{i+1}(r)$$

IM

$$r_{ei+1}(r)$$

MS Eloranta+IM

$$\beta_{acorrected}(r) \quad N_{0i+1}^*(r)$$

$$\left| \frac{\alpha_{i+1}(r_0) - \alpha_i(r_0)}{\alpha_i(r_0)} \right| > \epsilon$$

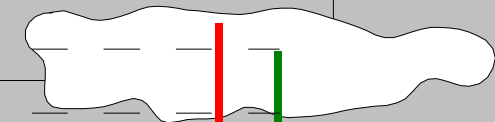
$$\left| \frac{\alpha_{i+1}(r_0) - \alpha_i(r_0)}{\alpha_i(r_0)} \right| < \epsilon$$

$$\alpha(r) \quad r_e(r) \quad N_0^*(r)$$

$$IWC(r)$$

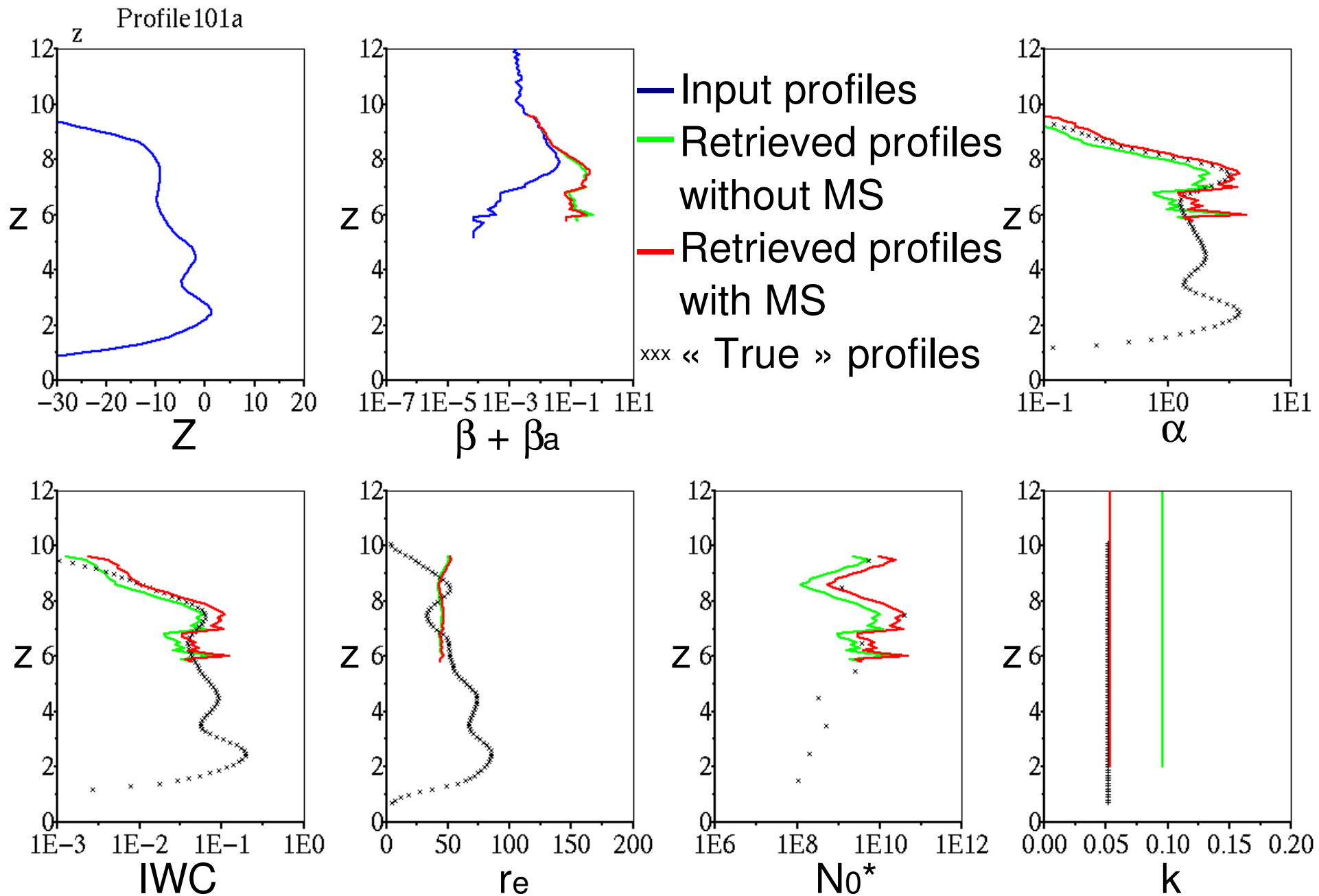
r_0

r_1

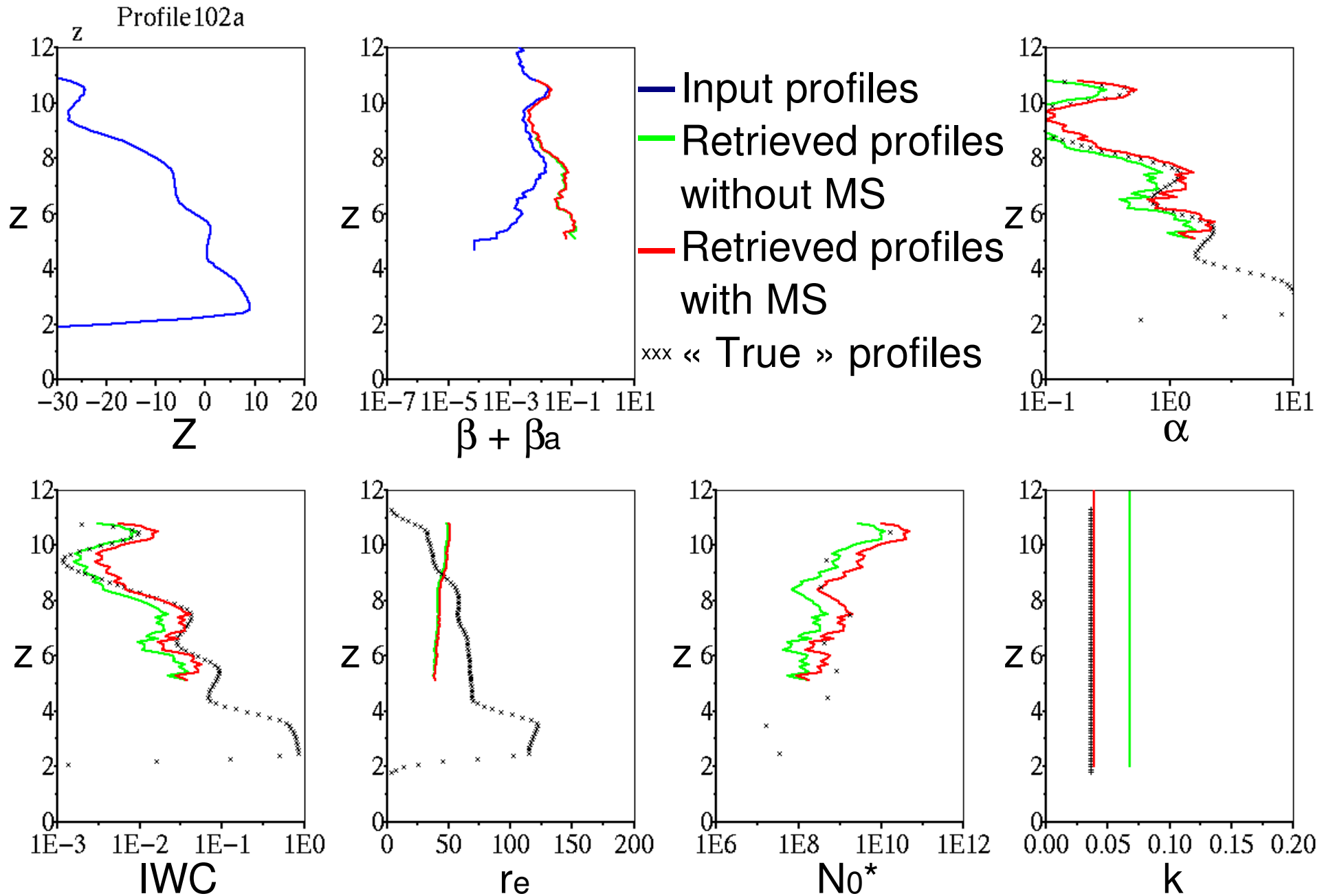


Radar Lidar

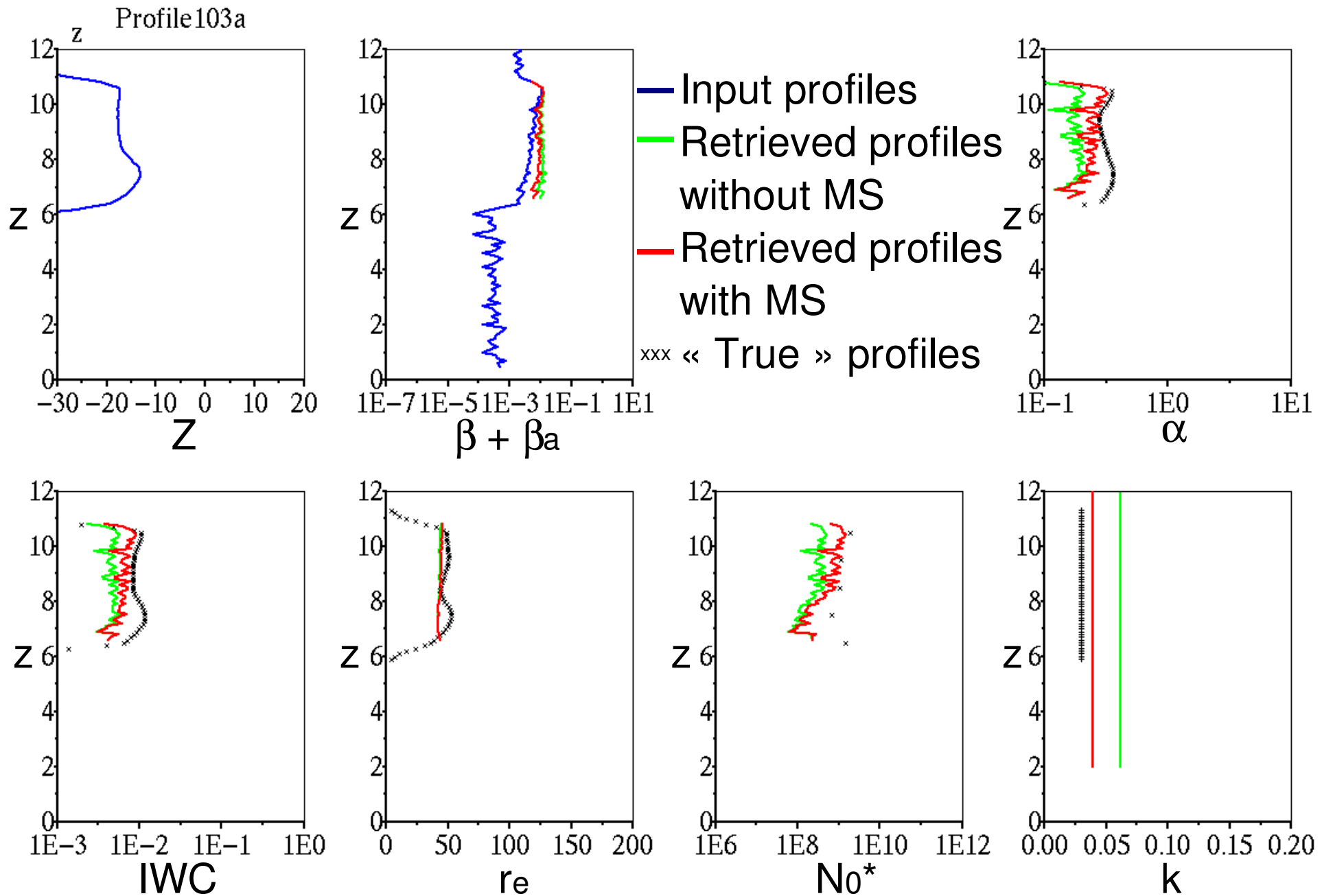
Application to the Blind Test : Profile 6



