# JEM/SMILES JEM/SMILES (VI): レベル 2 処理高度化研究

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## Introduction

The National Institute of Information and Communications Technology (NICT) has developed a system to process the observations performed by the Superconducting subMillimeter Limb Emission Sounder (SMILES) that is operating from the Japanese Experimental Module (JEM) onboard the International Space Station (ISS). More informations about the mission are given in the companion presentations 1.1 to 2.1. The motivation for developing the chain is double. First, the chain aims at supporting the operational processing performed by the Japanese Aerospace Exploration Agency (JAXA). The second motivation is for conducting researches on retrieval algorithms with application on real data. In the current researches, we are studying improvements of SMILES standard products and are investigating retrieval of new products such as ice water contain in the upper Troposphere or stratospheric wind along the line of sight. Hereafter the NICT products will be referred as the Level2 research (L2r) products.

## Status

The version 1.0 of the L2r dataset has been released on January 2010. The dataset contains the measurements performed from end of October, 2009. Since then, new observations (1600 profiles/day, about 20 products) are being processed everyday with 3 days lag with respect to the actual measurements. The lag is due to the time needed for the meteorological data (atmospheric temperature and pressure) to be available. In the version 1.0, we focus on the standard SMILES products (O3, HCl, ClO, HO2, …) in the stratosphere.

The retrieved parameters are obtained after a series of Levenberg-Marquardt iterations. At each iteration step the state vector is updated in order to decrease a cost function including retrieved parameters a priori (Rodgers, 2001). The forward calculation, i.e. simulation of the SMILES signal after calibration, is performed using the Advanced Model for Atmospheric TeraHertz Radiation Analysis and Simulation (AMATERASU) (Baron et al., 2008, Mendrok et al., 2008).

Early comparisons have shown that L2r O3 and HCl products agree well in the stratosphere with other measurements from AURA/MLS, ACE/FTS and Odin/OSIRIS. The analysis of the L2r data shows a good consistency between redundant products (e.g. O3 in bands A,B and C). Figure 1 shows anti-correlation between the reservoir HCl and active ClO during chlorine activation event in the Northern Hemisphere vortex. The known transformation of chemically inactive chlorine to active chlorine is well seen by SMILES.

Let's note that a comparison of the L2r products with the SMILES operational products is currently being performed. The version 2 of the L2r data will be released soon with major improvements in the Mesosphere.

## Current research

Beside the improvements of the current processing, the retrieval of three majors new products are being

investigated: ice water contain and humidity in the upper troposphere and line of sight (LOS) wind in the stratosphere. For example, Figure 2 shows a clear correlation between the wind estimated by Goddard Earth Observing System Data Assimilation System (GEOS-5 DAS) and the frequency shift of the O3 line for bands A and B on November 11, 2009. The frequency shift has been estimated by a simple Gaussian fit of the O3 line. A more robust algorithm is under development taking into account the different contribution of atmospheric layers to the frequency shift of single spectra.

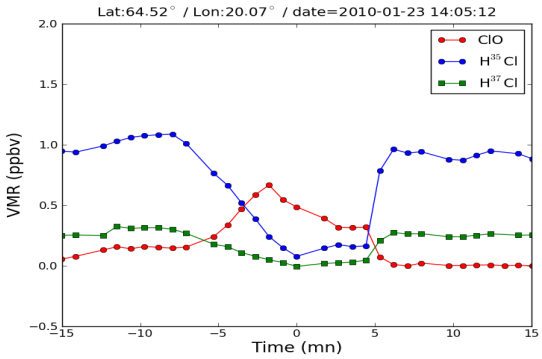


Figure 1. Increase of ClO and decrease of HCl during chlorine activation event in the Northern Hemisphere vortex. The points are a series of consecutive scans of a fraction of an orbit centered at (65.5 ˚N, 20.07 ˚E) on January 23, 2010.

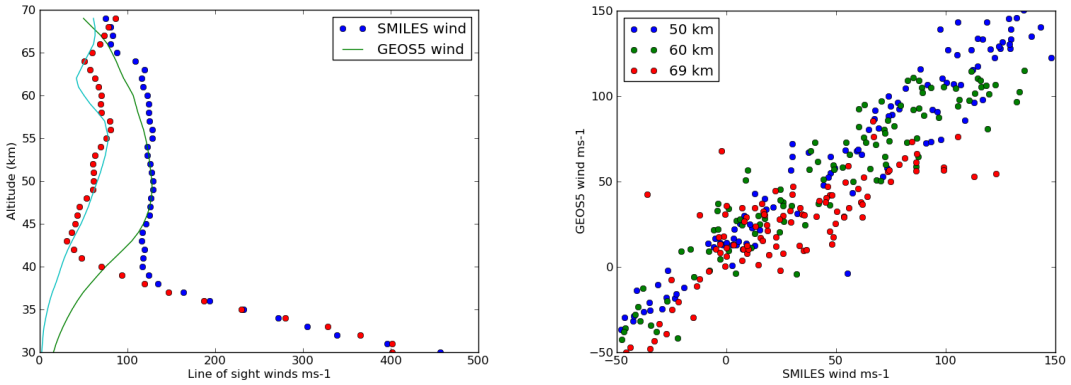


Figure 2. Comparison of GEOS5 wind projected along the SMILES line of sight with an estimation of the O3 line frequency shift. Data are for bands A and B on November 26, 2009.

## References

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