

Methodology

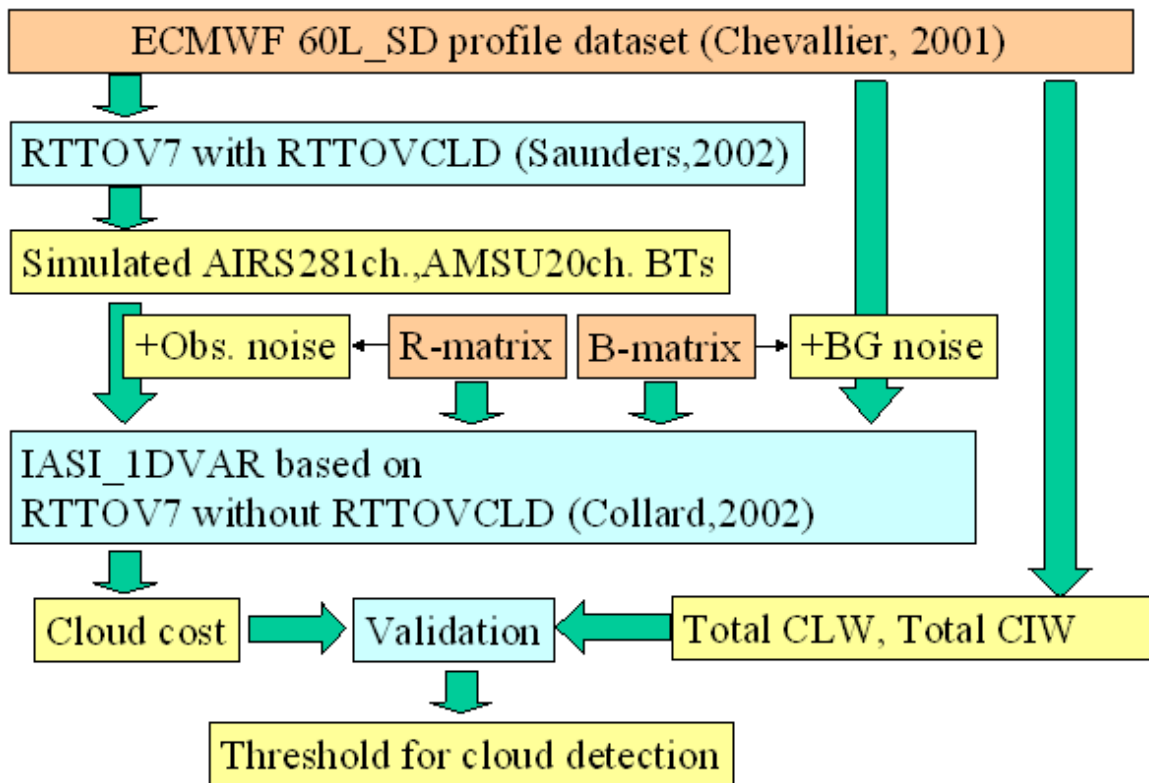


Fig.1 General flow of this study.

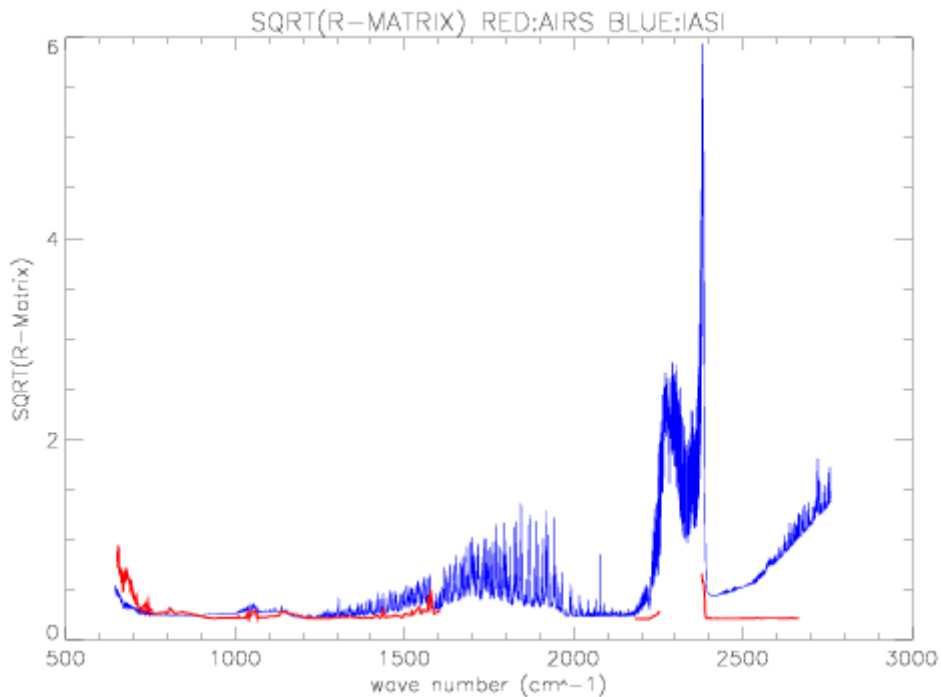


Fig.2 Square root of diagonal elements of R-matrix (unit: K) for AIRS (red line) and IASI (blue line).

