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Sensitivity study for the retrieval of carbon dioxide from IASI observations using the KLIMA algorithm

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We report the results of a sensitivity study carried out on forward and inverse models of the KLIMA algorithm with the aim of investigating the ultimate capabilities of IASI-METOP observations for the retrieval of carbon dioxide information. The study was conducted in the frame of KLIMA-IASI, an on-going project funded by ESA and lead by IFAC-CNR in collaboration with IUP, University of Bremen. The final goal of the project is to obtain accurate values of CO_2 total column from level 2 analysis of IASI spectra, for the purpose of inter-comparison and cross-validation with GOSAT products. The basic features of the KLIMA inversion code, originally developed and tested by IFAC-CNR and subsequently adapted to the analysis of IASI measurements, are provided and sensitivity tests conducted on the KLIMA-IASI forward and retrieval codes are described in details. In the FM (Forward Model) sensitivity study, a series of approximations was introduced to reduce the program size and the running time of the code. The impact of these approximations on the accuracy of the FM was evaluated and the results were used for implementing an overall procedure optimally suited for the selected target. In the RM (Retrieval Model) sensitivity study, further tests conducted on the ARM (Accelerated Retrieval Model) version of the KLIMA-IASI code aimed at quantifying the bias on CO_2 retrieval products due to the FM approximations implemented by the trade-off process between FM accuracy and efficiency. A summary of the consolidated results is provided in terms of performances of the ARM for the retrieval of CO_2 partial and total columns.