



DNMI

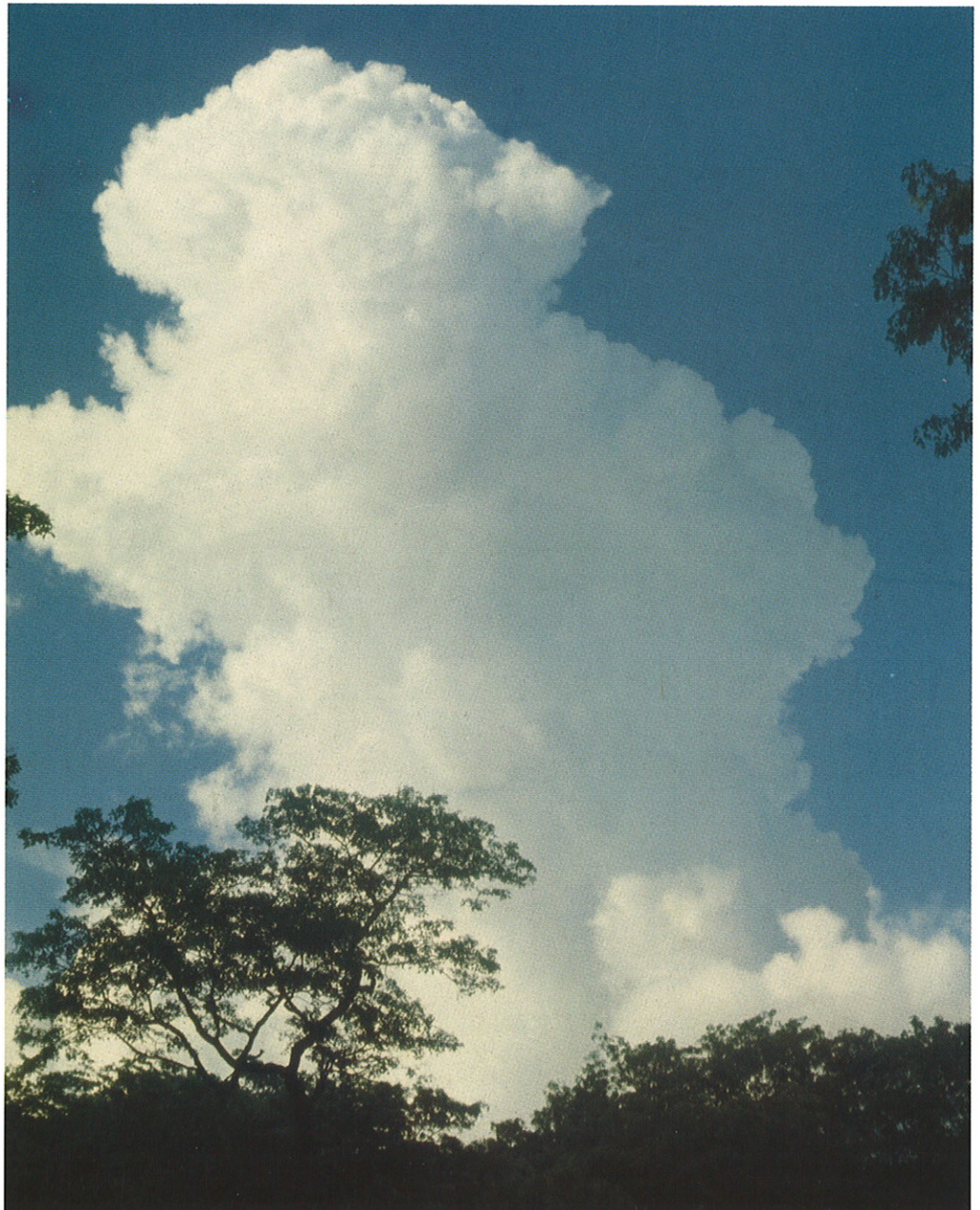
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KLIBAS research notes volume 4

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SUMMARY

In this volume 15 research notes dating from March 1999 are presented. All notes are related to on-going research and development of the KLIBAS climatological database system.

The problems analysed split into seven categories.

1. Quality control in the ALV data processing routine.
2. Automatic weather stations (AWS).
3. The XVIND automatic weather stations (VIND_REG).
4. The TELE routine.
5. The ALN data processing routine.
6. Preparations for Y2K testing of KLIBAS software.
7. Computer aided software engineering.

KEYWORDS

1. Climatological databases
2. Meteorological data collection
3. Meteorological quality control
4. NORDKLIM, AWS, TELE, XVIND

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KLIBAS RESEARCH NOTES VOLUME 4

Foreword

This 4th volume of KLIBAS research notes contains a documentation of problems studied in March 1999. While most of the problems addressed in this collection of notes have later been solved [1-13], the notes only contain an analysis of the problem, sometimes with suggestions on how to solve it or alter the situation in order to eliminate the problem in its present form.

The notes are presented in order of writing. 7 areas of climatological database research have been targeted for problem analysis.

1. *Quality control in the ALV data processing routine.* Check note no. 6 "Performing automatic air pressure analysis by CHECK_CONT2 on the CONTSYN2 output for improving the ALV routine at DNMI". Check note no. 9 "Planning an experiment in order to gradually improve the automatic climate data analysis performed by CHECK_CONT2". Check note no. 12 "Quality system evaluation for the ALV routine by KLIMA_KONTR".
2. *The XVIND automatic weather stations (VIND_REG).* Check note no. 1 "Handling data files with misguiding title information for the VIND_REG routine in the KLIBAS database system at DNMI".
3. *The TELE data processing routine.* Check note no. 2 "Status report from monitoring the KA_H_STAT subroutine in the TELE data processing routine at DNMI". Check note no. 5 "Quality Control of Real Time Meteorological Observations at DNMI". Check note no. 8 "Making SYNO_INN portable and able to run in test mode for Year 2000 testing". Check note no. 11 "Using SYNO_KONTR as a prototype for NORDKLIM quality control systems development". Check note no. 15 "Breakdown of the SYNO_INN program due to problems in the system statistics function".
4. *The automatic weather stations (AWS).* Check note no. 14 "Designing a program for updating the KLIBAS database system with historical observations from automatic weather stations".
5. *The ALN data processing routine.* Check note no. 3 "A suggestion on some preparations needed in order to automate a daily precipitation quality control data processing routine". Check note no. 4 "On the design of computer systems for validating results for iterated attempts at automating a daily precipitation quality control routine".
6. *Updates and preparations for testing software against the year 2000 (Y2K).* Check note no. 7 "Preparations for the testing of the Year 2000 problems for the KLIBAS database system at DNMI". Check note no. 13 "Making the STATUT program portable and ready for Y2K testing".
7. *Computer aided software engineering (CASE).* Check note no. 10 "Planning an experiment for improving the evaluation statistics for the KAPO systems development program".

The notes in this volume document a number of problems in the KLIBAS database system during March 1999. The reason why these particular problems were being addressed this month had to do with the automatically updated priority list presented in the status report for February 1999 [2].

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Blindern, April 1st 1999

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Handling data files with misleading title information for the VIND_REG routine in the KLIBAS database system at DNMI

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ABSTRACT

A problem where the title of the data file for the VIND_REG system contains numbers, but not numbers corresponding to the station identification causes problems. In this note the problem is described and a solution to the problem is suggested.

The VIND_REG program

Specifications for the VIND_REG program were written by Lars Andresen in September 1997, resulting in a first version of VIND_REG being released the 12th of July 1998 [1]. The purpose of the program was to read files, interpret and modify observations when necessary and store the results in suitable datatables in the KLIBAS database.

By August 18th 1998 a routine was being established at the Climatology Division for handling the observations. A quality control program VINDDEK was then released according to specifications by Lars Andresen and P.O. Kjensli [2].

By the end of August the same year, a revised version of VIND_REG appeared [3]. Minor faults in the algorithm had been corrected, the specification had been slightly updated.

Still there were problems with the program, and on the 20th of October 1998 a version 1.2 of VIND_REG was released [4]. The program was now running systematically every hour of the day by the crontab schedule on the UNIX machine. A new table XVIND was designed for storing the observations.

The first log of the program is in April 1998. It was then run 17 times, failing 0 of these. The curve below shows the relative number of runs of the program that has been failing according to the log.

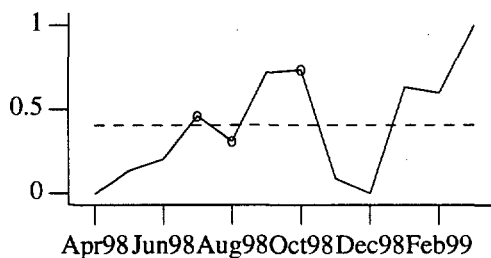


Fig 1. Relative number of failures

The average value dashed in the figure no 1. is 0.41. The time when the revisions of the program appeared are marked with a small circle.

The identification problem

On Wednesday February the 24th 1999 the VIND_REG program collapsed in an attempt to read data from the file 980527WT.txt, taking 98052 as the identification number for the station.

When examining the file, however, one sees that the identifier inside of the file says ENSN, meaning that the observations should belong to 30420 Geiteryggen. The title of the file refers to the fact that the last observation on file dates 1998.05.27.

Even though this type of identification is highly irregular, it makes the VIND-REG program break down, and causes total collapse of the system. In some way, the program should be made to use the identifier inside the file as default

when the title of the file does not make sense.

More importantly, however, the program should not have waited to collapse when trying to insert observations into the VIND data table. It should have found out at a much earlier stage that 98052 was not a bona fide station number.

Identifying stnr in program

The procedure used by VIND_REG to identify the station number is called "findStnr-FromVindPara". This function starts by reading the identifier from inside the file and stores this information in the variable *en_kode0*. As it sometimes happens, however, that there is a conflict between the number on the title of the file and the identifier inside that file, it has been decided that the title indicator is the one that should be used by default as there have been found errors on the inside identifier.

In consequence, the variable *en_kode0* contains the information 'ENSN', but this information will not yet be used. What the *findStnr-FromVindPara* function now does is to check the format of the title of the file. If the title consists of letters, it assumes that this is the correct EN-code, if it contains numbers, the program assumes this is the station number.

Conclusion

One way of solving the program may be to insert a check in the procedure that looks for the name of the station. If no rows are return when searching for a name in the ST_INFO table, this must mean that the station number was not wisely chosen, and the information inside the file is probably a better choice.

The function should then check whether the inside information really makes sense in terms of identifying a station. If no station is found in this case either, the program must abort in error, otherwise inserting observations into XVIND may continue as normal.

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Status report from monitoring the KA_H_STAT subroutine in the TELE data processing routine at DNMI

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ABSTRACT

The TELE data table is used for several climatological purposes. One of the major responsibilities of the TELE routine is to generate monthly climate statistics as soon as observations are stored on the KLIBAS database system. Numerical values for this monthly product is generated by the program KA_H_STAT. A program CHECK_H_STAT is, however, run as a part of the SYNO_KONTR system in order to monitor problems arising due to data quality used for the KA_H_STAT program.

The CHECK_H_STAT program

In January 1996 a first description of the SYNOP/TELE routine was published [1]. The purpose of the publication was to describe the system as it was performing primo 1996 in order to use this as a benchmark for further testing. An improved description was published three months later [2].

The first version of the CHECK_H_STAT program was released in May 1998 [3]. The purpose of the program was to check whether the computer program KA_H_STAT was generating reasonable statistics or not when processing the TELE data table. The idea of the program was to simulate what was already being done manually.

