Primary author: **Lipa, Wolfgang** (ZAMG - Zentralanstalt für Meteorologie und Geodynamik, Department Data Quality Control), wolfgang.lipa@zamg.ac.at

Co-authors: Susanne Zach-Hermann (ZAMG - Zentralanstalt für Meteorologie und Geodynamik, Department Data Quality Control)

Abstract ID: 501

#### The Austrian DQC Process – achieved and intended developments

Since 1984, when the first QC- system for climate data was established, our service had three significant improvements in climate data processing. The first system was completely self developed, the second system was developed 1997 in cooperation with a commercial software house. This GIS-based system was focused on the online climate data process and was presented at the ICEAWS 1999 and ECSN 1999.

The third DQC- system based on the DWD system QualiMET runs in an operational mode since March 2006. With the renewal and upgrading of our Austrian automatic weather stations network in the period 2006-2008 from 141 to 238 stations, a lot of work was carried out. The major challenge was that the upgrade of additional 100 stations was done without an increase of the concerning staff.

This presentation, which will be given at the ECSN workshop 2009, will focus on

- handling of the upgrade of 100 additional automatic stations
- data quality in dependency of the parameters
- building up a system with "online climate observations" by using the synoptical data way (GTS)
- redesign of all daily and monthly climate data tables
  - heredity of quality flags
  - parallel storage of data values for each parameter which is measured simultaneously by different systems

## The Austrian DQC Process – achieved and intended developments

QualiMET from 141 – 244 stations Climate Archive – digitalisation and protection Climate Data Rescue ProCLIM

Zentralanstalt für Meteorologie und Geodynamik

New design of data tables & ZAMG restructure



Silke Adler, Joachim Albenberger, Angelika Brunnader, Hermann Galavics, Michael Jensen, Anita Jurkovic, Gerald Lang, Wolfgang Lechner, Wolfgang Lipa, Roland Swietli, Ilona Vossberg, Susanne Zach-Hermann, Silvia Zehetner

(Präsentation)

04.01.2010 Folie 2

# Why is data quality control necessary and for what is it good for ?

That was the content of my last ECSN presentation 2007:

- DQC is the last check/filter for outgoing data and data products
- correction of previously made mistakes

### And what are you doing ?



### QualiMET 2007 - 2008 : Overview

(Präsentation)

04.01.2010 Folie 3



from TAWES 141 up to TAWES\_New 244 with less staff for data quality control

### achieved by:

- fewer gaps caused by communication systems (TUS + GSM)
- automatic retracing of missing data
- new sensors -> wind (ultrasound) -> no icing
- rejecting of non TAWES stations like (ORF, Minitaklis)

### but:

- problems by software performance in spite of new hardware (8 GM Memory & 8 CPU's a 3 GHz)
  - using of flash and radar information with another system
- no data capture of observations and manual gauging at site
- "Illness of staff not allowed"

### QualiMET 2008 key data

(Präsentation)

04.01.2010 Folie 4



the data flood

397.423.634 one- and ten- minutes data were checked with QualiMET

> 1.099.666 was suspicious flagged 465.977 committed as correct 372.812 deleted 260.877 changed

1.596.571 were automatic or manual completed



### Climate Archive – digitalisation and backup

(Präsentation)