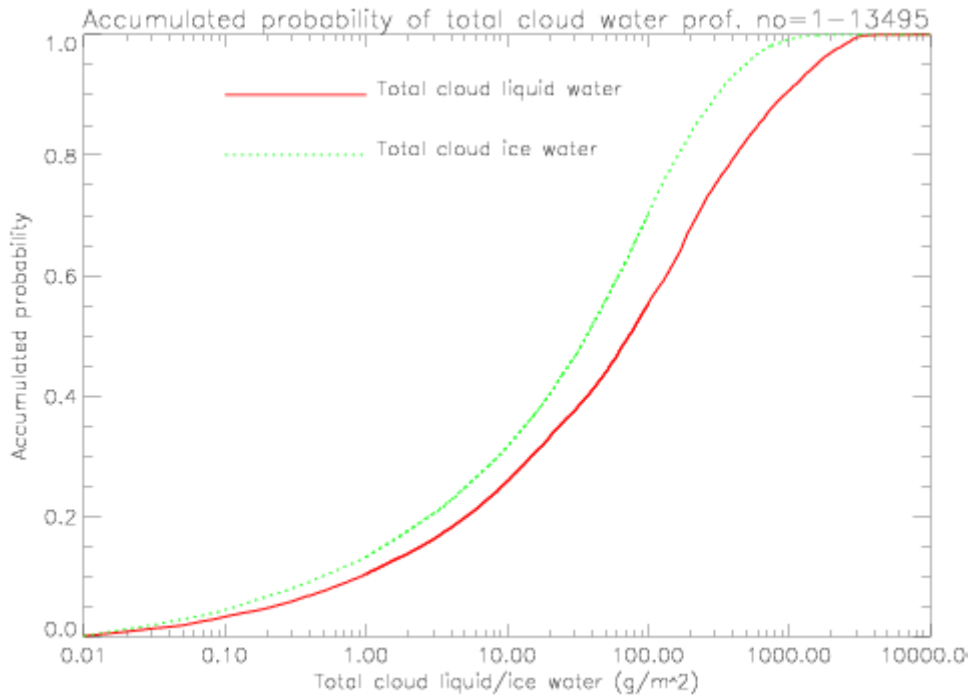


Fig.3 Accumulated probability of total cloud liquid water (red solid line) and total cloud ice water (green dotted line) for 13495 profiles in ECMWF 60L_SD data set.

Category Definition

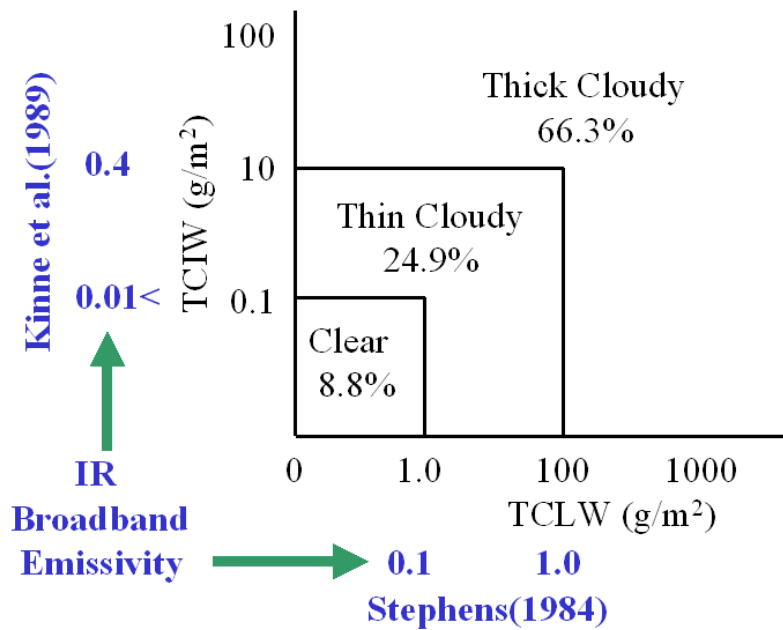
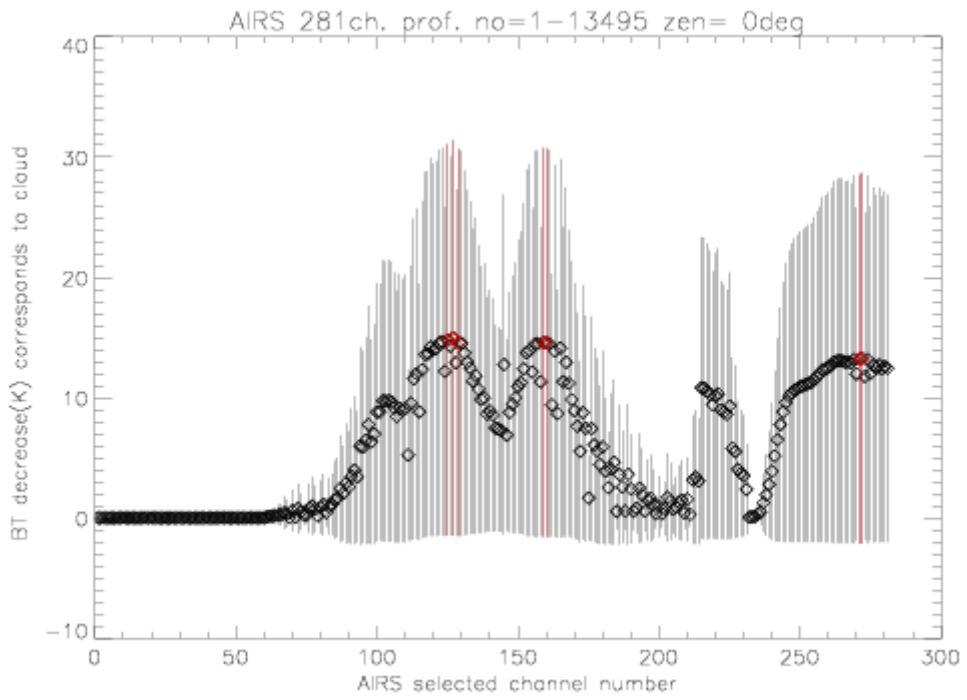
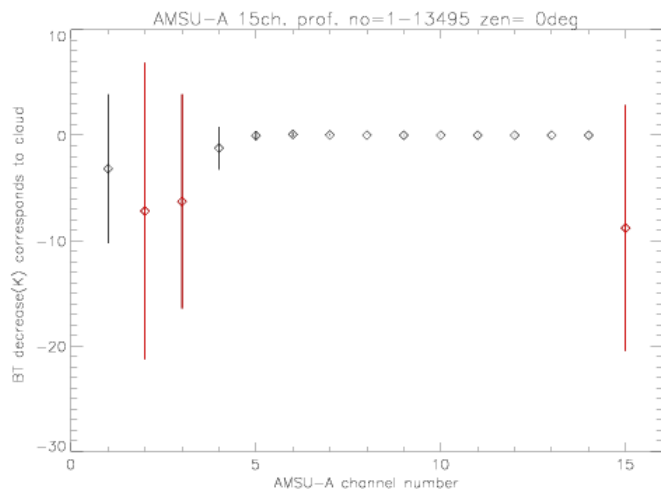