Shortly after, July 1998, a similar approach was made for checking output from the STATUT program [4]. As this was an even more important program, and update vc.1.1 of CHECK_STATUT was released as soon as the next month [5].

The version 1.0 of CHECK_H_STAT was based on checking instances where the fields in KA_H_STAT left blanks. Apparently observations were missing in these situations, and this information was hence channeled forward through to the maintenance report for daily check. In the February 1999 version 1.1 of

CHECK_H_STAT [6] the same approach was used, but this time the counting of missing fields in the KA_H_STAT output was based on correspondence with the TELE_PARA table.

The first log of CHECK_H_STAT was in Mars 1998. It was then run 42 times, failing 1 of these (2.4%). The curve below shows the relative number of runs of the program that has been failing according to the log.

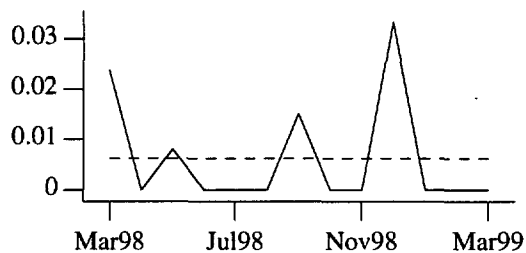


Fig 1. Relative number of failures

The average value dashed in the figure no 1. is 0.0062. There is no apparent visual indication in the figure that might indicate that the program is stabilising although the two last months show a defect ratio significantly below average.

The CHECK_H_STAT results

The plot shows the day by day measurement of defects for the KA_H_STAT output of the month measured by counting the number of missing values in the output file as it is run.

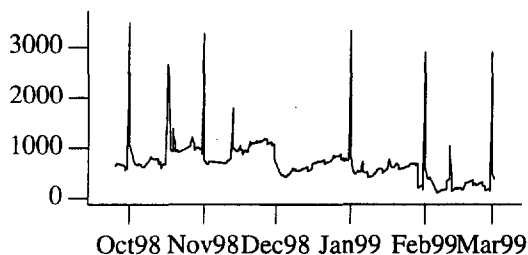


Fig 2. Defects in KA_H_STAT output

The first measurements up to late January 1999 are based on all stations in the TELE data table. As only a selection of these are actually used when producing KA_H_STAT statistics, only stations defined on the TELE_STASJ file have been used since.

A rather prominent feature of the curve in figure 2 are the dips that occur on the first day of the months, every month except December 1998. These dips have to do with the KA_H_STAT program not producing meaningful default specifications for data select for the first day of the month.

In order to improve the statistics, and gain control over the routine, a better definition of data to be selected should be specially cared for by the CHECK_H_STAT program for the first day of the month.

The CHECK_H_STAT system

In order to fully understand the consequence of the curve in figure 2, it is imperative to understand the CHECK_H_STAT system, or the system for updating TELE in order to produce KA_H_STAT statistics. In neither the system documentation of CHECK_H_STAT [5] nor the monthly statistics report [7] is there a diagram which would explain the routine in detail.

A system diagram should contain information that could be used for distributing the defects described as a curve. In other words, the reason for the failure in the curve should be easily pinpointed on the diagram. If there are missing values, for instance, defects should be attributed to the interpolation programs INTERPOL2, HIRLAM or both.

Worst case analysis

When running the CHECK_H_STAT program, there are reported problems with 57 weather stations of the 127 stations defined on /usr/people/kabt/tele_stasj (45%). Of these, 79530 RANA - BÅSMOEN is by far the "worst" station, having 16 defects according to internal definitions, while the next station on the list, 08130 EVENSTAD - ØVERENGET, has 9 defects.

A more detailed status for 79530 RANA - BÅSMOEN:

1. Missing temperature columns, TM, AV, TNM, TN, TNDT, TN<0, TN<-10.
2. Missing precipitation columns, RR, RRPRO, RX, RXDT, RR>=0.1, RR>=1.0, RR>=10.0.
3. Miscellaneous missing columns, FX>=F6, FX>=F9.

Below we deal with each of the three groups of problems separately, beginning with the temperature problem.

Temperature at Rana primo March

The "worst case" statistics above show that KA_H_STAT was unable to produce several temperature statistics. Looking at the TELE data table, we see that all temperature values have been interpolated for March, the only values missing are minimum temperature on the 1st at 06:00 and 18:00 UTC.

These particular minimum values have been removed by the S-T-F program [8] as we notice that the missing value are flagged by the number '5'. We don't know, however, if the interpolations were done by the INTERPOL2 program [9] or the HIRLAM program [10], as in either case interpolations are flagged '4' when inserted and '5' when removed.

Checking the symptoms file, on the other hand, from the HIRLAM program, shows that 79530 is not a station defined for validating synops, and therefore no interpolation is done in TELE by use of the HIRLAM program. The reason for missing observations, then, is due to bad estimates generated by the INTERPOL2 program.

When checking log files from the INTERPOL2 program, the files state that no update has been done, at least in the case of air temperature TT, as there is not sufficient test data to estimate

correlation and produce weights for estimation. This is in conflict, however, with the fact that TELE actually has been updated for TT as can be seen by the flags FLTT containing the value '4'.

Furthmore, when checking the content of the data table SYNOP2, it can be seen that there are no observations for 79530 after February the 18th. It is then, correct, as the INTERPOL2 program says, there is not sufficient data to estimate correlation and produce weights.

In spite of this, however, the INTERPOL2 program seems to have updated the TELE table anyway. The program should be modified so that only restricted values of a certain estimated quality are being used.

Precipitation at Rana primo March

The "worst case" statistics also show that KA_H_STAT has been unable to produce precipitation statistics RR, RRPRO, RX, RXDT, $RR >= 0.1$, $RR >= 1.0$, $RR >= 10.0$. When checking TELE the data set seems complete, so this is a mystery. The programmer responsible for KA_H_TELE has, however, been contacted. Hopefully this will give some insight.

Wind at Rana primo March

The third item on the list of problems with Rana mentions the parameter FX. When checking TELE_PARA, however, the station 79530 should not report the parameter FX, so this is an error in the CHECK_H_STAT program that should be corrected.

In the function "sortFields" in CHECK_H_STAT there is already a function that does a similar check in order to find out whether the station observes the weather or not, a typical discriminant for automatic whether stations. The function could be enlarged to also check the wind parameters.

Conclusion

Before the problem with temperature can be solved, the INTERPOL2 program need to be modified so updates in TELE are only executed for quality estimates. For further analysis on the precipitation problem, feedback is needed in order to understand why no value is indicated on the KA_H_STAT output. The problem with wind, however, may be directly solved by adding a feature as described above in the CHECK_H_STAT program.

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A suggestion on some preparations needed in order to automate a daily precipitation quality control data processing routine

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ABSTRACT

In this paper we take a look at some angles possible for producing an automatic quality control and data processing routine using the ALN data processing routine at DNMI as an example. Ever since the ALN data processing routine was implemented on SGI Typhoon in the second half of 1993, there has been a need for making the procedure more efficient and more automatic. As work on quality control of daily precipitation was also a main concern of other Nordic meteorological institutes, a Nordic project FREYR was initiated. The FREYR project has later been replaced by the NORDKLIM project. In the KLIBAS database system, a computer program PRECIP_KONTR has been designed for gradually automating the ALN data processing routine.

Automatic QC before FREYR

Although automatic quality control was not a main issue in the quality control specification report of 1993 [3], chapter 7 in this report is devoted to automatic quality control. Of special notice is that the problem of NON-DAILY precipitation stations, doing measurements only, say, during the weekends, should have the observations automatically distributed so they may naturally become part of the general quality control of daily precipitation.

The most important aspect of the 1993 specification report, is, perhaps, a note from Bjørn Aune, from November 1992, concerning several ideas on "total quality control" with references to an article on the quality assurance in the observations area of the Meteorological Office (UK) [2].

This article seems like a very good starting point for both the NORDKLIM project and the PRECIP_KONTR program, both discussed below.

Another highly important document for automation is the formal description of the ALN data processing routine, which was published in

January 1996 [3].

The FREYR project

The idea of a joint Nordic precipitation quality control system was proposed on a seminar within the Working Group on Precipitation in the Nordic Hydrological Programme (NHP) at SMHI on the 22.-24. of November 1995. It was believed that such a system would benefit in respects of finance and improved quality. The present state of quality control was presented by each of the Nordic countries.

On a follow-up meetin at SMHI on the 28. of March 1996, foundations for a joint quality system were studied. Preliminary dragts for the project were made. At a following NHP-meeting in Reykjavik on 15.-17. April 1996 it was suggested that the project should be named FREYR. A delegation of responsibilities was made and a time schedule was made.

Due to termination of the NHP working group late 1996, it was necessary to continue FREYR as an independet project. It was, however, decided that NHP representative Pauli Rissa-

nen of FMI should be project manager. Before a project proposal was made it was decided that there should be a meeting within the group in Helsinki on the 23.-24. of January 1997. Apart from Rissanen, the project consisted of members Flemming of DMI and Øgland of DNMI.

This turned out, however, to be the only meeting held within the group, draft 1.3 of the FREYR specifications [4] being the unfinished result from the FREYR efforts. The document is expected, however, to be of vital importance for the development of the NORDKLIM project.

The NORDKLIM project

The project was defined in July 1998 [5], and consists of several tasks, including *Task 1.2*:

Improve methods for operational quality control (QC) of meteorological data (including real time data from synoptic and automatic weather stations), exchange of experiences and ideas for more effective handling and presentation of weather and climate data, common standards for storing metadata information, etc. This activity will continue parts of the work commence within the NWGP-initiated quality control project FREYR.

The first NORDKLIM Steering Committee Meeting was then held in Oslo, Norway, 27.-28. January 1999, where participants were appointed for the NORDKLIM tasks, Pauli Rissanen given the responsibility as task manager for task 1 "climate data", and plans for a NORDKLIM Workshop was suggested for September 1999.

Of special interest for the quality control activities, the Task 1.2 was now described in the following terms:

Continuation of parts of the "FREYR-project", incl. GIS-based system for controlling and correcting suspect values. Deliverables [for the September Workshop]: Joint report on Nordic algorithms for QC of climate data, and suggestions for QC-routines on real time data (incl. data from Automatic Weather Stations).

A first meeting for the Task 1.2 group of NORDKLIM is planned for Helsinki, 15.-16. April 1999.

The PRECIP_KONTR program

The purpose of the program PRECIP_KONTR has been to grow a new version of the PRECIP control routine. Each element in this system is supposed to run independently, but in

order to make the system grow before being put to use, the mother program PRECIP_KONTR is supposed to simulate the manual run of the routine.

The first log of the program is from August 1998. It was then run 48 times, failing 28 of these (58.3%). The curve below shows the relative number of runs of the program that has been failing according to the log.

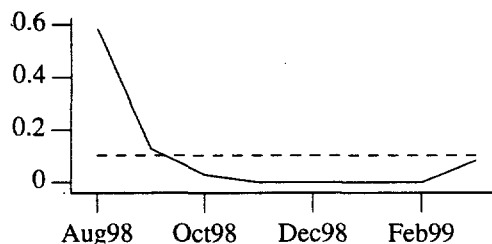


Fig 1. Relative number of failures

The average value dashed in the figure no 1. is 0.10. So far the program has only been running the FREYR and ROMRR programs, without any kind of analysis performed on the output from these, so there have, as expected, been very few cases with the PRECIP_KONTR program going wrong.

Plans for automating the ALN routine

For the upcoming NORDKLIM task-one meeting on quality control a prototype of the automatic ALN routine, partly based on experience from the FREYR project and elsewhere should be presented. A report should be written which contains both references to international results in automatic quality control and interpolation of daily precipitation, and statistical results, describing the efficiency of the automated ALN data processing routine so far.