04.01.2010 Folie 5

Nearly all climate paper data were digitalised during the last 4 years

### These pictures are converted in pdf's and accessible for all sections – server backup every six months

			Mete	orologisch	Beobachtunge	en.						
Jah	1872			Beebachtings-Station	Intralanstalt			Bea	inchtangestunden.	18 -	2-10	2.H
Ma	Janner Janner			Benhachter.							dela	
-	Emilidure Alloung an Bareneter					Frankligheit	Benilkung	Wardstellung und Stille	Welker		Medara	achiat
	P 2' 1P	(wel 0° ordani rise Baraneterstand)	des trackanen Tiermometers	des aussie Thermometers	Busstdrack	is Peressies.	Halter == 0 Tribe == 10	Windvill P Ockan 2P	beieuftper, noch. Zog bestimmt	welcher der it warde 1)	Denten 24 Stat- den	
	racter Bare- noter Bers- noter Iberne- au Bare- meter an Bare- noter an Jaco-	e s se Tigne	er 2º 10º Trate	0° 5' 50°	P 3º 10 Tapo-	0 5. 10 Trent	e si te Trees	4° 1° 10°	• T	1.10	nn thr pro-	free Cra
- 1	-7.0 53.80-7-0 728.80 -7.0 53.80	753-42 753-65 754-65 758-2	5.2 - 5.6 -6.2 -6.7	-8-4 -4-6-64	2.3 2.7 2.7 2.6	94 90 95 93	10 10 10 100	50-0-0			0.45*	2
2	- 6.0 5240-56 3062-54 50-10	33-19 5130 50-69 31-7	-6.0 -1-3 -5.0 -5.9	-6-2 -5-0 -5-2	2.7 29 29 2.9 2.8	95 96 93 .95	10 10 10 10.0	-0 550,550	P 18		-	12
3	-6.0 48.66 -42 48.70 -30 49.20	49.33 49.22 59 81 49.5 48.60 45.50 26-60 48.6	-6-8 -25 -88 -7-9	-7-2-29-4-0	2.9 35 20 2.0	39 92 19 92	10 10 5-7	SSO 0 5500 550		PHS.		2 1
.8	-4.3 44.30 - 35 43-13-4. 0 42.40	44.82 9385 42.88 43.8	-6-0 -82 -52 -4-5	-6-2 -37 -5-6	2.7 32 2.8 2.9	95 89 90 91	1 10 10 7.0	550 0 050 1 50	1	muber	9	0
6	-4.0 42.90 - 3.3 4552 3.5 46.70	43-38 4592 4742 45.5	-5.4 - 2-3 -3.6 -3.8	-0-8-2-9-3-8	2.7 3.4 3.3 3.1	90 17 95 91	10 10 8 93	50, 50, 50	e +74	0	-	2
7	-3.2 12.90 - 2.5 19 10-2.2 42.00	45-29 1480 45-27 45-8	-1.6 +0.2-0.6-0.7	-1-8 -0.9 -0.8	3.9 4.1 4.2 4.1	96 31 90 91	10 10 10 10 100	50. 900 - 21			1.15	3
9	b.0 30.30 +0.6 2060 0.0 30.20	30-30 2433 30-30 . 30.0	+1.4 +17 -0.6+0.8	+ 0-8 +10 -1.0	4.5 4.5 4.1 4.4	89 88 92 89	10 10 10 10 10	MNO KINZ NW.	5		0.80	3
10	00 3430 + FY 39.52 10.2 44.40	3430 3939 44:28 39.4	-1.4 +12 +0.4 +0.1	-1.4 0.0 + 07.	4.1 3.9 4.6 4.2	100 78 40 91	10 10 6.7	WARS 1.18 MA			21-20	0
11	+0.4 47.80 +11 9730 +83 48.30	47.05 47.37 4827 47.6	-0.4 -07 -10 -0.7	-1-6 -21 -4.9	3.3 2.9 20 3.0	10 13 04 68	10 10 10 100	NW 2 N. 56 57	85	and		1
13	-1.3 510 -06 503 -12 1010	01-16 5037 38 14 50.6	-7-6 -12 -22-4.0	- 3-2 -33 - 140	2.1 25 30 2.8	33 50 82 73	1 3 10 60	33W1 N.84 1 NY1			1.0	4
16	-1.8 48.60 - 83 96 20-1-4 45.00	48-81 46-24 45-21 46.8	-7-6 -43-6.6-6.2	-1.0 -50-7.0	2.2 2.8 2.5 2.5	89 84 89 87	0 1 6 2.3	NWO ANOM	/		1.10	3
15	-7.0 45.40 -1.6 45.50 - 2.0 45.40	45-34 45-69 4504 45-6	-6.6 -41 -2 3 -45	-69-44-29	2.5 3/ 50 3.1	92 99 40 94	10 7 11 10.0	010 -0011	- 75	2	1.06	2 3
17	-115 46-80 -12 46-28 -14 44410	46.98 46.92 411-80 36.1	-4-0-3-6-4-6-4-1	-412 -48 -43	3.2 3.2 31 3.2	95 91 40 94	10 10 10 100	501 550 - 34 1			1.10	3
18	-1.5 40.20 -1.0 38.11 -1.2. 38.18	40.38 38-22 3592 39.0	-3-6-2-7 -13-2.5	- 548 - 2.8 -1.4	3.7 2.7 4.1 3.7	95 98 98 97	10 11 10: 10	50 0 30 0 St	//	Habel	4	2
19	-1.2 37.70 -0.7 2708 -0.4 ×-10	37-85 37-16 2674 3713	-1-8 -13 +05-0.9	-2.0 73 +02	3-8 9-2 416 4-2	96 100 90 97	10 : 11 : 11 11.	SO . 500 1 0 0	mane P	Make	4-	3
21	+1.0 41.40 +17 40.12 +1 2 93 80	41.28 42.42 43-654-42.6	80 -01-8.2 -01	0.0 -0.0 -0.4	4-6 4.4 4.4 4.5	100 96 96 97	10 \$ 10 10 10	50. 30 050	Mubrel the	tol Bab	al, i	10