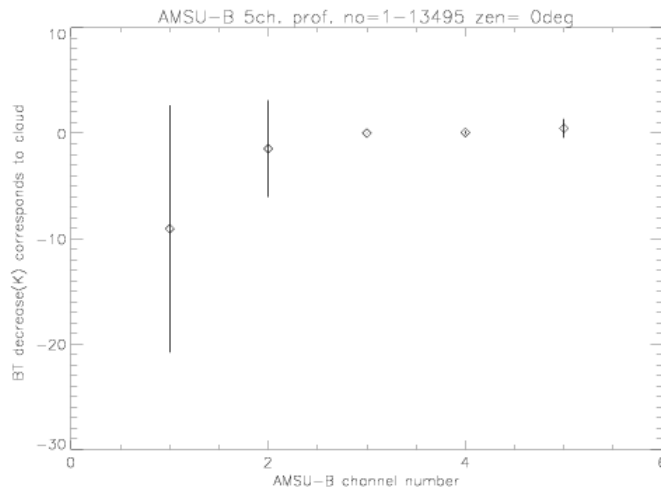
Fig.4 Cloud categories definition in this study. Abscissa denotes total cloud liquid water and ordinate denotes total cloud ice water.



a)



b)



c)

Fig.5 Sensitivity of simulated BT to cloud for a) AIRS, b) AMSU-A, and c) AMSU-B. Abscissa is channel number of each instrument. Average (diamond marks) and standard deviation (bars) for 13495 profiles are shown. Red coloured channel is used for cloud cost calculation.

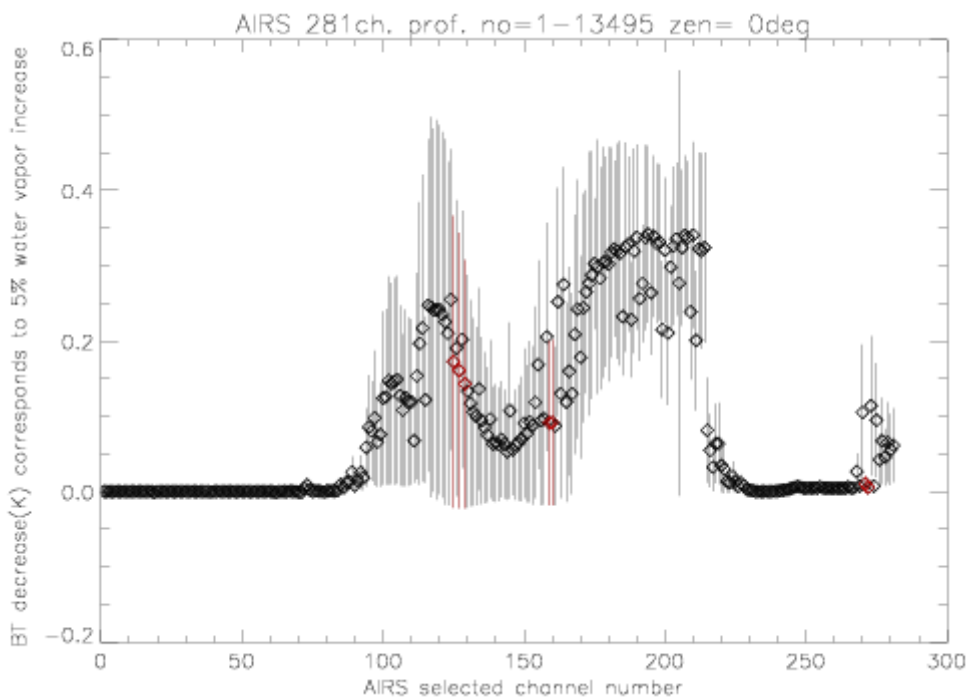


Fig.6 Sensitivity of simulated BT to water vapour increment of 5% for AIRS. Average and standard deviation for 13495 profiles are shown.