Data processing statistics should be aligned with other statistics produced for the DRIFT program [7].

This note being written at the beginning of week 10, there are five weeks for planning and implementing the system. Here is a suggested plan:

1. *Week 10.* Preparing the final report to be published in the DNMI/KLIMA-series. The report should contain a description of algorithms, international references, and sample statistics describing how well the system is performing as of yet. The KLIMA-report should be written as a doc-

- file from the PRECIP_KONTR program, including a txt-file on system statistics which will also be used for the DRIFT system. A first version of PRECIP_KONTR is published,
2. *Week 11.* Monitoring and simulation should include output from TELE2ALN, GEOK, ROMRR, FREYR, RRUTM and RRSSU, suggestions from the programs resulting in update in the ALN2 data table. Comparative statistics from ALN and ALN2 should then be displayed.
 3. *Week 12.* Functions for distribution measurements for non-daily observations into daily observations should be done. The interface with ALA, automatic weather stations, should be planned and implemented. There should be a major investigation of interational literature on quality control of daily precipitation.
 4. *Week 13 (Easter holidays).* Only three days available for research and development. A draft should be published and sent to the group, preferably in form of a KLIBAS report, perhaps including code description and system description.
 5. *Week 14 (Easter holidays).* Only four days available for research and development. The final report should, nevertheless, be published in order to work on other problems, preferably not related to QC before joining the group in Finland.
 6. *Week 15.* The meeting will be held in Helsinki, 15.-16. April 1999. The week should be spent aligning the FREYR/ALN report with other preparations for the meeting, such as the TELE routine, the AWS data and the ALV routine.
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On the design of computer systems for validating results for iterated attempts at automating a daily precipitation quality control routine

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ABSTRACT

The present ALN data processing routine, i.e. the quality control and data processing routine for daily precipitation at DNMI, is highly dependent on manual interaction in the quality control. In a gradual attempt at replacing this routine with a fully automatized routine, experiments have to be run and evaluated. The purpose of this note is to document some of the current plans for doing so by use of a computer program named PRECIP_KONTR.

The PRECIP_KONTR simulation

PRECIP_KONTR is a computer program which has been especially designed for simulating the ALN data processing routine. The program reads new observations from the ALN table, stores these in the ALN2 data table, makes an analysis of the quality control output and performs updates in the ALN2 table. A function for comparing the ALN and ALN2 data sets has not yet been completed, and the program in itself is far from complete.

The first log of the program is from August 1998. It was then run 48 times, failing 28 of these (58.3%). The curve below shows the relative number of runs of the program that has been failing according to the log.

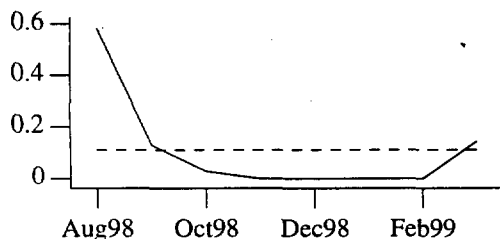


Fig 1. Relative number of failures

The average value dashed in the figure no 1. is 0.11. So far the program has only been running the FREYR and ROMRR programs, without any kind of analysis performed on the output from these, so there have, as expected, been very few cases with the PRECIP_KONTR program going wrong. The greater amount of errors recorded for March 1999 has to do with redevelopment and testing of the program.

Comparing ALN and ALN2

The observations of main interest in order to validate the automatic quality control is precipitation (RR), at least at this stage of simulation. The statistics needed for evaluation the performance of the automatic data processing should be thoroughly designed.

As a first approach, however, to validate statistics, the same kind of statistics used by the validation of operational forecast models used at DNMI could be used [1], although the basic premises are not exactly the same when producing the statistics.

In the case of forecast validation the surface observations are used as the standard and the model values are used as estimates for these, giving rise to statistical notions of error, bias and rmse.

In the case of the ALN data processing routine we are comparing two parallel routines where neither ALN nor ALN2 are expected to be totally free of errors. What is measured in this case, then, is the discrepancy between the two data tables which is something very different. Traditional statistical methods for comparing two treatments, such as chapter 9 in [2], should be exploited.

In addition to comparing ALN and ALN2 against each other observations by observations, it could perhaps be useful to introduce some kind of metrics for each of the quality control programs being used, metrics showing to which extent the set of operations fit with the tests.

For the present, however, simple statistics such as bias and rmse will probably be sufficient in order to put the beta version of PRECIP_KONTR in useful operation.

Presenting validation statistics

Instead of producing output from a stochastic variable as is done for describing the TELE routine [3], a stronger focus on sample stations should be made, perhaps even using the program just for special analysis of one particular station, such as one of the automatic weather stations that is presently used in the ALN routine, like, say, station no. 00180 Trysil Vegstasjon.

Using an automatic weather station as a query station is coherent with the goals of the NORDKLIM project for 1999 [4], where it is stated:

Continuation of parts of the "FREYR-project", incl. GIS-based system for controlling and correcting suspected values. Deliverables [for the September Workshop]: Joint report on Nordic algorithms for QC of climate data, and suggestions for QC-routines on real time data (incl. data from Automatic Weather Stations).

When presenting the validation statistics there should be a full description of the cases where there is a difference in the approach of the PRECIP_KONTR program and manual routine.

Description of algorithms and results

A description of the ALN routine and listing of all quality controls and methods inherent in the routine should be a continuously running process as a preparation for a final report to be published in the DNMI/KLIMA-series. The report should contain a description of algorithms, interna-

tional references, and sample statistics describing how well the system is performing as of yet.

The KLIMA-report should be written as a doc-file from the PRECIP_KONTR program, including a txt-file on system statistics which will also be used for the DRIFT system. A first version of PRECIP_KONTR is published,

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Quality Control of Real Time Meteorological Observations at DNMI

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ABSTRACT

Meteorological observations are updated on the KLIBAS database system every ten minutes. At every hour of the day, these observations are updated manually with the aid of the S-T-F quality control software. The S-T-F program is also run twice a day as a part of an automatic quality control with subsequent automatic corrections (interpolations). In this paper we take a look at status for the S-T-F quality control program, discussing some of the failures and possibilities for improvement.

S-T-F real time quality control

The basis for the present S-T-F real time quality control dates from an similar S-T-F program developed in the late 1980's [1]. In July 1995, however, the first KLIBAS-version of S-T-F was released [2], containing checks for temperature and precipitation in the TELE data table.

In February 1998, a version 2.0 of S-T-F was released [3], the program now being also a part of the automatic quality control routine running on the TELE data table. The updated version 2.1 was released in May 1998 [4], now augmented with functions for deleting automatically generated interpolations that were not consistent with the quality checks.

After the release of version 2.1 there has been made several updates of the program, the most important one being that statistics from daily automatic quality control are now being collected and fed to the DRIFT system treating the program as a problem in Statistical Process Control [5].

The first log of the program is in July 1995. It was then run 27 times, failing 2 of these (7.4%). The curve below shows the relative number of runs of the program that has been failing according to the log.

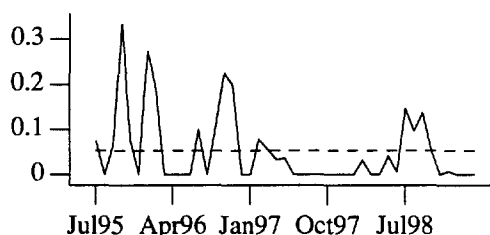


Fig 1. Relative number of failures

The average value dashed in the figure no 1. is 0.05. According to the graph there is a certain amount of randomness in the quality of the program, in terms of some months running without error then a few months with quite a few errors. On the whole, however, the program seems to have been stabilising since mid 1995.

Problems during mid February 1999

On Tuesday February 16 1999, it was reported a problem of S-T-F not removing automatically interpolated values for the station no. 24 Særna. Checking the observations of TT, TN and TX for February 1999 it can be seen that there are several cases of TN and TX having been interpolated by the INTERPOL2 program [6] and consequently flagged '4', while still being in conflict with the quality control checks in S-T-F. In the version 2.1 of S-T-F, the program was augmented

with code designed for removing observations that were flagged '4' and in conflict with the quality checks.

The reason for observations not being removed, however, can be found in the KLIBAS statistics report for January 1999 [7], page 16, where it is said that until January 30th the S-T-F statistical process control plot was based on running S-T-F for all stations in TELE, while only stations on the TELE_STASJ file have been used for producing statistics from then on.

Running S-T-F only on the TELE_STASJ stations means that only false interpolations on these particular stations are removed. Station no. 24, which is a Swedish station, is not defined on this file, and, hence, no '4' values in conflict with the quality tests are removed from this station.

The reason for narrowing the focus from the complete population of all stations in TELE to the stations defined on TELE_STASJ at the end of January was that for producing monthly climate statistics [8], one of the major reasons for running the TELE routine, only the TELE_STASJ stations are being used, and running the statistical process control routine over all stations seemed to draw attention to stations that were not of particular interest for this routine.

At the present, however, it seems reasonable to re-enforce automatic quality control on all stations in TELE as the climate statistics is not the only product made from this source, important statistical applications, such as the weather statistics for the past thirty days [9] and the SYNO_ESPEN files [10] are based on TELE with stations not only defined on the TELE_STASJ table.

The automatic quality control is run by the SYNO_KONTR program [11], but the defaults deciding whether TELE_PARA, TELE_STASJ or other domains of stations should be used as default is defined in the S-T-F program. The default TELE_STASJ should be altered back to TELE_PARA.

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Performing automatic air pressure analysis by CHECK_CONT2 on the CONTSYN2 output for improving the ALV routine at DNMI

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ABSTRACT

The program CHECK_CONT2 is designed for analysing and producing evaluation statistics for stations based on output from the CONTSYN2 quality control program that is part of the ALV quality assurance routine. In this paper we investigate strategies for analysing output relating to air pressure as this is one of the weather elements the present version of CONTSYN2 has some difficulty dealing with.

The CHECK_CONT2 program

In May 1993 a report on quality control methods for the KLIBAS database system was published [1], mostly devoted to precipitation stations, but also with treatment of other types of weather stations, stressing the need of a modular system.

In October 1994 special concern was taken in order to investigate the present state of the ALV quality control routine [2]. The report gave a short historical overview of the development of the quality control routine, a description of how the present system was working, analysing tests and output for all programs, and some suggestions on further development.

By September 1995, a new ALV quality control was under production for the KLIBAS database environment, starting by migrating the core quality control program CONTSYN2, and making this work under the new environment [3], soon followed by a complete migration of the rest of the system [4].

By April 1996 a version 1.1 of the ALV quality control system was running [5], now debugged to be working with the same stability as it had been doing on the ND-computer system prior to KLIBAS, although some minor attempts at improving the system even further was also

made this year [6].

In July 1998, however, a new approach to improvement of the ALV routine was made by running a simulation program KLIMA_KONTR [7] that started subprograms analysing the different results from the ALV quality control routine and made a total evaluation of the system.

Two vital components in the KLIMA_KONTR system were the CHECK_RELFUKT [8] and CHECK_KONTHUM programs, both producing automatic analysis of the output from the quality control programs that were specially designed for locating problems related to relative humidity, the KLIMA_KONTR system further improved during August 1998 [10].

In December 1998 new work commenced on the CONTSYN1 quality control program as the ALV routine was expanded in order to also handle semi-automatic weather stations (SAWS) [11], and in February 1999 a version 2.0 of CONTSYN2 was made [12] that would produce an appendix to the results produced by the earlier CONTSYN2.