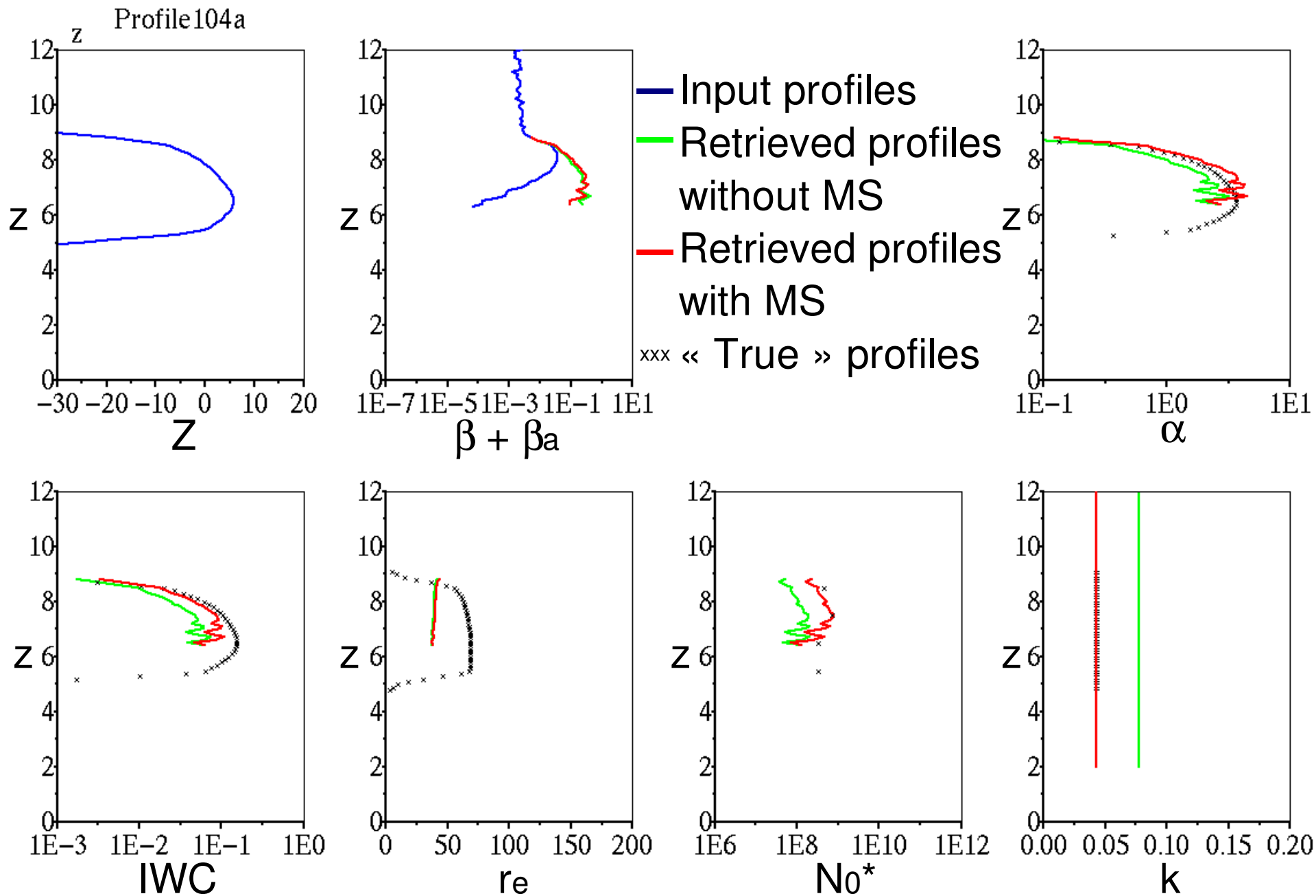
Application to the Blind Test : Profile 7