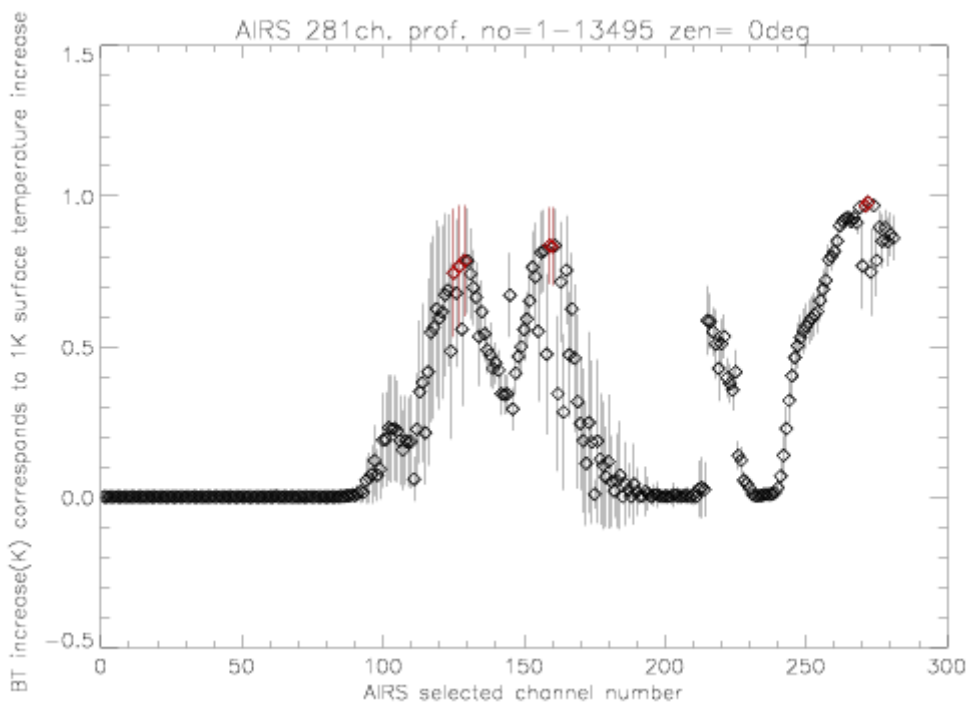


Fig.7 Sensitivity of simulated BT to surface temperature increment of 1K for AIRS. Average and standard deviation for 13495 profiles are shown.

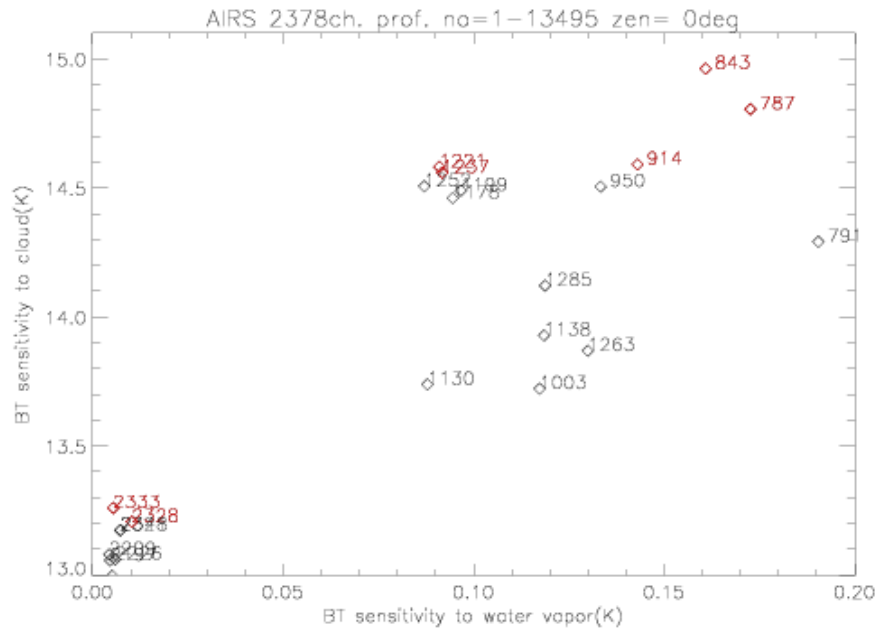
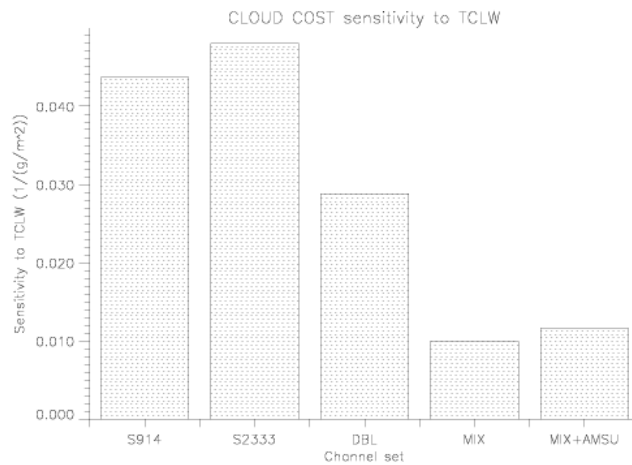
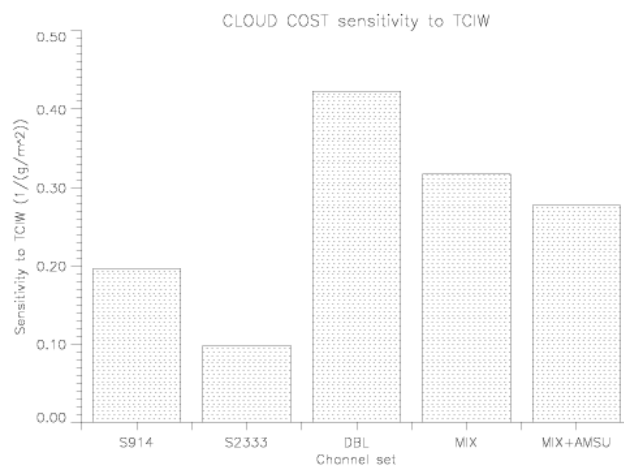


Fig.8 Mean sensitivity of simulated BT to water vapour and cloud for AIRS selected channels for 13495 profiles. Ordinate is BT difference for water vapour increment of 5% and abscissa is BT difference due to cloud. The BT difference is average of these for 13495 profiles in 60L_SD data set. The number assigned is channel number of AIRS 2378ch.