The most important program in the KLIMA_KONTR simulation is, however, the CHECK_CONT2 program [13]. CHECK_CONT2 uses output both from CON-

TSYN2 v.1.1 and v.2.0 in order to investigate the status of each particular station.

The first log for this program was produced in August 1998. It was then run 53 times, failing 2 of these (3.8%). The curve below shows the relative number of runs of the program that has been failing according to the log.

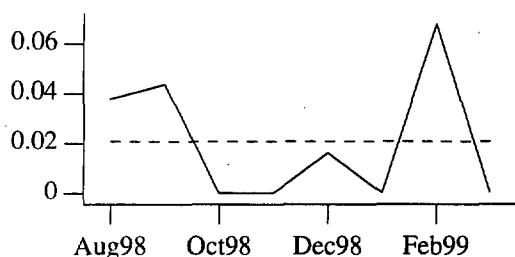


Fig 1. Relative number of failures

The average value dashed in the figure is 0.02. There has been very little trouble with the program in its present version. The program is designed to be run twice a day, executed from KLIMA_KONTR.

The air pressure problem

One pressing problem with the CONTSYN2 output is the air pressure control formulas where special cases of air pressure handling for certain stations are hard-coded into the system. As the station network is updated and altered this may result in new or old stations falling into wrong categories, sometimes making the CONTSYN2 output indicate that there may be problems with stations that actually are working as specified.

Similarly, air pressure faults may not be detected if formulas are not set up in a proper manner. Lars Andresen has analysed the use of air pressure formulas in quality control at some ALV weather stations [14], concluding that there may be problems with inversion on certain stations. Fiplingsvatn should use inversion formula, so should Kautokeino, but Byglandsfjord should not. All three stations generate misleading output on CONTSYN2.

Automatic analysis of the CONTSYN2 output

The purpose of the CHECK_CONT2 program has been to make an automatic analysis of the CONTSYN2 output in order to help the ALV routine in how to handle quality control problems, and also, as the system develops, make automatic updates in the ALV data table for simple routine

errors that are detected by the program and which may be algorithmically detected and solved.

Presently, what the program does, is to loop all stations, count the number of defects or warnings for each particular one, producing statistics and curves that are then printed in the monthly interpolation and quality control status reports [15], and perform the early stages of an automatic analysis of air pressure output.

The air pressure analysis consists of running a simulation of an actual attempt of identifying and solving problems for the station no. 15730 Bråtå - Slettom mid February 1999. The algorithm and results are documented in [13].

As the problem at Bråtå have been solved since this, it is now natural to run the program on the current list of stations in order to eliminate problems and add features in the algorithm as problems are encountered and solved. If there are faults or problems found in the CONTSYN2 V.1.1 program, these should be identified and give birth to improved methods in the CONTSYN2-v.2 series.

An experience from developing the analysis functions in the first version CHECK_CONT2 was that the algorithms soon become very complex. It is our belief that ideas and methods of artificial intelligence perhaps could be helpful in order to overcome some of the difficulties, or at least such ideas and methods should be investigated in order to find out if they may turn out useful in the context of quality control of climate data [16].

When the CHECK_CONT2 program start producing results that seem very likely to lead to sensible updates in the ALV data table, summarised output from the program should be written both to the DRIFT program and as output for the ALV routine in order to help making the routine more efficient.

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Preparations for the testing of the Year 2000 problems for the KLIBAS database system at DNMI

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ABSTRACT

At DNMI a special computer, vnn-y2k, have been defined for testing in order to prepare for eventual problems having to do with certain dates related to the year 2000. The purpose of this paper is to document tests for the programs SYNO_INN and STATUT which are part of the KLIBAS real-time data system. First login scripts, compiler instructions and file paths have been updated. This includes solving practical problems and discussing with the people responsible for the vnn-y2k computer in order to prepare the computer for test.

The vnn-y2k computer

While logging on to the Thunder SGI computer and testing KLIBAS software was a non-trivial task [1], the kapo environment on the vnn-y2k computer appears more user friendly.

From the point of view of the halo SGI computer, the vnn-y2k computer may be reached by telnet, using the instruction *telnet vnn-y2k* which then prompts for user (*login:*) and user password.

Having logged on to vnn-y2k, the Oracle8 interface may be tested by running SQL*Plus. The SQL*Plus interface does not accept the customary user kaxx, but the development user kapo is accepted.

However, vital data tables such as TELE, TELE_PARA, SYNOP and SYNOP2 are not available for this user, so no testing for the SYNO_INN program can be done by kapo until this problem is solved. There is another user, however, the user x which has been designed for testing, so initial attempts may be performed by using this.

Preparing to test SYNO_INN

The SYNO_INN software on the vnn-y2k has apparently been copied from SGI Thunder, not SGI Gale, and is, hence, not completely up to date. In fact, the SYNO_INN software in this particular case is the version 3.6 of the system [2], while version 3.7 is running on SGI Gale [3].

As no changes in part of the code that had anything to do with dating of observations or system dates were addressed in the update from v.3.6 to 3.7, the consequences from running the test on 3.6 should be the same as running it on 3.7. In principle, the testing can commence.

Running the SYNO_INN program in its current state, however, does not work, as the paths in the *syno_inn.csh* script are non-portable, specially designed for Gale, meaning that the first thing to do in order to run the program on vnn-y2k will be to alter the path definitions of the program in order to make it portable [4]. This is done by replacing the pattern */usr/people/kapo* with the variable *\$HOME*.

In order to alter program code it is necessary to use some kind of file editor. The emacs editor used on SGI Gale and Thunder does not seem to be available, so the jot editor is the used

as an alternative, and the updates are done with jot.

The program script now runs, but the system breaks down when it tries to access the syno-files on /opdata as vnn-y2k is not mounted against SGI Monsoon. Discussing the problem with Trond Bø at the Computer Division, it appears that it is impossible to do this mounting at we are suggested copying the syno-files from Monsoon to a local directory on vnn-y2k by use of ftp.

A directory dat is then made under then syno_inn directory and all references to the /opdata/dat directory in the program script are changed to refer to the dat directory.

The reference to the trunclog program at the end of the script is also removed from the script at the trunclog program is not duplicated for the vnn-y2k computer.

Now the program script now manages to run without problems, but the program itself breaks down is there are specific path reference inside it. The only way to alter this will be by reprogramming that particular bit so the complete program will be portable.

Changes in source code for SYNO_INN

First of all, the program breaks down as it tries to read the summary description on the ~kapo/drift/dat directory. As this directory is not duplicated on the vnn-y2k computer, the function have to be put out. This is done by placing comment symboles around the "title_page" function inside the "system_test" function of the program.

The change in source code means that the program have to be recompiled. This is automatically attempted by the syno_inn.csh script, but as the old version was designed to work on the Oracle7 Pro*C compiler, the attempt at compilation breaks down in a similar fashion as described in [4] with the message *cannot get /oracle/klibas/8.0.4.1/precomp/env_precomp.mk for including*.

The conclusion from [4] was to use this particular file as a local proc.mk file. In this case, however, no such file exists, and it is therefore impossible to compile and perform the tests on vnn-y2k.

Conclusion

As it is not possible to compile on the vnn-y2k computer, the source code on SGI Gale have to be altered so that both the programs

SYNO_INN and STATUT are able to run on both computers. Reprogramming must consist then, of methods of making the programs portable and able to read the testfiles when the ordinary files cannot be found.

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Making SYNO_INN portable and able to run in test mode for Year 2000 testing

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ABSTRACT

Updating SYNO_INN from version 3.7 to 3.8 in order to run on the vnn-y2k computer for year 2000 testing is a non-trivial task. This note describes some of the problems related to this update.

SYNO_INN data collection

The purpose of the SYNO_INN data collection system is to read binary GTS files that are updated every 5 minutes into an Oracle RDBS as often as necessary, at the moment every 10 minutes. The present SYNO_INN program has been developed through several versions.

Using data from realtime synop data flow for insert in the climatological data base was discussed in 1985. Andresen et al. [1] wrote at the time a report addressing quality control issues in relation to observations being digitalised outside the Climatology Division.

The dataflow then implemented consisted on only reading observations relevant for long time storage in the Climatological database system on the ND computers. The dataflow was summarized in further detail during the autumn of 1993 by Øgland, Aasen and Vidal [2] as a part of the plans for the implementation of a new data collection system to be build for an Oracle RDMS on a SGI platform.

The first version of the SYNO_INN program, reading all observations from zone one on the synoXX-files into Oracle database tables, was implemented and put in operation in February 1994 (Øgland [3]) and revised due to upgrading the Oracle database system from version 6.0 to 7.0 in November 1994 [4], and revised once again by the end of the year [5] with a final revision 2.0

in April 1995 [6].

Runtime statistics from the system were systematically collected and summarised under the name GTS2FIFO in monthly reports from June 1995 and onwards (Øgland [7]). The name GTS2FIFO was chosen due to a FIFO-construction modelled after the work by Schøyen [8] on administrative data.

In October 1996 the SYNO_INN program was completely rewritten [9], later versions up to the present [10-15] being grown out of this code.

The version 3.7 of program [16] was made to prevent the system from breaking down in case of failure in the insert procedures INSERT_SYNOP, INSERT_SYNOP2 and INSERT_TELE. The adjustment was made to compensate on a problem of SYNO_INN breaking down on Sunday janary 17 at 19:41 GTM as it was unable to extend the SYNOP-index. Still the program will not be able to extend the SYNOP-index, but it automatically generates an e-mail message to a person who may be able to do so and continues inserting data into the other data tables.

The first log of the program is in May 1997. It was then run 212 times, failing 28 of these (13.2%). From the next month and onwards, the system stabilised and recorded only fragments of problems until a new design v.3.3 in October 1998 [12]. The average number of failures then

increased to about one percent.

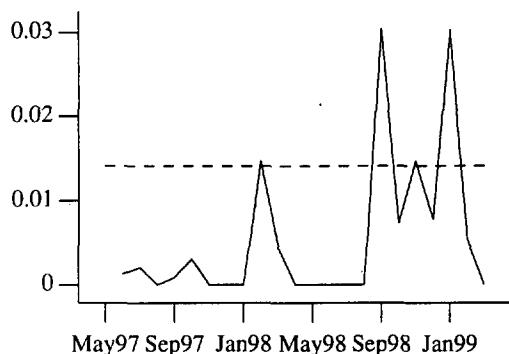


Fig 1. Relative number of failures

The average value dashed in the figure is 0.0141.

A fatal logon problem

After having done several adjustments in the *syno_inn.csh* file and the *syno_inn.pc* file, running the revised program on *vnn-y2k*, using *x/x* as Oracle user and password, the program breaks down with the message **ORACLE ERROR: ORA-01005: null password given; logon denied** although the program recognises *uid = 'x' (len=1)* and *pwd = 'x' (len=1)*.

In order to eliminate any causes that may have to do with the *csh* script being used rather than the *bash* script, the sentence in the *syno_inn.csh* file that makes the reference to the *syno_inn.pc* program has been embedded in a *bash* call. Apparently this makes no difference as the program terminates in the same manner.

Conclusion

It is impossible to undergo the Y2K test as *SYNO_INN* will not run on the *vnn-y2k* computer.

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Planning an experiment in order to gradually improve the automatic climate data analysis performed by CHECK_CONT2

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ABSTRACT

The program CHECK_CONT2 is designed in order to simulate the manual investigation of the quality control program CONTSYN2 in the ALV routine. The program CHECK_CONT2 is run by a system call from the KLIMA_KONTR program and as an appendix process to the CONTSYN2 program. This note addresses a problem with the program causing it to top the problem statistics in the KLIBAS maintenance system.

