NNORSY-GOME Ozone Profile Retrieval Products and Climatology

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The Neural Network Ozone Retrieval System (NNORSY) developed by ZSW was successfully applied to long term TOVS data for total ozone column retrieval and to GOME Level 1 spectra for total column and ozone profile retrieval. This presentation will focus on NNORSY-GOME ozone profiles retrieval and resulting products of the latest reprocessing of global GOME data in the time range 1995 to 2003. Beside ozone profile retrieval itself in a second step an new approach based on neural network technique for a dynamic ozone profile climatology was undertaken yielding to an easy to use software package for the dynamic NNORSY ozone profile climatology. NNORSY for GOME is a very fast ozone profile retrieval scheme based on neural networks. For training, ozone measurement data from ground based (e.g. ozone sondes and lidar) and satellite (e.g. SAGE, HALOE, POAM) based ozone profile measurements are used. In the first step we developed a special training procedure based on RPROP which is able to deal with incomplete target data without loss of generalization ability during application and in the second we established a two stage quality control (QC) procedure for ozone profile measurement data where the second stage is based on partial neural network training to find outlier and additional measurement errors that passed the first QC stage. After training application to GOME data is very fast. A whole GOME orbit with full spatial resolution can be processed in less than 1 minute and therefore NNORSY-GOME ozone profile retrieval can easily be applied in real-time with minimal costs on a simple workstation computer. NNORSY-GOME was already implemented in near-real-time at DLR-DFD but the service was stopped in June 2003 when the data recorder on ERS2 failed. Within the ESA project CHEOPS-GOME ZSW reprocessed of all available GOME Level 1 data at full spatial and temporal resolution up to June 2003 yielding to NNORSY-GOME Version 3 global 8 year ozone profile data. Beside the ozone profile information from ground up to 61 km height with a sampling rate of 1 km the data comprises for each profile level an ozone profile error estimation and contains temperature profile data derived from GEOS 4 model data. This data set was used to training different neural works without satellite instrument data yielding to the new dynamic NNORSY ozone profile climatology. Depending on which user input information is available, the NNORSY-CLIMATOLOGY does not only consider standard input information such as date, time and geographical position but also optional dynamic input parameters like total ozone column and/or temperature profile into account which represents the current state of the atmosphere. Due to this option of respecting dynamic parameters this new approach exploits the supplied

dynamic information leading to a significant gain of accuracy in climatological ozone profile retrieval. Each climatology product is delivered with ozone profile information as well as according standard deviations. If no input temperature profile is provided the NNORSY-CLIMATOLOGY delivers a climatological temperature profile as well. The presentation will show comparison of derived ozone profile data with independent data sources for single measurements as well as for long term time series of different regions and ozone profile regimes. It can be shown that the neural networks are able to compensate for GOME instrument degradation and calibration uncertainties if parameters about the GOME instrument (e.g. time in orbit) are supplied as input to the neural network trained with real ozone profile measurement data. The climatology ozone profile data are compared with measured time series as well as with classical lookup-up-table climatology products. Current developments for NNORSY are underway for ozone profile retrieval and near-real-time application from SCIAMACHY data and we are looking forward to implement NNORSY for the new atmospheric sounding instruments IASI and GOME-2 MetOp satellite in an new synergistic approach using UV and IR sounding data.