PCRTM Test at the Joint Center for Satellite Radiance Assimilation (JCSDA): JCSDA invited Dr. X. Liu from National Aeronautics and Space Administration (NASA) Langley Research Center to work with JCSDA scientists for testing a Principal Component-based (PC) Radiative Transfer Model (PCRTM). The two-day collaboration enables us to investigate PCRTM adjoint performance and future applications for hyper-spectral sensors like Atmospheric Infrared Sounder (AIRS), Infrared Atmospheric Sounding Interferometer (IASI) and Cross-track Infrared Sounder (CrIS). This PCRTM derived eigenvectors from real IASI observations. The original 8461 IASI channel measurements can be compressed into a few hundred, or even a few dozen PC scores, depending on needs in applications. The advantage of an adequate decomposition eliminates redundant information and reduces instrumental noise. However, quality control (for example channel selection for clear radiance), and error covariance determinations in the PC domain are very challenging. The result of the two-day collaboration also addresses the action item RTSP-10 on how to assess the PC-RTM adjoint performance from the Radiative Transfer and Surface Properties Working Group at the last International TOVS Study Conference (ITSC), ITSC-15. The assessment has been carried out in both PC-score and spectral domains. Our preliminary results show a good agreement in forward and adjoint radiative transfer calculations between using the Community Radiative Transfer Model (CRTM) and using the PCRTM. Differences in the CRTM and the PCRTM may be attributed to the different line-by-line models used at the JCSDA and NASA Langley Research Center; the CRTM uses layer quantities while the PCRTM uses level quantities; and the eigenvectors being derived from real IASI measurements, which include measurement errors. The difference in Jacobian calculations for weak water vapor absorption in the upper atmosphere is marked. The difference there may have very little impact on retrievals and data assimilation because water vapor amounts are very small in the upper atmosphere. Further comparisons and application considerations are planned.

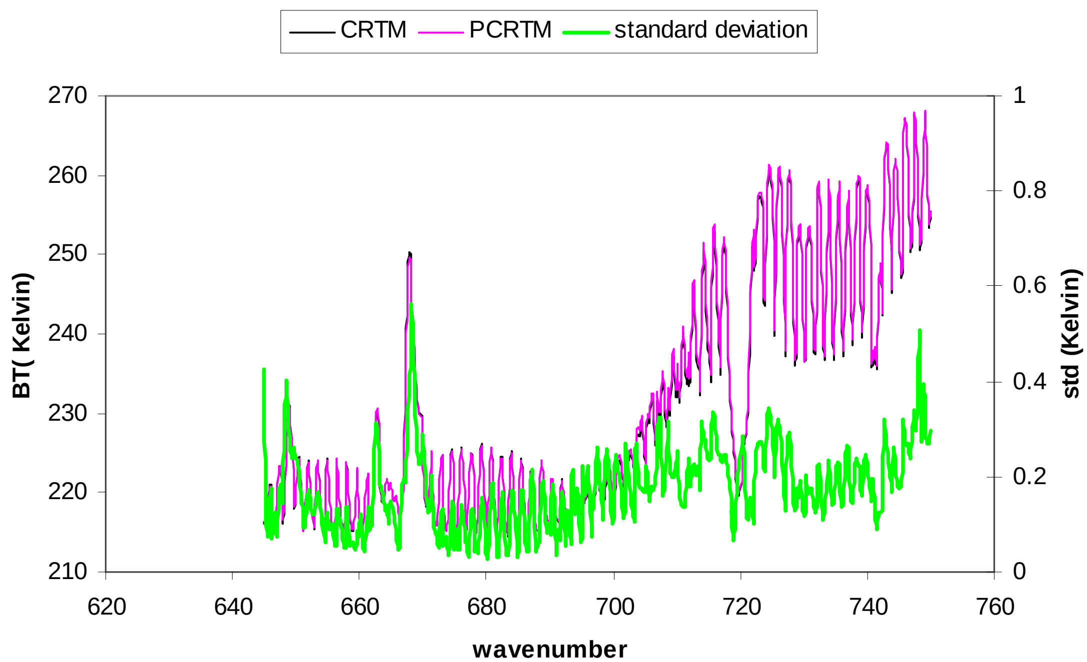

Fig. 1. Comparisons of forward simulations and the standard deviations between using the CRTM and the PCRTM.