< 22	313 420 019 9292 +110 4118	42.94 42.25 HIVE 42.2	-0.6-05-14-0.8	-0.6 -0.7 -1.11	4.4 4.3 41 4.3	100 95 98 98	10 \$ 10 10 10 10	501 050 . 160	Mabel P.	shal Make	\$1.02	1 3
23	+10 10:00 +11 38-70 +0.8 27-40	26-81 38-57 J. N. 18.6	-12-06-18-12	-12 -09 -22	112 44 37 9.0	115 94 92 95	10 10 10 10-1	SH. 50 3 00	A	·#		1
25	+3.4 32.80 +45 34.21 +37 35.40	32.40 3875 34-96 30.7	+5.2 +7-0+31 +5.1	+4.0+55+24	3.4 50 50 5.4	81 78 88 82	10 9 9 9	507 SO3 #	R	r	1	3
24	1.4.0 36.95 +41 38 50 +42 4130	36 43 37 96 40.02 38.2	+2.6 +90 +2.4 +3.0	+ 2.3 +39 +12	3.2 6.0 53 5.5	94 98 96 96	10: 10 10 10	50, 500 \$ ,	Mabal &	is man	-	3
27	+4.0 40-20 +4.1 40-30 +3.8 4230	39.72 40.01 41.85 40.5	+ 1.8 + 2.8 + 2.4 + 2.3	+ 1.6 + 24 + 16	5-1 4-9 4-7 4-9	96 88 85 90	10 11 9 9	Se det i kau	THS PA	K. On	11.96	1 4
29	43.5 55.00 + 8.4 50.88 + 8.5 18:50	30-58 00-42 50.08 50.4	+1-8 +4-8 +2.6 +2.8	+1.2 + 7.6 +11	9.7 4.7 41 4.5	90 77 74 80	10 10 10 10	W - W , 344	/ F	HS:		
30	+3.5 29.20 +3.6. 98.92 + 3.5 49 20	48.77 48.98 48.69 48.6	+1-2 +19 +0.8 +1.3	+0.4 +12 +04	4.2 46 45 4.5	85 88 112 88	10 10 10 10	0-0-0 5371	0	FH	5 milator	
31	43.3 - 59.60 +3.4 50.75 +3.1 82.90	49.20 50-37 52-50 50-7	+0.2 +17 +0.8 +09	0.0 +1.5 +0.6	4-5 50 4-7 4-7	96 96 90 95	10 10 10 10 10	- 550 - 0.40 + 350	0 9/mone 1	1 the Malon	5 0.03	
	6-10	188.32 191.00 192.43 191.6	-7.9 + 5.0 - 3.6 - 3.8		19.5 24 -0 20.5 20 3	8 471 416 462 452	50 48 38 45	1		8 4-	10 13 13	1 1
	E 1-15	130.26 239.50 24035 240.0	-15.2-12.3-19.2-18.9		12 .9 13 .8 13 .6 13 .1	\$ 414 366 993 391	30 39 46 36	3		11-1	18 3.16	5
	16-20	706-88 203-72 205-81 20516	-13.0-6.0-6.1-9.1		17.8 19-6 19.7 19.	1 471 461 476 469	30 41 50 47	e		2 18-1	25 4.94	
	2 1 20 - 31	19295 19012 13935 1910 26836 25 2.26 282.62 and	+ 2.4 + 13.2 + 3.7 + 6.5		28 .3 24 .9 27.6 28.9	6 19 5 53 0 52 5 53 5	60 60 39 39	2		1 24-1	81 13 5	
	1-31	336-18 1333.70 1358.191349.7	-65.3- 17-21-2-340	100	118-2 129 9 118 8 1194	1847 2653 17 1 17 K	272 271 282275	.0	-	w/ 1:	31 96.24	٢.,
m	Mittel	793.43 793.50 793.81 793.54	-2-11 -0.05-1.33-1.17		3.65 9.00 7.52 9.5	91.50 1590 1990 19 0	8.5 8.7 9.1 5	9	-			1
10	acture f. Die Berry Bachachier welche unter find all	tale sills and one is the		1	D Felerates and and	P. Restoration oil R. Callab	taulkes mit S. heptichest. For	depekieltsolies nit FS. u. s. f.				
An	nerkung 2. Für anderweilige Bechnehtungen, Notines, Anne	ukungen u. u. v. int die fehrende Hottprit	e bestivent. Eine besondere Aufereikaan	skelt ist das Stärmen av	") Breeichnung der Ferm den	Siederschlages: • Sidel, 1 Re	ogen, ∴ Engel. « Schnee. In Dei atürkeren Berren und inth	n Falls eines Gewitters mit oder nondere hei Gewittern ist die Xe	ohno Naderschlag m R misfichet stemas a	ord das Zeiche	a l'aisgracht	rides.
An	nerkung 3. Bei den einschen Beplachtungen ist der Lafbiruh, bei, Bewillung, Windelich bin, -	Duastdrack and Nationality and a wei, dor Ta	resperider soft ein a Decisado grass are	nyshen and die Fearbäg-	(1) In diese Dubriken sind bla- wie all jole singular Richt	a die Sommen and Mittan der W	in datar kan (ahna Rarksirht	t sof die Hielvang) eisentragen.	In Braithang auf die	Wiedeleht	ang lat same	goben.
	Strame des Niederschlages sind zuf am ei Dorimit	m, die Mesatuitiel der Feueleigkeit, Benti	hwag and Windstlicke and eine Deckm	ale grant as herecharts	Vertheilung der	Windesrichtungen: Ini .	Bestarhtungen im Gen	neo wardo				



