



## ERA-CLIM work package 4 Workshop on observation errors April 19-20 2012, Vienna, Austria

From April 19th to 20th a workshop on observation errors within the ERA-Clim work package 4 was held at the University of Vienna, Austria. A list of the participants is appended to this document. The contributed slides can be downloaded from [ftp://srvx7.img.univie.ac.at/pub/WP4\\_Workshop\\_201204/](ftp://srvx7.img.univie.ac.at/pub/WP4_Workshop_201204/)

Next to members from different project partners G. Desroziers from Meteo France joined the workshop as an invited speaker.

After a welcome by the department head Prof. G. Bokelmann of the department of meteorology and geophysics at the University of Vienna and a short introduction the workshop started with presentations on the diagnosis and specification of observation errors in reanalysis.

First ERA-CLIM project coordinator D. Dee from ECMWF gave a talk describing the handling of observation errors in data assimilation systems. Different available reanalysis were presented and it was pointed out that the future lies in a climate reanalysis that is coupled with an ocean model to get a consistent reanalysis. An inspiring effort in this direction is the NOAA 20<sup>th</sup> century reanalysis (20CR) that spans the whole 20<sup>th</sup> century with the use of surface pressure and sea surface temperature (SST) data. With ongoing data rescue efforts and the use of more observations future reanalysis will benefit. Since in data assimilation the basic equations are assumed bias free, data needs to be bias corrected. Typical types of errors are: a representation error, gross errors (bad data), a systematic error (bias) and random errors. The first three mentioned can be large (same scale as the signal) and need to be addressed. This can be done offline with homogenisation methods or during the assimilation with a variational approach that was already used for satellite data in the last ECMWF reanalysis ERA-Interim.

After this introduction G. Desroziers from Meteo France spoke about observation error specifications. The observation error is part of the data assimilation equations and different diagnostics can be used to determine the observation error using the background error covariance. After discussing different diagnostics it was pointed out that within those framework model error is always neglected so the diagnostics rely on a good model.

Next P. Poli from ECMWF showed how observation error variance estimates were used in former reanalyses and how these can be used in future efforts. The current practice at ECMWF is to use the operational estimates used at the time the reanalysis system is set up. This has the drawback that a current modern system is described with them rather than historical data. Investigations on different observation datasets showed that the observation error variance is dependent on the report type and within the report type on each instrument used. As an example HIRS

channel 4 data was showed where a change with the introduction of each new satellite could be seen.

The second half of the day was dedicated to bias correction of in situ upper air data as well as error estimation and bias correction for satellite data.

First L. Haimberger from the University of Vienna spoke about the status of the bias correction work on Radiosonde data. The presented homogenisation methods RAOBCORE and RICH rely on observation feedback data to detect inhomogeneities in the time series. As well as an adjustment of shifts within the time series also a climatological adjustment is done. Results from sensitivity tests varying the parameters of the system and results from removal of signal experiments were shown. In comparison with the CRU surface data set the “southern climate shift” in 1977 can be seen. Still planned are adjustments with an annual cycle and adjustments back to the pre-1958 era. This offline method should compliment the variational bias correction efforts.

R. Wartenburger from the University of Bern spoke about assessing errors from observations from 1930-1960. Validation of this data is done without other datasets or metadata. Currently work is ongoing on the CHUAN dataset version 1.7. Using selected neighbour stations for homogenisation this method is constrained by the density of the network (at least 5 stations within 400 km are required). The results for temperature and geopotential height look promising however the method does not work as well for wind observations. Future plans are to finish the analysis and gain an error covariance matrix. Some ideas raised were to test the method on a modern Radiosonde dataset as well as on simulated observations.

Next members of the group at the University of Vienna introduced their work. L. Ramella-Pralungo showed first results of the homogeneity of pre-1958 radiosonde temperature data. After some interpolation efforts different archived could be merged into long time series that can be evaluated with web-based time series viewer ([http://srvx7.img.univie.ac.at/~lorenzo/DEVL\\_rrvis\\_2.0/html/index.html](http://srvx7.img.univie.ac.at/~lorenzo/DEVL_rrvis_2.0/html/index.html)). To homogenise those time series the 20CR was used as a reference and first results at example stations were shown. Future plans are to add wind and humidity data and investigate in the different reanalyses possible as references. C. Tavolato presented the current status of the variational bias correction (VarBC) for radiosonde wind direction bias correction. First results with artificially introduced biases at example stations look promising. M. Milan is working on the VarBC for radiosonde temperature data. This bias depends on the solar elevation at the observation time and on the used radiosonde type. The main focus for now is on the grouping of the data and first experiments with a constant bias correction for the solar elevation bias are in progress.