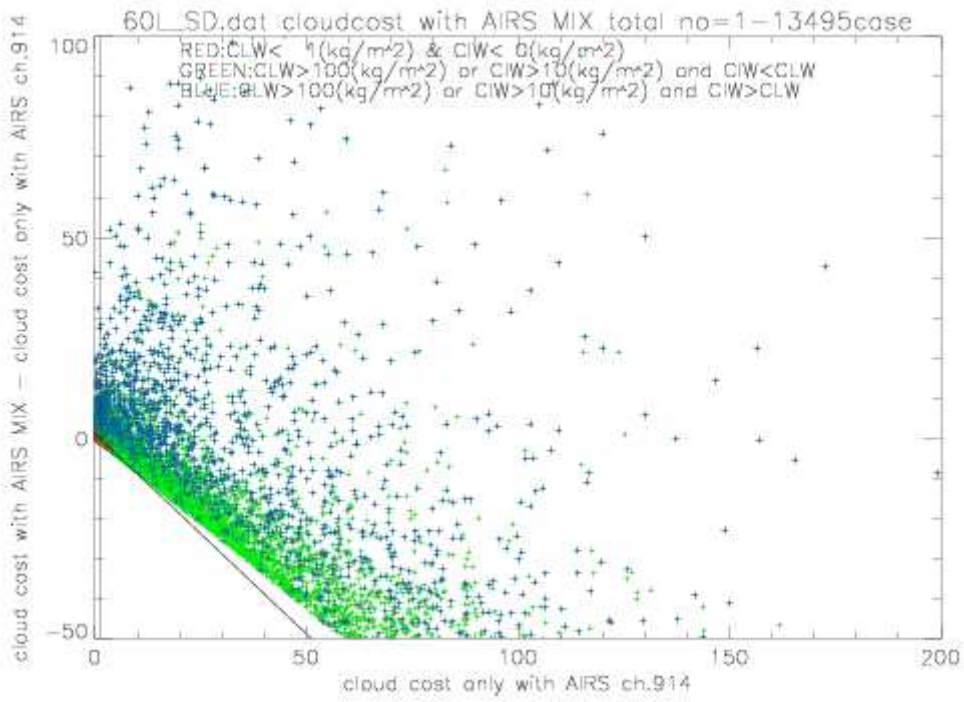


a)

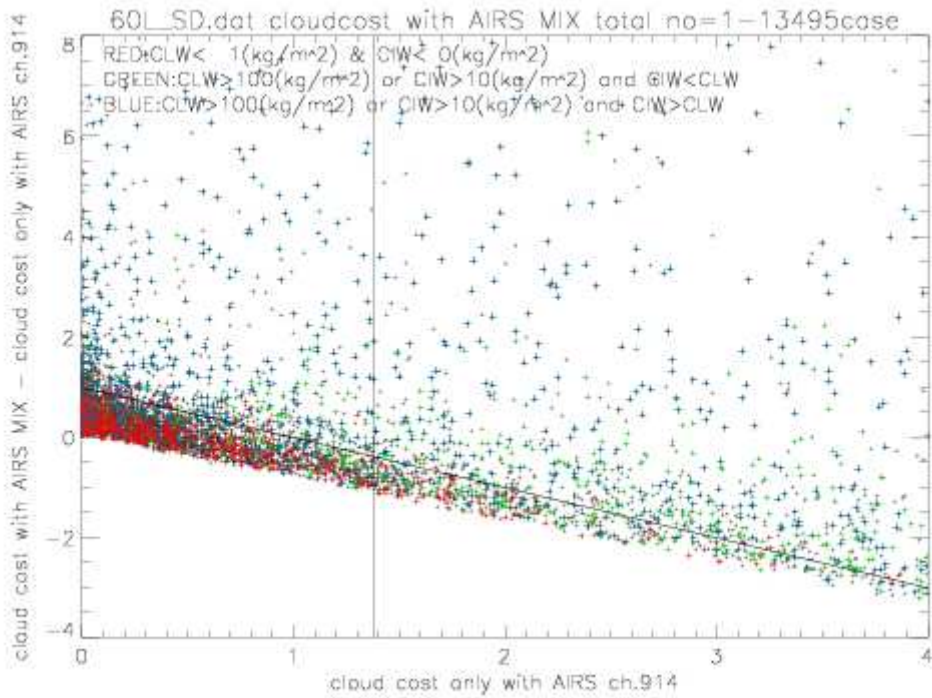


b)

Fig.9 Sensitivities of cloud cost to a) total cloud liquid water, and b) total cloud ice water, for each of the channel set.

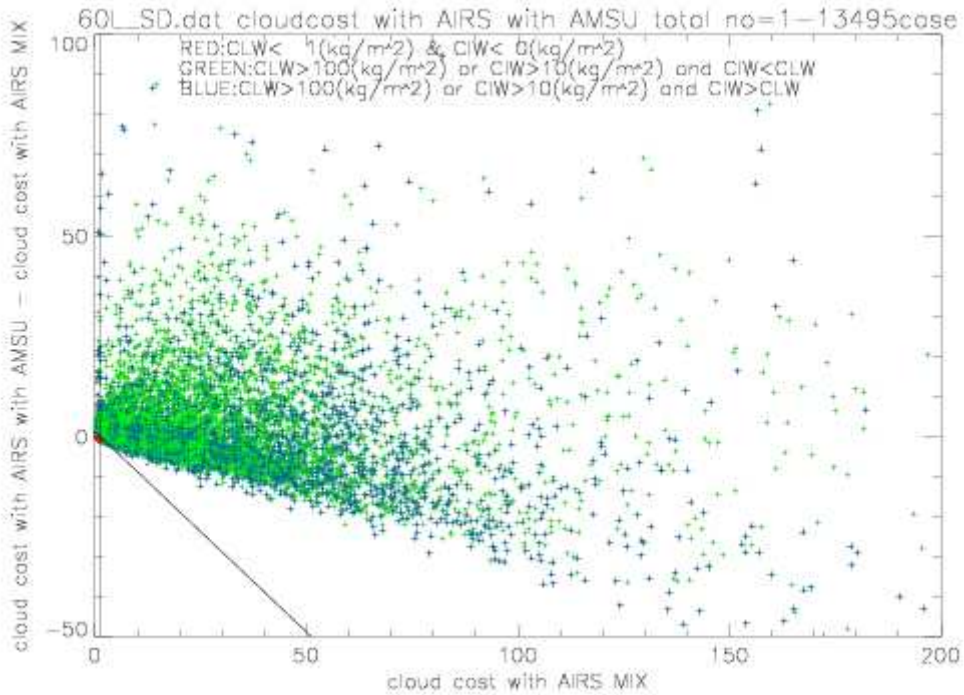


a)