### Climate Archive – digitalisation and backup

(P(nalsässetatiatin)n)

04.01.2010 Folie 6

If you have a look at the archive -> than you can see how correct and careful the content will be handled

-> Your archive is your business card for quality

### New project:

reorganisation of the ZAMG paper archive with a

- new self developed archive system
- handling of paper archive
- access to the digital picture archive

### **Climate Archive – Adaption**

(Präsentation)

04.01.2010 Folie 7







Inventory of all climate paper records

- logistic reorganisation new folder System
- new ARCHIVE data base (Access)

One of our very happy and competent colleague by developing the ARCHIVE Database System



### **Climate Data Rescue**

(Präsentation)

04.01.2010 Folie 8



### • History:

- Only a few daily climate data available before 1939: Kremsmünster (Kloster), Wien, Innsbruck, Salzburg, Graz, Sonnblick, currently: digitalisation of Villacher Alpe, Hochobir, Mallnitz, ...
- Reason: all Austrian Climate Data have been transferred to Berlin --> burned by bomb blast (1944/45)
- 1970: first digitalisation with punch cards -> no DQC
- 1984: first ZAMG DQC for all current daily data
- Data capture of all historical daily data (before 1984) :

### Internal Project: Climate Data Rescue

- Goal: complete digitalisation and DQC for all historical data
- Final status: typ 6



**Climate Data Rescue** 

(Präsentation)

04.01.2010 Folie 9



#### Status of daily climate data (1872-1983) 2009/12



- Since 1985 data capture of historical data : in 23 years 3670 station years -> 160 station years/year
- 2008 internal project CDR to hurry up
- 2008: 300 station years/year
- 2009: 300 station years/year
- 2010 2014: 900 station years/year (costs: 150.000.- Euro/year)
- Additional check -> PROCLIM (typ7)

### ProCLIM

(Präsentation)

04.01.2010 Folie 10



Why ProCLIM ? Additional, statistical DQC of Database

Goal: to check all "final checked daily" and monthly data with an independent new DQC Software

-> Implementation into a scientific and commercial project climate description of Carinthia (40.000 Euro for checking foreigner data sets)

-> as well as for all other ZAMG data



(Präsentation) New designe of data tables & ZAMG restructure 04.01.2010

- 1997 GEKIS Flag System for hourly data
- 2006 QUALIMet Flag System for one and ten minutes values only three different flags: unknown, original + correct, changed + correct
- 2010? Daily and monthly values
  - Internal project: Hope Flagsystem
  - For each parameter and different gauging system one row (precipitation, snow, visibility)
- 2010? Data capture of observed and manual gauged values on site
- 2010? Computing of global radiation data from sunshine duration (Angstrom formula) and vice versa



Folie 11

(Präsentation) New designe of data tables & ZAMG restructure 04.01.2010 Folie 12

Automatic data supplementation of gaps

- 2008 Internal project: feasibility study of an Austrian Weather Radar systems for an Austrian wide surface precipitation evaluation
- 2009 INCA -> import of calculated values (in hourly resolution) for all TAWES
- 2010 Internal projects: HOPE – Heritage Of PropertiEs – Heritage of flags from minutevalues to monthly-values

ÜNKOR reduction of evaporation errors by heating the precipitation bucket