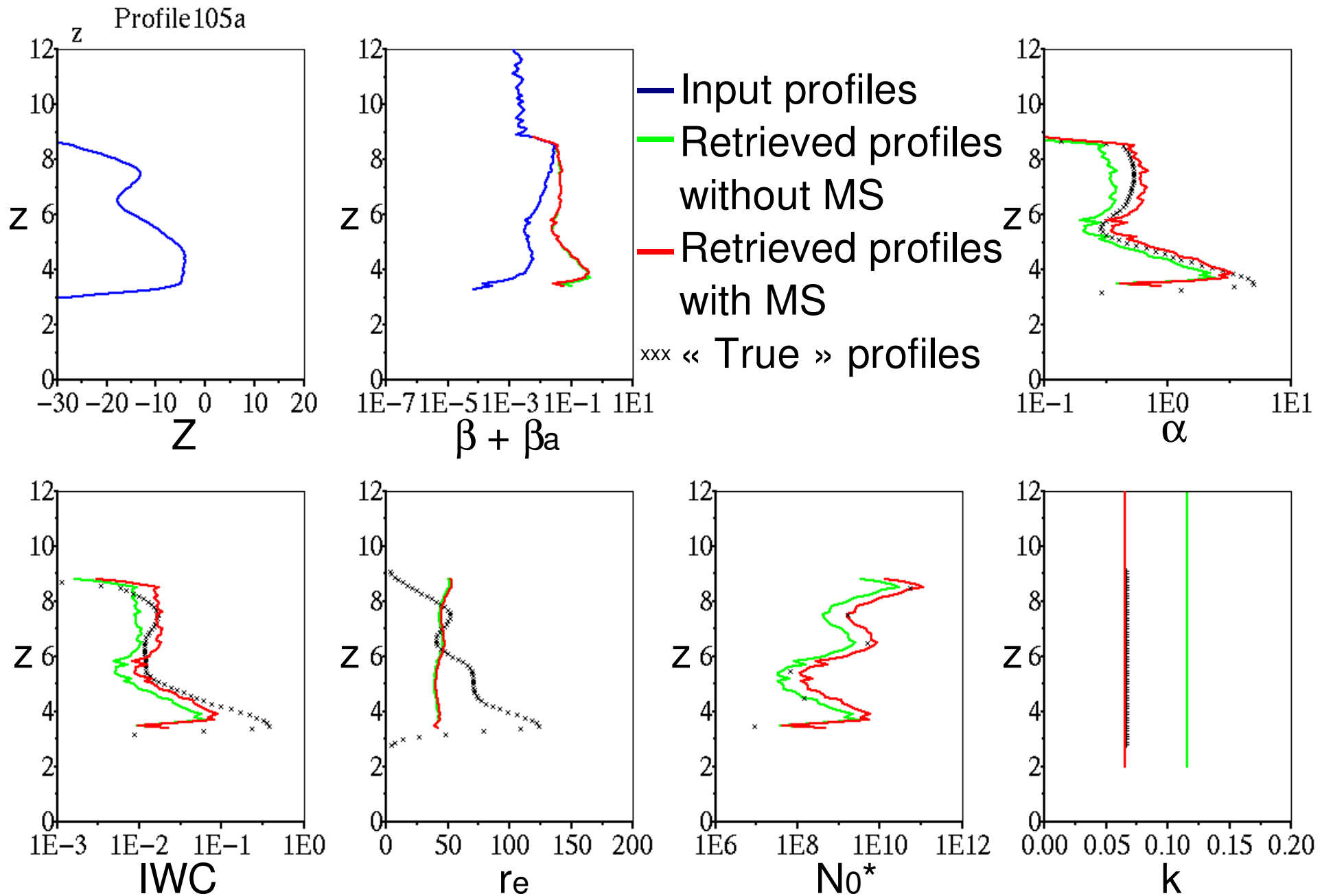
Application to the Blind Test : Profile 8



Application to the Blind Test : Profile 9



Application to the Blind Test : Profile 10



Evaluation on optical thickness (Hogan *et al.* 2005)

Profile	True optical thickness	Optical thickness to lidar penetration	Retrieved optical thickness			
			KNMI	IPSL (2002) Tinel	IPSL (2005) Bouniol	IPSL (2005) with MS
1	4,74	4,74	0,12	0	0,17	
2	21,67	7,16	-0,06	0,22	-0,01	
3	5	5	-0,89	-0,39	-0,3	
4	52,91	8,33	-2,89	1,21	0,85	
5	11,83	7,23	-0,71	-1,01	-0,62	
Abs. error			0,93 (14%)	0,56 (9%)	0.388 (6%)	
6	13,86	3,64	1,44	-3,06	-0,9	1,01
7	22,27	3,53	0,8	-2,48	-1,18	0,24
8	1,42	1,42	0,21	-0,92	-0,49	-0,29
9	8,02	4,03	0,47	-3,19	-1,52	0,31
10	5,72	5,69	-2,17	-5,01	-2,26	-0,77
Abs. error			1,02 (28%)	2,93 (80%)	1,27 (35%)	0,52 (14%)

Maybe a bug in the Tinel 2002 retrieval !!!

Once the MS correction is included the error is reduced to an acceptable value

Conclusions

A MS module is now included in the IPSL radar-lidar algorithm

Evaluation has been conducted on the blind test profiles

- bug in the first retrieval by Claire... 35% of error instead 80% !
- once the module is included the error is reduced to 14 %

Improve the choice of the inverse modele by using a module of RadOn that enable to choose the more representative density law

- error on the choice on the IM can lead to error of about 30% on IWC

Improve the way Mie effects are taken into account (important for ground version of the algorithm)

Better investigate why do we have divergence on some real case