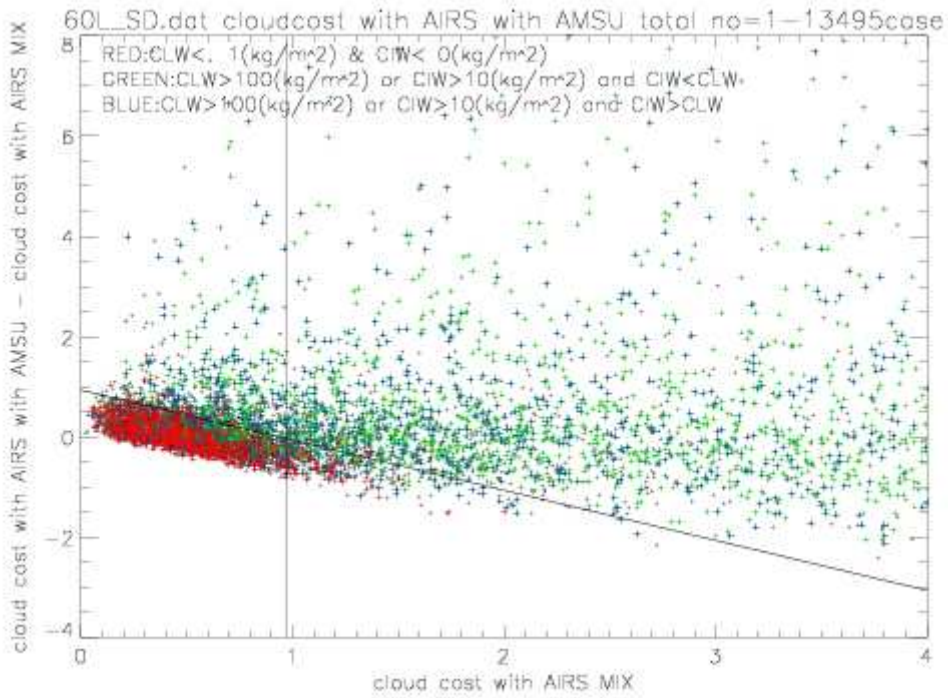


b)

Fig.10 Multi-channel cloud cost against single-channel cloud cost. Abscissa is S914 cloud cost and ordinate denotes difference between MIX cloud cost and S914 cloud cost. Fig.10 a) is plots for wide cloud cost range and Fig.10 b) is for small cloud cost range.

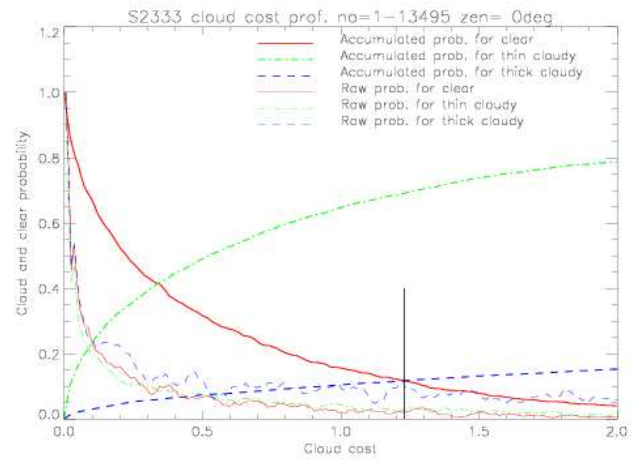
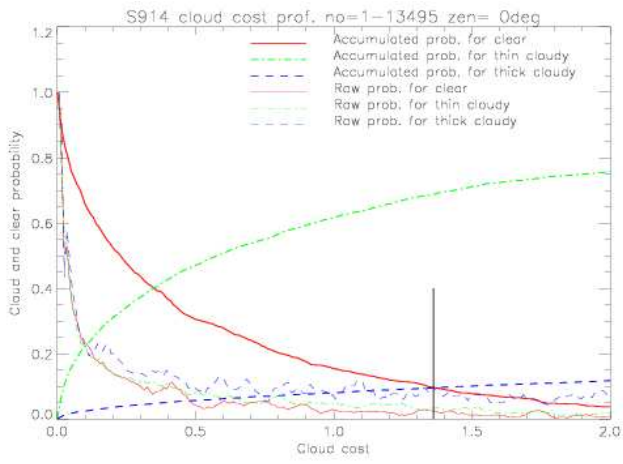


a)



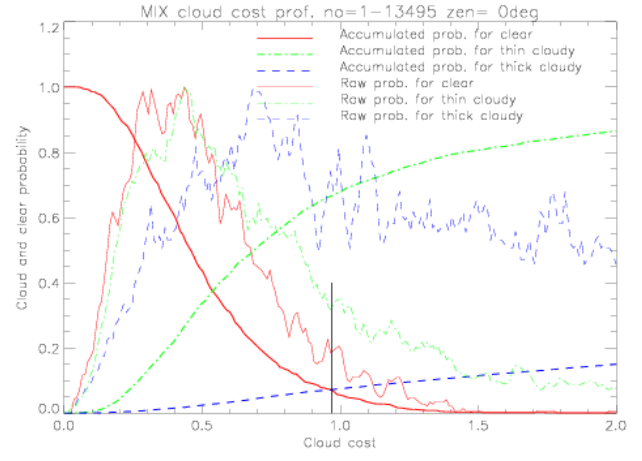
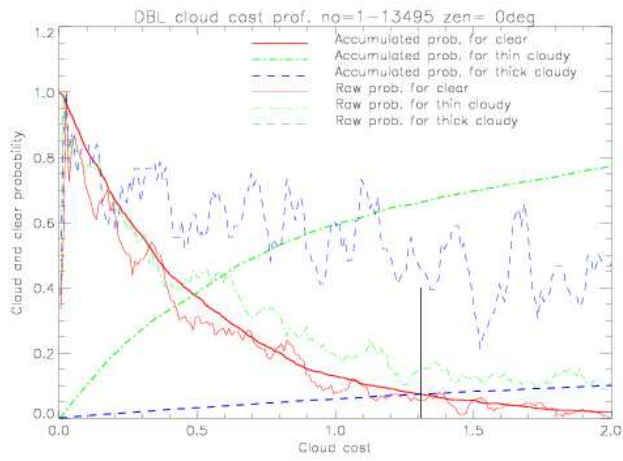
b)

Fig.11 MIX with AMSU cloud cost against MIX cloud cost. Abscissa is S914 cloud cost and ordinate denotes difference between MIX cloud cost and S914 cloud cost. Fig.10 a) is plots for wide cloud cost range and Fig.10 b) is for small cloud cost range.