INTRODUCTION

The first version of the CONTSYN2 program [1] was a FORTRAN adaption of the old CONTSYN2 program altering as little as possible of the original program in order to make the program work.

The KLIMA_KONTR program [2] was intended for simulating the KLIMA quality control routine and consists of system calls to all the programs described in report no. 12/96 KLIBAS and functions for analysing the output from these programs.

The version 1.1 of the KLIMA_KONTR program [3] evolved further towards a simulation and automation of the Weather Station Routine (ALV routine) by including system calls to CHECK-programs designed for analysing the output of the QC programs. Also new in the revised version was a test run mode for faster execution and a brachning in order to prevent the LORLIST programs from being run if there are registered problems with the analysis of the MET programs.

This first version of the 'new' CONTSYN2 program [4] includes some checks for weather that are not included in the running version of CONTSYN2 and some warnings in order to give information on how to handle special cases of air

pressure quality control. CONTSYN2 v.2.0 is to be run as an appendix to the traditional CONTSYN2 v.1.1 described in KLIBAS reports nos. 23/95, 29/95 and 11/96.

In order to evaluate the CHECK_CONT2 program, [5], a quality control problem in January 18th 1999 at 15730 BRÅTÅ - SLETTOM was used to illustrate how an automatic analysis may simulate the normal manual quality control analysis, and, when the reasons for a particular quality problem is understood, the program may update the ALV table automatically. No updates are performed, however, by this early version of the program.

Each run by CHECK_CONT2 is logged, registering program breakdown as a defect. The first log of the program is in August 1998. It was then run 53 times, failing 2 of these (3.8%). The curve below shows the relative number of runs of the program that has been failing according to the log.

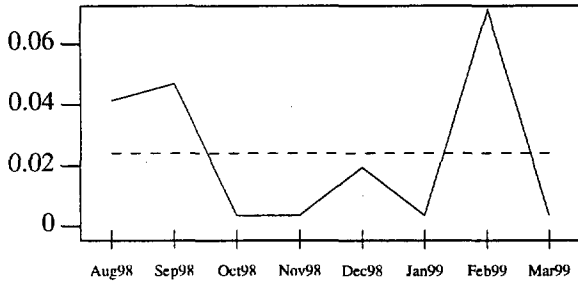


Figure 1. Relative number of defects

The average value dashed in the figure is 0.02. Statistics of this kind is present method for documenting general system quality and improvement.

CURRENT PROBLEM

The message "Error: old pressure reduction test should be removed by CHECK_CONT2 (Lars)" was first recorded on a DRIFT err file on Fri Jan 22 1999. We ask ourselves what can be learned about the KLIBAS system and CHECK_CONT2 by understanding this problem, and how may it help achieving the ultimate goal of the system?

The ultimate goal of the KLIBAS system is to be totally self-contained in terms of automatically carrying out all operations of quality control of climate data with as little manual interaction as possible [6].

In order both to understand the problem and to solve it, a plan is devised, an experiment must be carried out and the results must be interpreted.

PLANNING THE EXPERIMENT

The program CHECK_CONT2 is designed in order to simulate the manual investigation of the quality control program CONTSYN2 in the ALV routine. The program CHECK_CONT2 is run by a system call from the KLIMA_KONTR program and as an appendix process to the CONTSYN2 program.

In order to evaluate the performance of CHECK_CONT2 a simple method of Statistical Process Control (SPC) has been used, counting the number of problems on the cont2.txt file that CHECK_CONT2 uses as standard input. If CHECK_CONT2 had been performing perfectly, and ALV had been updated as a result of the performance of the program, the curve below would have been an indirect measure of the quality of its performance.

In order to measure the quality of the CHECK_CONT2 program in a better way, defects should be defined as the programs lack of ability to analyse the data given by CONTSYN2. The curve should, however, work as a first approach measure for this as it then can be seen as the quality of the system when no analysis is performed.

In addition to investigating the current CONTSYN2 file, on the other hand, the program should also run CONTSYN2 for the previous month and add this to the actual statistics.

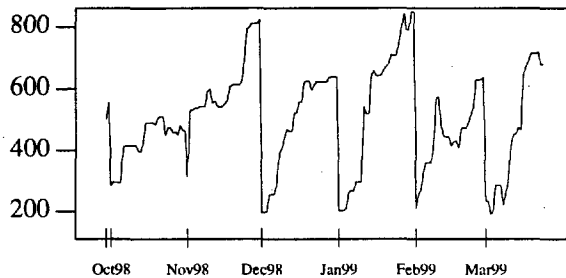


Figure 2. CHECK_CONT2 evaluation by SPC

RUNNING THE EXPERIMENT

According to specifications above, an experiment should be run and evaluated. The actual running of the experiment should be handled by the systematic running of the CHECK_CONT2 program itself.

The CONTSYN2 program is normally run as part of the LORI-LIST module in the ALV routine, but it can also be run independently, and for the purpose of improving the general quality control, CONTSYN2 is run by KLIMA_KONTR by crontab on a daily basis.

When the system has been running for sufficiently long time, it should again be evaluated, this note being a vital reference for documenting improvements.

DISCUSSION AND CONCLUSION

As a step in solving the title problem in this note, an experiment has been designed, and measures on how to carry this experiment out have been described. The results will be evaluated when enough data is available for drawing conclusions.

However, in order to put the results in a wider context and prepare for the next set of experiments, literature in the field of research should be investigated in case there are methods

and concepts that should be included before new experiments are designed.

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Planning an experiment for improving the evaluation statistics for the KAPO systems development program

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ABSTRACT

The purpose of the program KAPO is to gradually automate more and more of routine tasks done in order to maintain and develop the KLIBAS database system. This note addresses a problem with the program causing it to top the problem statistics in the KLIBAS maintenance system.

INTRODUCTION

The standard definitions report [1] contains standards for system development at the Climatology Division. Standards include programming, user interfaces, computer interfaces, documentation.

The quality management report [2] gives a quality plan for the KLIBAS database project based on Norsk Standard for quality systems, the NS-ISO 9000 series. The quality plan defines two tools to manage quality: 1) the quality handbook and 2) internal quality revision.

The practical quality assurance report [3] contains a preliminary specification for a quality management procedure by using a manual quality report system, check lists and approval notes.

The quality handbook [4] is designed to contain all information needed to check that the quality procedures are being followed.

The second part of the quality handbook [5] is designed to contain all information needed to check that the quality procedures are being followed for 1995.

Performance for the KLIBAS software has been logged since June 1995 (KLIBAS-note no. 11/95). Since 1995 the log system [6] has been continuously improved. The log report gives a full description of the ideas behind the current log system.

The qual_trend system [7] is used for making quality prognosis for the monthly maintenance reports.

The programs QUAL_TELE, QUAL_ALN and QUAL_DATA [8] are designed for data quality monitoring in the monthly system quality reports.

The DRIFT program [9] has been in use since April 1995. In order to reach an ISO-9000 level for the program development, the five level Software Engineering Institute (SEI) method is being used. The final level should be fairly close to ISO-9000.

In the prototype version of KAPO, which has been used on a daily basis since December 1997, only a restricted functionality has been included. The program [10] is used for marking problems as ignored or solved on the err-files for a program program as the problems are being solved.

The version 1.1 of the KAPO program [11] aims at running the trivial tasks in the daily and weekly routine when specifying and implementing for the KLIBAS database system. This version is run by the crontab daily. It starts by looking through the mail that may have arrived during the night, then collects statistics from DRIFT for the KLIBAS system, arranging programs in a priority list.

Each run by KAPO is logged, registering program breakdown as a defect. The first log of the program is in December 1997. It was then run 17 times, failing 4 of these (23.5 %). The number of users during this first month was 1. The curve below shows the relative number of runs of the program that has been failing according to the log.

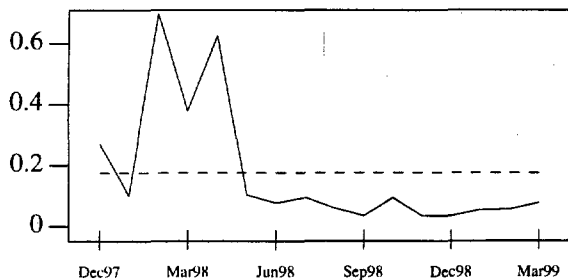


Figure 1. Relative number of defects

The average value dashed in the figure is 0.1406. Statistics of this kind is present method for documenting general system quality and improvement.

In order to focus not only on long term problems caused by breakdown of the program, a circular structure of the last twelve months is used for recording errors and warnings from the program.

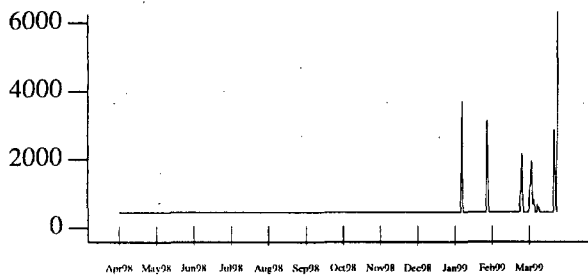


Figure 2. Problems day by day

The type of curve represented by figure 2 is used for checking whether there have been much update of the program recently or if the program is systematically reporting a great number of problems.

THE CURRENT PROBLEM

The message "Error: a cv/publication list should be prepared by the KAPO program" was first recorded on a DRIFT err file on Thu Feb 25 1999. We ask ourselves what can be learned about the KLIBAS system and KAPO by understanding this problem, and how may it help

achieving the ultimate goal of the system?

The ultimate goal of the KLIBAS system is to be totally self-contained in terms of automatically carrying out all operations of quality control of climate data with as little manual interaction as possible [12].

In order both to understand the problem and to solve it, a plan must be devised, an experiment must be carried out and the results must be interpreted.

PLANNING THE EXPERIMENT

The purpose of the program KAPO is to gradually automate more and more of routine tasks done in order to maintain and develop the KLIBAS database system.

In order to evaluate how the KAPO program is performing, a method of Statistical Process Control (SPC) is being used, counting the number of tasks on Work Breakdown Structure (WBS) of the project plan as basis for producing statistics. The better KAPO is performing in terms of solving problems on this list, the more rapid the total number of tasks on the WBS will be removed.

The current method of evaluation is not the best possible, as there are other factors that are perhaps even more important for evaluating the KAPO program, including CV and list of publications. Furthermore, the program should be able to produce articles to be published in international scientific journals and write job applications as success in these tasks would be comparable with normal measures of success for an analogue scientist.

The curve below is based on the formula $(T-F)/T$ where T is the total number of defined tasks according to WBS at the sample point while F is the number of finished tasks. The formula hence gives a measure for the relative number of unfinished tasks day by day which is also a sort of defect measure or quality measure.

The sudden rise from December to January is due to the fact that the lists were updated at this moment by deleting all jobs that were finished. In order to accomodate the requirements above, the SPC will have to be redesigned, the current plot being only the starting point of such a redesign.

From Thu Mar 25 1999, then, the daily values in the curve below will be devided by the length of the CV and the number of publications (P), adjusting the formula to $K*(T-F)/(T*CV*P)$

where K is a constant representing the initial value of the product CV*P in order to make the curve develop continuously.