The last topic of the day was inter-calibration activities for Meteosat and their quantification of uncertainties presented by R. Roebelink from EUMETSAT. Most of the work is done in cooperation with the GSICS (Global space-based inter-calibration system) project. The aim is a homogeneous dataset with focus on the adjustment of instrument changes as well as calibration changes. The approach presented uses HIRS data as reference to calibrate Meteosat data. One of the challenges is that the HIRS data comes with some inhomogeneities as well (synchronisation between different instruments, orbital drift, ...). At the moment the quality is increasing in time

but the proposed method still needs an uncertainty analysis and a quantification of the uncertainty of the HIRS data needs to be done.

On the second day the workshop continued with talks on errors in surface observations.

A. Valente from Fundação da Faculdade de Ciências, Universidade de Lisboa spoke about the first steps in homogenising the historical Portuguese records. As an example the time series from Lisbon was shown where records are available from 1864 onwards. A lot of different variables are observed. The most important for the ERA-Clim project are surface pressure and temperature. The digitalisation of the dataset is almost complete and homogenisation efforts will start soon. The best possible statistic tests for break point detection were discussed and it was referred to the COST project ES602([www.homogenization.org](http://www.homogenization.org)) that compared different break detection methods.

Next N. Rayner from the MetOffice talked about different projects within ERA-Clim that are carried out at the MetOffice. The first topic was observation errors from satellite sounder data. An improvement in the reanalysis forecast skill can be seen with the introduction of satellite data. To use the most possible data an error assessment is needed. Different uncertainties were found for different sensors/instruments. The second topic discussed uncertainties in SST fields. Those are presented as through an ensemble. Each ensemble member represents a different handling of the uncertainties in the dataset. For the ERA-Clim project 10 SST ensemble members will be available. Another product of the MetOffice is an ensemble of sub-surface data profiles. This is important in preparation for a coupled reanalysis. Also plans to join the SST dataset and the sub-surface data into one database were discussed. This database should also include bias and uncertainty estimates.

The final talks were an introduction to quality control using buddy checks within data assimilation system by D. Dee followed by a talk of a reanalysis user. M. Mayer from the University of Vienna presented energy budget diagnostics that can be used to estimate uncertainties in reanalysis products.

The last afternoon of the workshop was spent discussing the tasks and deliverables from the work package 4 to the ERA-Clim project. All those deliverables are in year 3 of the project and the progress so far looks promising. It was stated that this work package concentrates more on the work and the bias correction efforts itself than on deliverables. A wish from the group was to soon get an updated version of the CHUAN dataset to start working with the observations. Another useful tool would be a database containing the statistical detected break points probabilities of the observation time series. One of the urgent things to do is to replace the currently not working bias correction for radiosonde temperature in the reanalysis. Some questions were raised on what dataset would suit best as a reference for homogenisation of early records and the general consent was to use the 20CR until the first ERA-Clim reanalysis is available.

This workshop was also the first where a member of the project partner the Universidad del Pacifico, Chile attended. Their main work will be on making ship data from their historical archives available for reanalysis efforts. Some questions on data handling were discussed.

## Workshop participants:

Dick Dee	ECMWF	<a href="mailto:Dick.Dee@ecmwf.int">Dick.Dee@ecmwf.int</a>
Paul Poli	ECMWF	<a href="mailto:Paul.Poli@ecmwf.int">Paul.Poli@ecmwf.int</a>
Richard Wartenburger	U. Bern	<a href="mailto:richard.wartenburger@giub.unibe.ch">richard.wartenburger@giub.unibe.ch</a>
Antonia Valente	FFCUL	<a href="mailto:mavalente@fc.ul.pt">mavalente@fc.ul.pt</a>
Nick Rayner	MetOffice	<a href="mailto:nick.rayner@metoffice.gov.uk">nick.rayner@metoffice.gov.uk</a>
Mariela Vasquez	Chile Met Service	<a href="mailto:mariela.v.vasquez@gmail.com">mariela.v.vasquez@gmail.com</a>
Rob Roebeling	EUMETSAT	<a href="mailto:Rob.Roebeling@eumetsat.int">Rob.Roebeling@eumetsat.int</a>
DESROZIERS Gerald	Meteo France	<a href="mailto:Gerald.Desroziers@meteo.fr">Gerald.Desroziers@meteo.fr</a>
Christina Tavalato	U. Vienna	<a href="mailto:christina.tavalato@univie.ac.at">christina.tavalato@univie.ac.at</a>
Michael Mayer	U. Vienna	<a href="mailto:mima@univie.ac.at">mima@univie.ac.at</a>
Lorenzo Ramella Pralungo	U. Vienna	<a href="mailto:lorenzo.ramella-pralungo@univie.ac.at">lorenzo.ramella-pralungo@univie.ac.at</a>
Marco Milan	U. Vienna	<a href="mailto:marco.milan@univie.ac.at">marco.milan@univie.ac.at</a>
Leopold Haimberger	U. Vienna	<a href="mailto:leopold.haimberger@univie.ac.at">leopold.haimberger@univie.ac.at</a>