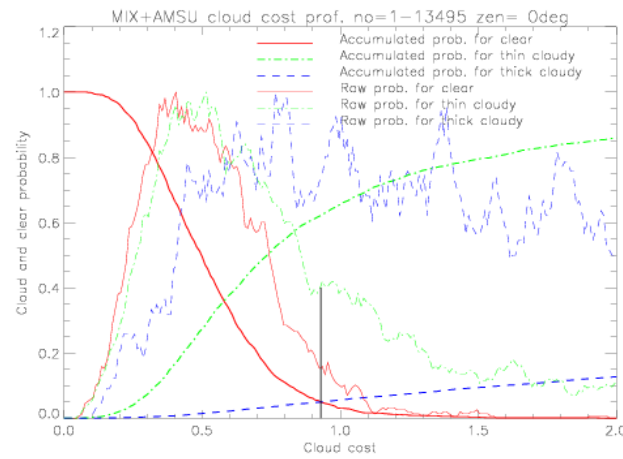
a)

b)



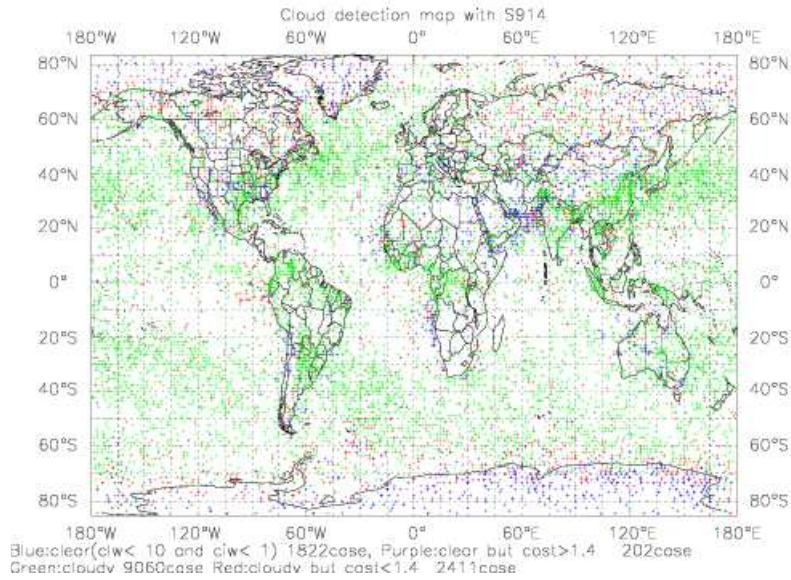
c)

d)

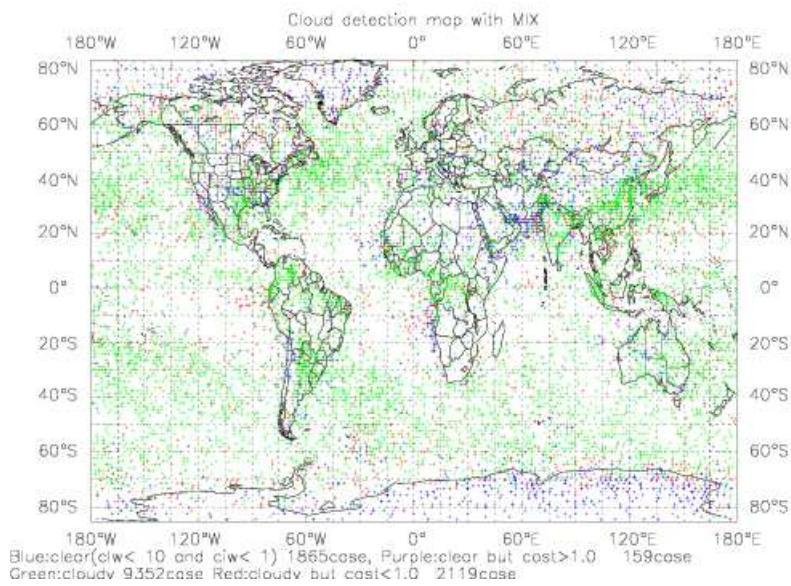


e)

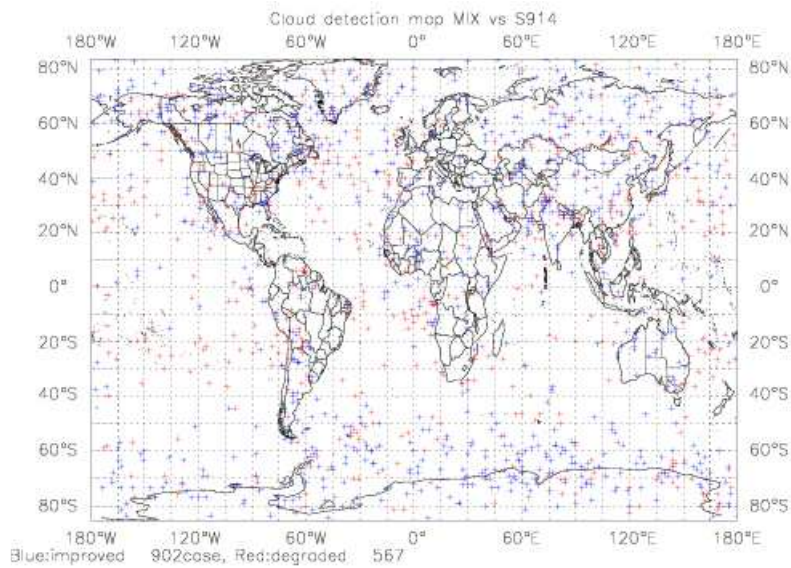
Fig.12 Abscissa denotes cloud cost and ordinate denotes accumulated and raw probability of each cloud categories (clear, thin cloudy, and thick cloudy). The raw probability is normalized by its maximum value. The vertical black line is the determined threshold for cloud detection. Fig. 12 a) is for S914, b) for S2333, c) for DBL, d) for MIX, and e) for MIX with AMSU.