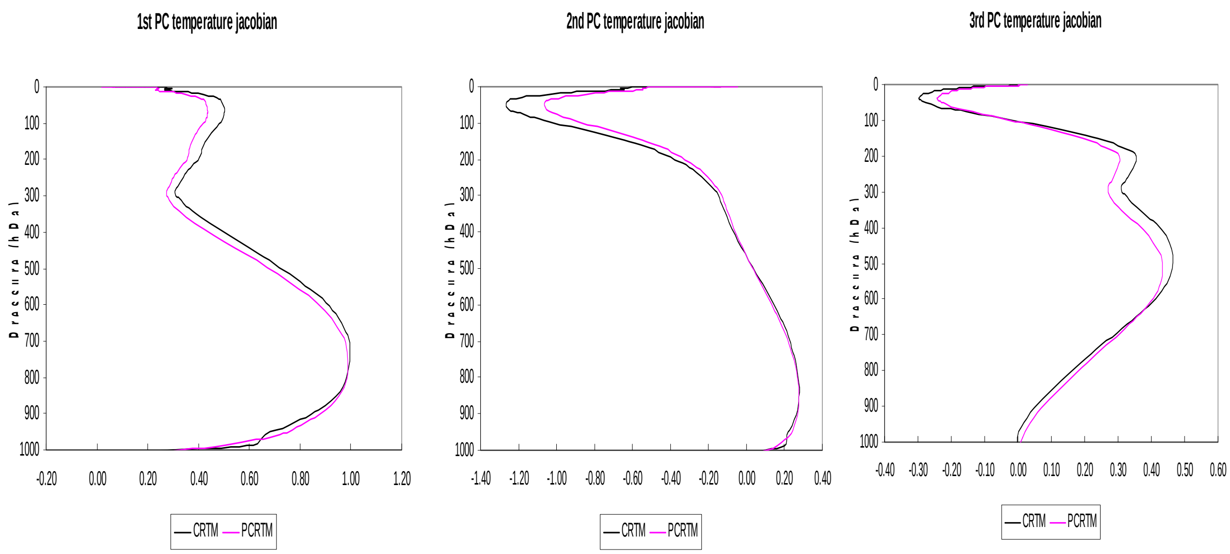

Fig. 2. PC score Jacobian Comparisons between CRTM and PCRTM.

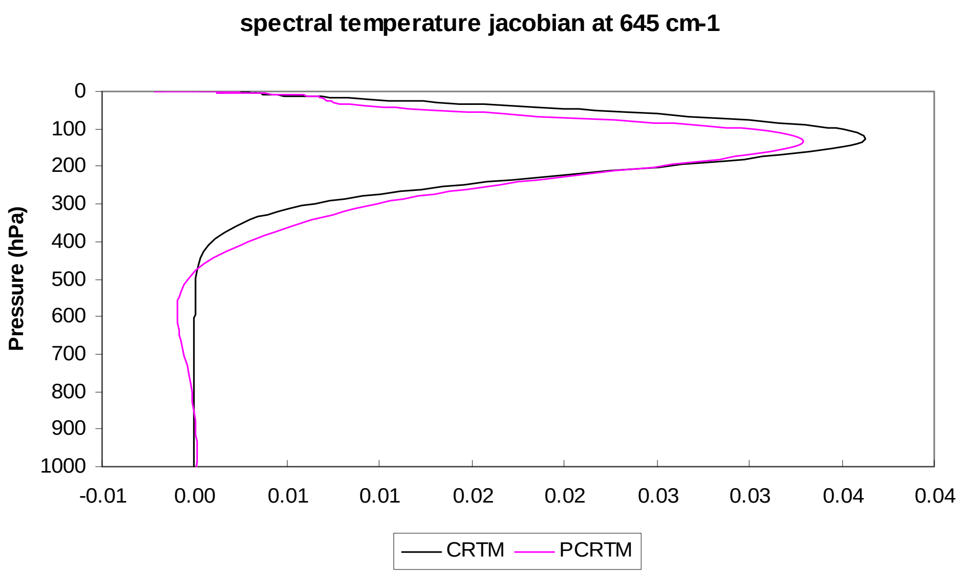

Fig. 3. Spectral jacobian at 645cm-1 Comparison between CRTM and PCRTM.