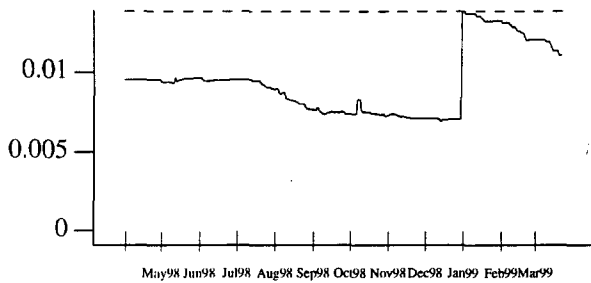


Figure 3. KAPO evaluation by SPC

RUNNING THE EXPERIMENT

According to specifications above, an experiment should be run and evaluated. The actual running of the experiment should be handled by the systematic running of the KAPO program itself.

The KAPO program is run twice a day by crontab (05:40 and 17:40 UTC), but can also be run in interactive mode. The program makes system calls to the programs MAILSTAT, DRIFT and WEB, making sure that these are also run systematically.

When the system has been running for sufficiently long time, it should again be evaluated, this note being a vital reference for documenting improvements.

DISCUSSION AND CONCLUSION

As a step in solving the title problem in this note, an experiment has been designed, and measures on how to carry this experiment out have been described. The results will be evaluated when enough data is available for drawing conclusions.

However, in order to put the results in a wider context and prepare for the next set of experiments, literature in the field of research should be investigated in case there are methods and concepts that should be included before new experiments are designed.

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Using SYNO_KONTR as a prototype for NORDKLIM quality control systems development

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ABSTRACT

The purpose of SYNO_KONTR is to manage the interpolation and correction programs in the TELE/SYNOP system and thereby prepare the TELE datatable for monthly climatology statistics and for daily use at 8 or 9 UTC. The output from SYNO_KONTR contains information on observation quality and problems in the automatic quality control routine for quality processing TELE. This note addresses a problem with the program causing it to top the problem statistics in the KLIBAS maintenance system.

INTRODUCTION

October 1996: SYNO_INN was totally restructured and programmed from scratch. A quality control program SYNO_KONTR [1] was created in order to compare values in the data tables SYNOP and SYNOP2.

August 1997: The SYNO_KONTR [2] system was remodelled and added to the TELE/SYNOP system as a monitor. The purpose of SYNO_KONTR was to start quality control and interpolation programs on a daily basis and generate statistics from the execution of these programs.

January 1999: The version 2.1 of SYNO_KONTR [3] is expanded by including a test for checking for "non-defined" observations in the datatable TELE. If values are inserted by the SYNO_INN program or the interpolation programs (INTERPOL2 or INTERPOL_P0) in columns that should not have been updated, this program takes notice and include these problems along with a count of missing values in curves and lists updated daily. The purpose of all this is aid to help that the TELE data table contain all needed obser vations, but no more.

Mars 1999: The S-T-F system is used for autmatic and manual quality control of real-time

data at DNMI. The report [4] describes the development and performance of the system, with emphasis on how the quality checks relate to WMO guidelines. The S-T-F program is part of the Quality Assurance System at DNMI, and statistical process control is used for monitoring the performacne and quality of the data processing of read-time data in order to find ways of improving the system.

Each run by SYNO_KONTR is logged, registering program breakdown as a defect. The first log of the program is in July 1997. It was then run 15 times, failing 6 of these (40.0%). The number of users during this first month was 1. The curve below shows the relative number of runs of the program that has been failing according to the log.

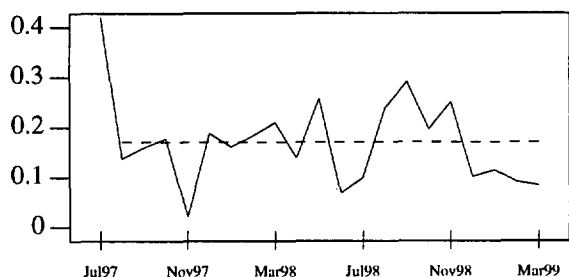


Figure 1. Relative number of defects

The average value dashed in the figure is 0.15. Statistics of this kind is present method for documenting general system quality and improvement.

In order to focus not only on long term problems caused by breakdown of the program, a circular structure of the last twelve months is used for recording errors and warnings from the program.

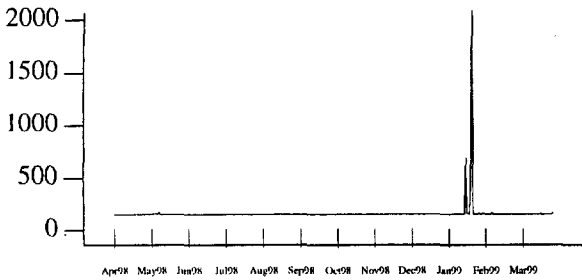


Figure 2. Problems day by day

The type of curve represented by figure 2 is used for checking whether there have been much update of the program recently or if the program is systematically reporting a great number of problems.

THE CURRENT PROBLEM

The message "Prepare for NORDKLIM meeting 15. April." was first recorded on a DRIFT err file on Mon Mar 01 1999. We ask ourselves what can be learned about the KLIBAS system and SYNO_KONTR by understanding this problem, and how may it help achieving the ultimate goal of the system?

The ultimate goal of the KLIBAS system is to be totally self-contained in terms of automatically carrying out all operations of quality control of climate data with as little manual interaction as possible [5].

In order both to understand the problem and to solve it, a plan must be devised, an experiment must be carried out and the results must be interpreted.

PLANNING THE EXPERIMENT

The purpose of SYNO_KONTR is to manage the interpolation and correction programs in the TELE/SYNOP system and thereby prepare the TELE datatable for monthly climatology statistics and for daily use at 8 or 9 UTC. The output from SYNO_KONTR contains information on observation quality and problems in the

automatic quality control routine for quality processing TELE.

As the automation of the TELE system is a vital task for general attempts at automating the quality control routines at DNMI, the development of the program has been coordinated with the development with the NORDKLIM project (Task 1.2 quality control), using the SYNO_KONTR program as a prototype for the development of tasks related to this project.

According to the Danish proposal for NORDKLIM, the task of developing a quality control system should be divided into five phases or work packages; WP100 Requirements Specification, WP200 Functional Specification, WP300 Data Collection, WP400 Selection and Implementation of Methods and, finally, WP500 Testing on real data.

The plot is based on the day by day count of elements (TT, TN, TX, N, UU, RR, SS, P0, P, PP and A) either defined for a certain station according to TELE_PARA but having no observations in TELE or not defined in TELE_PARA but nevertheless found in TELE.

These values are treated as a part of the Statistical Process Control (SPC) for the system. The lower solid line shows the average number of defects each day while the upper solid line shows a six sigma upper limit for the process. The SPC is intended to work as a measure for control of the complete process represented by SYNO_KONTR as it is a simple measure of the quality of the data table TELE.

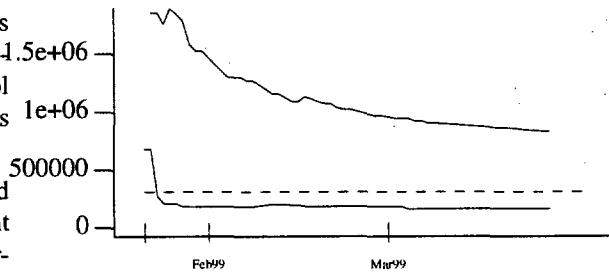


Figure 3. SYNO_KONTR evaluation by SPC

RUNNING THE EXPERIMENT

According to specifications above, an experiment should be run and evaluated. The actual running of the experiment should be handled by the systematic running of the SYNO_KONTR program itself.

The SYNO_KONTR program is run automatically twice a day as scheduled by crontab. The program is responsible for running all quality control and interpolation programs used systematically to maintain the TELE data table, and will, after these programs have been run, check the TELE table and produce statistics to be fed to the DRIFT program for daily manual control and monthly publications in the KLIBAS statistics reports.

When the system has been running for sufficiently long time, it should again be evaluated, this note being a vital reference for documenting improvements.

DISCUSSION AND CONCLUSION

As a step in solving the title problem in this note, an experiment has been designed, and measures on how to carry this experiment out have been described. The results will be evaluated when enough data is available for drawing conclusions.

However, in order to put the results in a wider context and prepare for the next set of experiments, literature in the field of research should be investigated in case there are methods and concepts that should be included before new experiments are designed.

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Quality system evaluation for the ALV routine by KLIMA_KONTR

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ABSTRACT

The purpose of the program KLIMA_KONTR is to grow a new version of the KLIMA control routine. Each element in this system is supposed to run independently, but in order to make the system grow before being put to use, the mother program KLIMA_KONTR is supposed to simulate the manual run of the routine. This note addresses a problem with the program causing it to top the problem statistics in the KLIBAS maintenance system.

INTRODUCTION

July 1998: The KLIMA_KONTR program [1] was intended for simulating the KLIMA quality control routine and consists of system calls to all the programs described in report no. 12/96 KLIBAS and functions for analysing the output from these programs.

August 1998: The version 1.1 of the KLIMA_KONTR program [2] evolved further towards a simulation and automation of the Weather Station Routine (ALV routine) by including system calls to CHECK-programs designed for analysing the output of the QC programs. Also new in the revised version was a test run mode for faster execution and a brachning in order to prevent the LORI-LIST programs from being run if there are registered problems with the analysis of the MET programs.

March 1999: This version 1.2 of KLIMA_KONTR [3] has been modified in order to function as a prototype evaluation module in the NORDKLIM project. Reprogramming has been done so that the subprogram CHECK_CONT2 now uses six consecutive months for automatic quality control evaluation. A SPC plot is generated for the system using the quality flags in ALV to define the process.

Each run by KLIMA_KONTR is logged, registering program breakdown as a defect. The first log of the program is in May 1998. It was then run 44 times, failing 2 of these (4.5%). The number of users during this first month was 1. The curve below shows the relative number of runs of the program that has been failing according to the log.

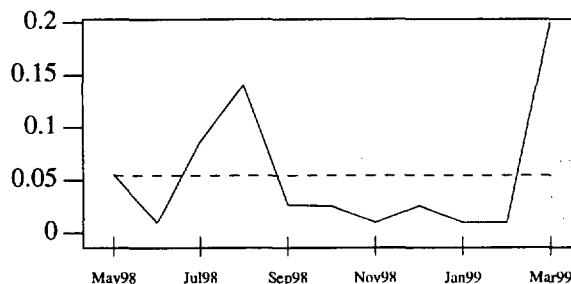


Figure 1. Relative number of defects

The average value dashed in the figure is 0.04. Statistics of this kind is present method for documenting general system quality and improvement.

In order to focus not only on long term problems caused by breakdown of the program, a circular structure of the last twelve months is used for recording errors and warnings from the program.

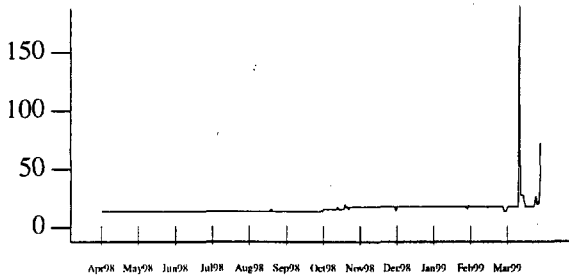


Figure 2. Problems day by day

The type of curve represented by figure 2 is used for checking whether there have been much update of the program recently or if the program is systematically reporting a great number of problems.

THE CURRENT PROBLEM

The message "Prepare for NORDKLIM meeting 15. April." was first recorded on a DRIFT err file on Mon Mar 01 1999. We ask ourselves what can be learned about the KLIBAS system and KLIMA_KONTR by understanding this problem, and how may it help achieving the ultimate goal of the system?