a)

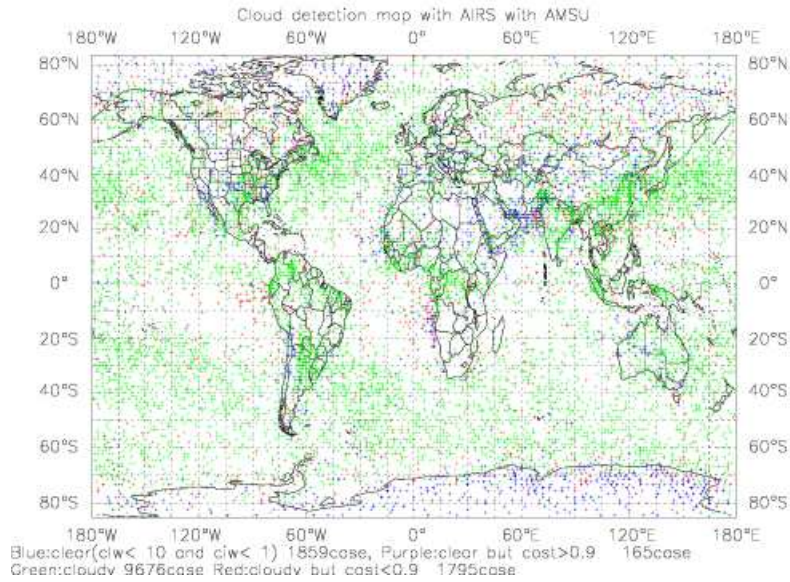


b)

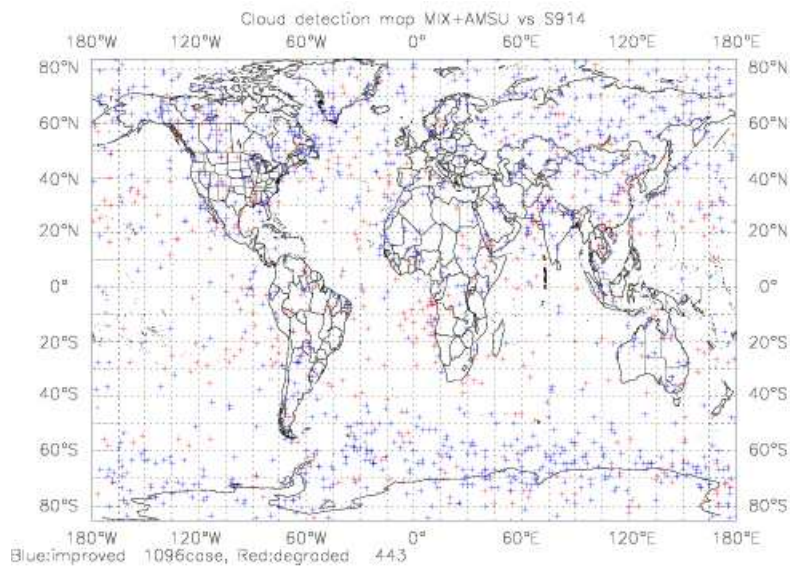


c)

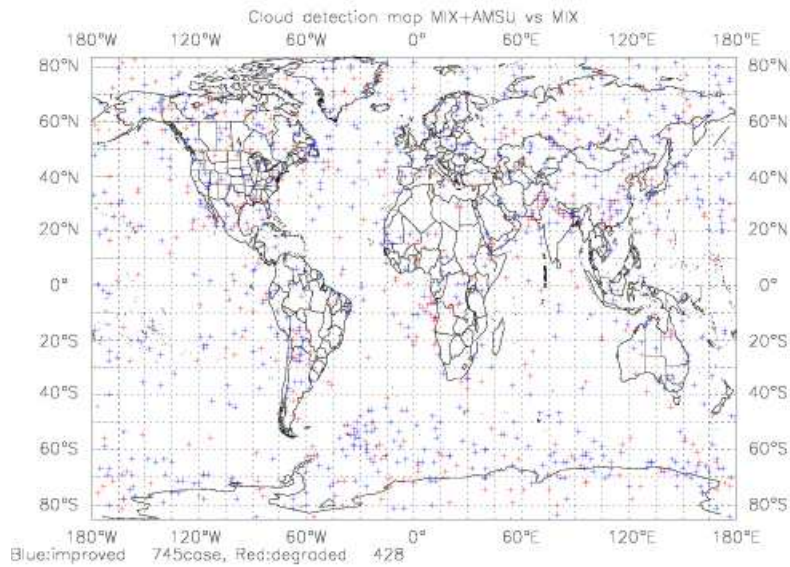
Fig.13 Geographical distribution of each category assigned correctly and misassigned profiles. Blue colour shows clear, green colour cloudy, purple colour clear with large cloud cost, and red colour cloudy with small cloud cost. Red colour can be seen continental region. a) is for S914 and b) for MIX. c) is the upgraded profiles and degraded profile.



a)



b)



c)

Fig.14 Geographical distribution of each category assigned correctly and misassigned profiles. Blue colour shows clear, green colour cloudy, purple colour clear with large cloud cost, and red colour cloudy with small cloud cost. Red colour can be seen continental region. a) is for MIX with AMSU. b) and c) is the upgraded profiles and degraded profile MIX with AMSU channels against S914 and MIX with AMSU channels against MIX channels, respectively.