The ultimate goal of the KLIBAS system is to be totally self-contained in terms of automatically carrying out all operations of quality control of climate data with as little manual interaction as possible [4].

In order both to understand the problem and to solve it, a plan must be devised, an experiment must be carried out and the results must be interpreted.

PLANNING THE EXPERIMENT

The purpose of the program KLIMA_KONTR is to grow a new version of the KLIMA control routine. Each element in this system is supposed to run independently, but in order to make the system grow before being put to use, the mother program KLIMA_KONTR is supposed to simulate the manual run of the routine.

The figure shows the day by day count of quality flags in ALV. As each element that has been modified in ALV is updated with a flag equal one, the curve gives a measure on the activity on ALV and quality of the observations.

The plot is a part of the Statistical Process Control (SPC) for the system and consists of a dashed line representing the average value for the process and the upper limit of the process (pro-

cess capability) given in terms of six times the standard deviation of the process.

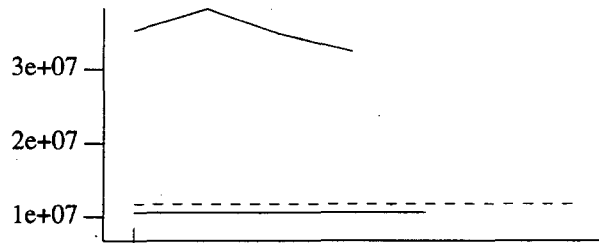


Figure 3. KLIMA_KONTR evaluation by SPC

RUNNING THE EXPERIMENT

According to specifications above, an experiment should be run and evaluated. The actual running of the experiment should be handled by the systematic running of the KLIMA_KONTR program itself.

The KLIMA_KONTR system is run twice a day by a crontab schedule; at 03:15 and 18:15 UTC, but can also be run interactively. The program is responsible for running all the quality control programs in the ALV routine and generates SPC statistics from the quality flags in ALV.

When the system has been running for sufficiently long time, it should again be evaluated, this note being a vital reference for documenting improvements.

DISCUSSION AND CONCLUSION

As a step in solving the title problem in this note, an experiment has been designed, and measures on how to carry this experiment out have been described. The results will be evaluated when enough data is available for drawing conclusions.

However, in order to put the results in a wider context and prepare for the next set of experiments, literature in the field of research should be investigated in case there are methods and concepts that should be included before new experiments are designed.

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- [1] DNMI-Report no. 24/98 KLIBAS "KLIMA_KONTR: Simulation and control of a quality control system for weather data.", Oslo, July 20th, 1998.
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Oslo, August 19th, 1998.

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- [4] *DNMI-Report no. 12/99 KLIMA "Quality Control of Climate Data: An Automatic Approach"*, Oslo, March 19th, 1999.

Making the STATUT program portable and ready for Y2K testing

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ABSTRACT

The program STATUT generates weather statistics for the last 30 days for all stations defined in TELE/TELE_PARA. The program should be extended in order to make it handle error diagnostics and generate input for daily quality control. This note addresses a problem with the program causing it to top the problem statistics in the KLIBAS maintenance system.

INTRODUCTION

March 1996: The total description of the TELE/SYNOP system was revised as the program STATUT [1] was introduced and general changes had been made to the system.

March 1997: Bugs were removed from the program STATUT [2]. The program was extensively reprogrammed.

June 1997: A number of bugs were corrected in STATUT. A program [3] FAXUT was also made, generating a FAX for weather station V44560 SOLA from STATUT.

July 1998: The purpose of the program CHECK_STATUT is to analyse the output from the program STATUT. [4] This first version focuses on finding instances where no value is displayed for a certain statistic on the STATUT output file. Information of this kind is directed into the stderr flow of the STATUT program and will give the program higher priority on the KLIBAS maintenance list.

August 1998: The version 2.0 of STATUT [5] contains an update of the algorithm that is used for producing and presenting amount of precipitation for the 30 last days, using a 06-06 definition of the day rather than an 18-18 definition as before. A new specification for the program has been written, emphasising STATUT as a part in a greater SYNOP system, and a number of program

statistics are now being collected and automatically investigated. The SYNOP meny has also been altered and simplified.

August 1998: This version 1.1 of CHECK_STATUT has developed the idea of finding instances where no value is displayed for a certain statistic on the STATUT [6] output file from just the first rows of the STATUT file to all rows. The program will then feed input to the interpolation system and will automatically demand further development in terms of areal checks when there are no more missing values reported.

March 1999: The version 2.1 of STATUT [7] has been created in order to accommodate the Y2K test on the vnn-y2k. The program had to be modified in order to run in the test environment and, as a consequence of this, STATUT is now portable and ready for the database update of 1999. A statistical process control based on counting the number of stations on the STATUT output file is also included.

Each run by STATUT is logged, registering program breakdown as a defect. The first log of the program is in March 1996. It was then run 426 times, failing 38 of these (8.9%). The number of users during this first month was 1. The curve below shows the relative number of runs of the program that has been failing according to the log.

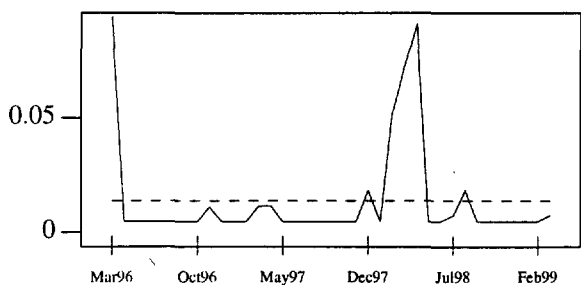


Figure 1. Relative number of defects

The average value dashed in the figure is 0.01. Statistics of this kind is present method for documenting general system quality and improvement.

In order to focus not only on long term problems caused by breakdown of the program, a circular structure of the last twelve months is used for recording errors and warnings from the program.

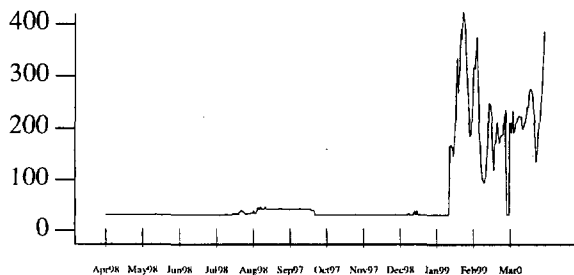


Figure 2. Problems day by day

The type of curve represented by figure 2 is used for checking whether there have been much update of the program recently or if the program is systematically reporting a great number of problems.

THE CURRENT PROBLEM

The message "Perform Y2K test for SYNO_INN/STATUT on the vnn-y2k computer" was first recorded on a DRIFT err file on Thu Feb 25 1999. We ask ourselves what can be learned about the KLIBAS system and STATUT by understanding this problem, and how may it help achieving the ultimate goal of the system?

The ultimate goal of the KLIBAS system is to be totally self-contained in terms of automatically carrying out all operations of quality control of climate data with as little manual interaction as possible [8].

In order both to understand the problem and to solve it, a plan must be devised, an experiment

must be carried out and the results must be interpreted.

PLANNING THE EXPERIMENT

The program STATUT generates weather statistics for the last 30 days for all stations defined in TELE/TELE_PARA. The program should be extended in order to make it handle error diagnostics and generate input for daily quality control.

The figure shows the day by day count of stations on the statut.txt output file as a measure for the STATUT process. The plot is a part of the Statistical Process Control (SPC) for the system and consists of a dashed line representing the average value for the process and the upper limit of the process (process capability) given in terms of six times the standard deviation of the process.

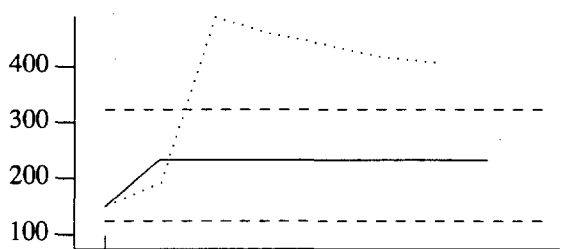


Figure 3. STATUT evaluation by SPC

RUNNING THE EXPERIMENT

According to specifications above, an experiment should be run and evaluated. The actual running of the experiment should be handled by the systematic running of the STATUT program itself.

The STATUT program is basically run in two modes, either it is executed from crontab via the DAGLIGSTATISTIKK script or it is run via the interactive SYNOP menu. If the files are made by the DAGLIGSTATISTIKK script, the files are nevertheless normally collected and printed from the SYNOP menu. Files are also being automatically sent to external customers by the SMS system run by the EDB Division. In order to make sure that the quality of the STATUT statistics are acceptable, a program CHECK_STATUT runs immediately after each run of STATUT by investigating the output file.

When the system has been running for sufficiently long time, it should again be evaluated, this note being a vital reference for documenting improvements.

DISCUSSION AND CONCLUSION

As a step in solving the title problem in this note, an experiment has been designed, and measures on how to carry this experiment out have been described. The results will be evaluated when enough data is available for drawing conclusions.

However, in order to put the results in a wider context and prepare for the next set of experiments, literature in the field of research should be investigated in case there are methods and concepts that should be included before new experiments are designed.

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- [1] *DNMI-Report no. 09/96 KLIBAS "Beskrivelse av synop-rutine. Versjon 1.1."*, Oslo, March 26th, 1996.
- [2] *DNMI-Report no. 47/97 KLIBAS "DAGLIGSTATISTIKK. Programmet statut v.1.1."*, Oslo, March 7th, 1997.
- [3] *DNMI-Report no. 57/97 KLIBAS "DAGLIGSTATISTIKK - Programmet statut v.1.2."*, Oslo, June 18th, 1997.
- [4] *DNMI-Report no. 23/98 KLIBAS "Computer program CHECK_STATUT."*, Oslo, July 14th, 1998.
- [5] *DNMI-Report no. 32/98 KLIBAS "Computer program STATUT v.2.0."*, Oslo, August 5th, 1998.
- [6] *DNMI-Report no. 35/98 KLIBAS "Computer program CHECK_STATUT v.1.1."*, Oslo, August 11th, 1998.
- [7] *DNMI-Report no. 22/99 KLIBAS "Producing daily weather statistics with STATUT v.2.1."*, Oslo, March 30th, 1999.
- [8] *DNMI-Report no. 12/99 KLIMA "Quality Control of Climate Data: An Automatic Approach"*, Oslo, March 19th, 1999.

Designing a program for updating the KLIBAS database system with historical observations from automatic weather stations

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ABSTRACT

The purpose of the program JOSTEIN is to insert observations from Automatic Weather Stations from the JOSTEIN data table into relevant A-tables in the KLIBAS database system. This note addresses a problem with the program causing it to top the problem statistics in the KLIBAS maintenance system.

INTRODUCTION

March 1999: The first version of the program JOSTEIN [1] is tested against the historical data set from the automatic weather station on Blindern. In this case the program inserts data into the table A18700 and writes comments on overlapping values or observations that otherwise have been impossible to transfer to a file jostein.txt.

For the present version of JOSTEIN there are no prime evaluation statistics.

In order to focus not only on long term problems caused by breakdown of the program, a circular structure of the last twelve months is used for recording errors and warnings from the program.

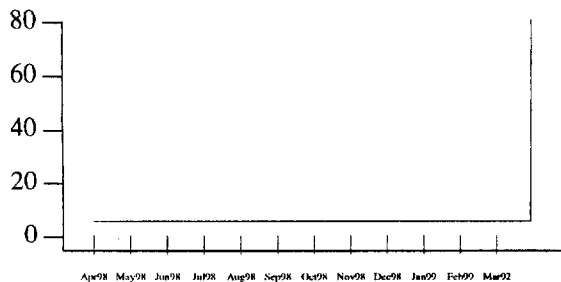


Figure 1. Problems day by day

The type of curve represented by figure 1 is used for checking whether there have been much

update of the program recently or if the program is systematically reporting a great number of problems.

THE CURRENT PROBLEM

The message "Error: Kan du overføre Blindern-data fra tabellen Jostein til A-tabellen (alt som ligger i tabellen). S" was first recorded on a DRIFT err file on Fri Feb 19 1999. We ask ourselves what can be learned about the KLIBAS system and JOSTEIN by understanding this problem, and how may it help achieving the ultimate goal of the system?

The ultimate goal of the KLIBAS system is to be totally self-contained in terms of automatically carrying out all operations of quality control of climate data with as little manual interaction as possible [2].

In order both to understand the problem and to solve it, a plan must be devised, an experiment must be carried out and the results must be interpreted.

PLANNING THE EXPERIMENT

The purpose of the program JOSTEIN is to insert observations from Automatic Weather Stations from the JOSTEIN data table into relevant A-tables in the KLIBAS database system.

The figure shows the day by day count of number of rows in the JOSTEIN data table. Too many or too few rows indicates that the process is out of control. The plot is a part of the Statistical Process Control (SPC) for the JOSTEIN program and consists of a dashed line representing the average value for the process and the upper limit of the process (process capability) given in terms of six times the standard deviation of the process.

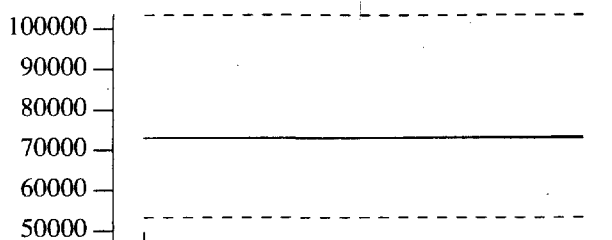


Figure 2. JOSTEIN evaluation by SPC

RUNNING THE EXPERIMENT

According to specifications above, an experiment should be run and evaluated. The actual running of the experiment should be handled by the systematic running of the JOSTEIN program itself.

The JOSTEIN program is run manually by the AUTO menu, but also automatically once a day by the crontab as a system call from the program AUTO. According to user specifications, data are selected from the JOSTEIN data table, stored temporarily on file and loaded into an A-table in HLA by use of the SQL*Loader. Statistics from the SQL*Loader are stored on the jostein.txt file.

When the system has been running for sufficiently long time, it should again be evaluated, this note being a vital reference for documenting improvements.

DISCUSSION AND CONCLUSION

As a step in solving the title problem in this note, an experiment has been designed, and measures on how to carry this experiment out have been described. The results will be evaluated when enough data is available for drawing conclusions.

However, in order to put the results in a wider context and prepare for the next set of experiments, literature in the field of research should be investigated in case there are methods and concepts that should be included before new

experiments are designed.

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Breakdown of the SYNO_INN program due to problems in the system statistics function

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ABSTRACT

The purpose of the program SYNO_INN is to insert data from syno-files into datatables SYNOP, SYNOP2, TELE and TELE2. The program also generates a log and statistics for observations that are rejected for various reasons. This note addresses a problem with the program causing it to top the problem statistics in the KLIBAS maintenance system.

The SYNO_INN program

February 1994: In order to produce weekly up to date statistics for certain weather stations, fresh observations need to be inserted into the KLIBAS database. A program SYNO_INN [1] (FIFOfeed + FIFOread) has been implemented in order to read syno-files on SGI computer Tornado into Oracle datatable SYNOP every hour at 00:00, 01:00, ..., 23:00 UTC.

December 1994: In the version 1.1 of the SYNO_INN program [2], bugs were removed and minor changes were made.

July 1995: The program SYNO_INN [3] was once again revised. Shell programming was used to a greater extent than what had been the case earlier on.

September 1995: A report [4] was written to document recent developments of the TELE/SYNOP system, including VNN program TROMSO and the SYNO_INN programs AUTO2TELE and GTS2SYN.

October 1996: SYNO_INN [5] was totally restructured and programmed from scratch. A quality control program SYNO_KONTR was created in order to compare values in the data tables SYNOP and SYNOP2.

January 1997: The program SYNO_INN [6] was extensively reprogrammed.

June 1997: The SYNO_INN program [7] was extended with routines to reduce the need for manual surveil of the program.

January 1998: The purpose of the revised version 3.3 of the computer program SYNO_INN [8] was to make it possible to insert chosen foreign synop observations into the TELE datatable. At the moment of its release, five test stations were being used.

October 1998: SYNO_INN [9] was revised due to an uncontrolled breakdown on Friday October 16th 1998. Errors in the code documented in report no. 03/98 KLIBAS were found and corrected.

October 1998: The 3.5 version of the SYNO_INN program [10] is augmented by statistical process control in terms of logging every format problem that arises when inserting into the Oracle database and logging every discrepancy having to do with observations not corresponding to definitions in TELE_PARA in order to use the log for statistical analysis.

November 1998: The prototype version of ALF2TELE updates only temperature from ALF to TELE. The program is run from the SYNO_KONTR system, making sure that meteor data are inserted into TELE before interpolation is executed. The program produces control charts

for daily statistical process control of the system.

November 1998: In the 3.6 version of the SYNO_INN system [12] the SPC statistics have been developed further. It turned out the program changes made for verion 3.5 made the program critically slow, so in this new version reprogramming in order to make the routine more efficient have been applied.

January 1999: The version 3.7 of program was made to prevent the system from breaking down in case of failure in the insert procedures INSERT_SYNOP, INSERT_SYNOP2 and INSERT_TELE. The adjustment was made to compensate on a problem of SYNO_INN [13] breaking down on Sunday Janary 17 at 19:41 GTM as it was unable to extend the SYNOP-index. Still the program will not be able to extend the SYNOP-index, but it automatically generates an e-mail message to a person who may be able to do so and continues inserting data into the other data tables.

March 1999: The version 3.8 has been made in order to accomdate requirements for running the SYNO_INN program [14] on the vnn-y2k computer in order to test for Year 2000 problems. In order to achieve this, the program is now portable, and does no longer depend on files being stored on specific paths. The new version also reads data into the new TELE2 data table that is designed for simulating the TELE routine.

Each run by SYNO_INN is logged, registering program breakdown as a defect. The first log of the program is in May 1997. It was then run 212 times, failing 28 of these (13.2%). The number of users during this first month was 1. The curve below shows the relative number of runs of the program that has been failing according to the log.

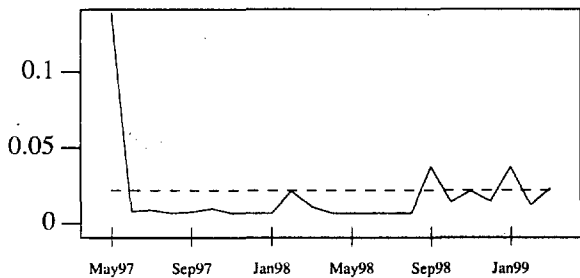


Figure 1. Relative number of defects

The average value dashed in the figure is 0.0150. Statistics of this kind is present method for documenting general system quality and

improvement.

In order to focus not only on long term problems caused by breakdown of the program, a circular structure of the last twelve months is used for recording errors and warnings from the program.

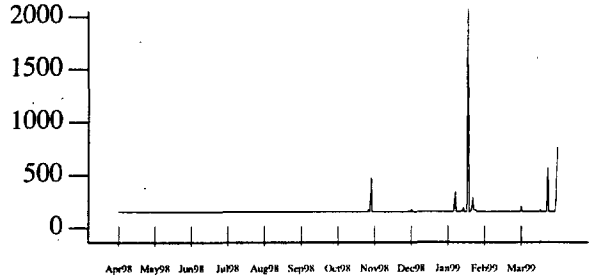


Figure 2. Problems day by day

The type of curve represented by figure 2 is used for checking whether there have been much update of the program recently or if the program is systematically reporting a great number of problems.

The current problem

The message "ERROR: SQL-02112: SELECT..INTO returns too many rows" was first recorded on an err file on Thu Dec 31 1998. We ask ourselves what can be learned about the KLIBAS system and SYNO_INN by understanding this problem, and how may it help achieving the ultimate goal of the system?

The ultimate goal of the KLIBAS system is to be totally self-contained in terms of automatically carrying out all operations of quality control of climate data with as little manual interaction as possible [15].

In order both to understand the problem and to solve it, a plan must be devised, an experiment must be carried out and the results must be interpreted.

Planning the experiment

The purpose of the program SYNO_INN is to insert data from syno-files into datatables SYNOP, SYNOP2, TELE and TELE2. The program also generates a log and statistics for observations that are rejected for various reasons.

The figure shows the day by day count of defects according to quality control and updates by SYNO_INN. The plots are a part of the Statistical Process Control (SPC) for the system and consists of a dashed line representing the average

number of defectes, the daily number of defects and the upper limit of the process (process capability) in terms of six times the standard deviation of the process.

As the process matures it is expected that the process capability measure declines along with the average and actual measurements. As there will always be observations in the syno-files that do not fit with the KLIBAS datatables, it is expected that the curves will converge against a statistical measure for this number.

Due to an unexplainable error *ERROR: SQL-02112: SELECT..INTO returns too many rows* occuring in the *statistics* function quite regularly by the end of the month, since the end of March 1999, statistics have not been calculated during the last day of the month. It remains to be seen whether this will solve the problem.

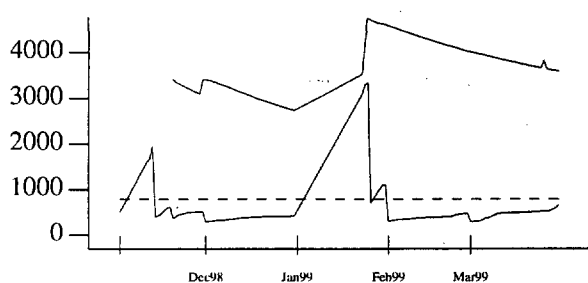


Figure 3. SYNO_INN evaluation by SPC

Running the experiment

According to specifications above, an experiment should be run and evaluated. The actual running of the experiment should be handled by the systematic running of the SYNO_INN program itself.

The program SYNO_INN is executed by crontab every ten minutes and reads syno-files that have not been previously read or have recently been updated. Statistics from the SYNO_INN algorithm is stored on the syno_inn.txt files, which may be printed for the KLIBAS statistics report. Observations from the syno-files are stored in the SYNOP and TELE datatables.

When the system has been running for sufficiently long time, it should again be evaluated, this note being a vital reference for documenting improvements.

Conclusion

As a step in solving the title problem in this note, an experiment has been designed, and measures on how to carry this experiment out have been described. The results will be evaluated when enough data is available for drawing conclusions.

However, in order to put the results in a wider context and prepare for the next set of experiments, literature in the field of research should be investigated in case there are methods and concepts that should be included before new experiments are designed.

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- [8] DNMI-Report no. 03/98 KLIBAS "SYNO_INN v.3.3: Revised for inserting international synops into TELE.", Oslo, January 14th, 1998.
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- [14] *DNMI-Report no. 20/99 KLIBAS "Reading data from syno-files into KLIBAS: SYNO_INN v.3.8."*, Oslo, March 23rd, 1999.
- [15] *DNMI-Report no. 12/99 KLIMA "Quality Control of Climate Data: An Automatic Approach"*, Oslo, March 19th, 1999.