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Specifications of Inter-Parameter Constraints at MeteoSwiss (Internal Consistancies)

Specification Document DABES.2

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Christian Häberli, Thomas Konzelmann, Daniela Lorenzi, Josefa Mettler, Mario Rohrer	09.12. 98	2.0	Überarbeitung, Ergänzung	Directory: '/dabes/doc/Realisierung/PuM/Dok_PuM' FM-Dokument 'InterParameterIntegrity_98_10.fmx'

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Christian Häberli	17.05. 01		Überarbeitung, Ergänzung	Directory: '/proj/MAZ/MCH-DWH/work/ sw_dokumente/PuM' FM-Dokument 'InterParameterIntegrity_98_12.fmx'
Josefa Mettler, Christian Häberli	09. 01	3.2	Überarbeitung, Ergänzung; Dokument wird in MCH-DWH Dokumentation übernommen	FM-Dokument 'inter_parameter_integrity.fmx'
Josefa Mettler	26.02. 02		Anmerkung: - bei der Ablage unter spez_doc... gemerkt, dass es zw. 27.9. 01 und 26.2. 02 Änderungen durch Mitglieder der Gruppe 'dwh' gegeben hat - Änderungen können mit diff herausgefunden werden, aber es ist nicht möglich nachzuvollziehen, wer wann welche Änderung ausgeführt hat	

KAPITEL 1 Introduction

This document gives the collection of inter-parameter rules, which are used to test the internal consistency of meteorological measurements at MeteoSwiss. Parameters are classified in 20 groups. Each group is tagged with a three letter word (e. g. vis for the group visibility). Each test can be assigned to a group combination.

Group combination and their tests are named as follows:

- Group combination tag: It is always the combination of the group tags preceded by the letter ‘i’.
- Test tag: The group combination tag is further specified by a number.

The chapter “Integrity Rules classified by Parameter Combination” auf Seite 17 lists all group combinations together with a table of their tests. The specified rule for each test indicates the condition for *in*consistency. The condition is TRUE if tested parameters are not consistent. Most tests are specified with a sort of C-syntax (‘||’ is a logical ‘or’, ‘&&’ is a logical ‘and’, ‘!’ means ‘not’, ‘!=’ means ‘not equal’).

For each test its source is indicated. The first three letters are an abbreviation for the references. This abbreviation is succeded by a number which corresponds to the internal rule number of the original document. All source documents are listed in chapter “References” auf Seite 83.

Some tests require - apart from parameter values - the sequence of all measurements of the last three, six or twelve hours. In the formula such parameters are marked with an upper right index. E. g.: T_{200}^{-2} denotes the second measurement before the reference time.

It has to be considered that all specifications cannot be applied to aggregated values.

KAPITEL 2 Sources

The collection of rules in this document is based on two sources.

The major source are tests defined and applied in VAMP (Verarbeitung von ANETZ-Daten mit METEOR Programmen). The second source are tests defined and applied in kaa (Kontrolle der Augenbeobachtungen ANETZ). In VAMP hourly data and Terminwerte are checked with the intension to detect critical values. In kaa the intension was to detect formal errors in the eye observation data. Some aditional sources where used to define tests (see also “References” auf Seite 83). Some tests or testlimits are defined in this work specially to take into account the testing of data with a 10 minutes timestep.

In this document tests of different sources and logical context are defined. Therefore it has to be considered what result a certain test is producing.

KAPITEL 3 Parameter and Parameter Groups

Table 1 on page 10 lists all parameters used for our tests, together with the parameter's location in the MCH Data Warehouse system (source document var_names_DABESQ.fmx).

Name of Variable	Description of Variables	Unit	Table in MCH DWH System	Short Name in MCH DWH System
c	c-factor; station dependent constant for calculating daily means of relative humidity at conventional stations	-		
d	Winddirection (Symbol is also used in general sense)	deg	wind_princ	dkl010z0
d_d	Winddirection	ddeg		
d_g	Winddirection of maximal 1s-gust within 10min	deg	wind_princ	dkl010z1
e	Vapour pressure	hPa	komf_hour	pva200h0
f_{kn}	Windspeed	kn		
f_{kmh}	Windspeed	km/h		
f_v	Windspeed, vectorized	m/s	wind_princ	fve010z0
f_s	Windspeed, scalar (Symbol is also used in general sense)	m/s	wind_princ	fkl010z0
f_g	Maximal windspeed within 10min (1s gust)	m/s	wind_princ	fkl010z1
h	Height of base of deepest cloud above station (normal scale)	Code	eye_obs	chh000s0
h_{s1}	Height of base of lowest cloud layer above station (reduced scale)	Code	eye_obs	ch1000s0
h_{s2}	Height of base of middle cloud layer above station (reduced scale)	Code	eye_obs	ch2000s0

Tabelle 1. Variable Names

Name of Variable	Description of Variables	Unit	Table in MCH DWH System	Short Name in MCH DWH System
h_{s3}	Height of base of highest cloud layer above station (reduced scale)	Code	eye_obs	ch3000s0
h_b	Altitude of the barometer	m a.s.l.	(disposition)	
i	intensity of weather event (code of Swiss 'National Bulletin EB'	Code	-	-
h_s	Altitude of the station	m a.s.l.	(measure_site)	
k	k-factor; station dependent constant for calculating daily means of temperature at conventional stations	-	(sta_coeff)	
s_n	Depth of fresh snow	cm	snow	hns000s0
s_h	Total depth of snow cover	cm	snow	hto000s0
u	East-component of wind (sign does not correspond to conventional use!)	m/s	wind_princ	fea010z0
v	North-component of wind (sign does not correspond to conventional use!)	m/s	wind_princ	fna010z0
w	Weather at time of observation (code of Swiss 'National Bulletin EB')	Code	-	-
ww	Present weather according to WMO Table 4677	Code	eye_obs	wat000s0
w_1	Past weather, drizzle or rain	Code	eye_obs	w1p000i0
w_2	Past weather, rain with snow or snow	Code	eye_obs	w2p000i0
w_3	Past weather, small hail or hail	Code	eye_obs	w3p000i0
w_4	Past weather, thunder storm far or close	Code	eye_obs	w4p000i0
w_5	Past weather, mist or fog	Code	eye_obs	w5p000i0
w_6	Past weather, dew or hoar frost	Code	eye_obs	w6p000i0
w_7	Past weather, hoar frost or black ice	Code	eye_obs	w7p000i0
B_n	Close lightning	Anzahl	princ	brecloz0

Tabelle 1. Variable Names

Name of Variable	Description of Variables	Unit	Table in MCH DWH System	Short Name in MCH DWH System
B_f	Distant lightning	Anzahl	princ	brefarz0
C_L	Clouds of type Sc, St, Cu, Cb (normal scale)	Code	eye_obs	ccl000s0
C_M	Clouds of type Ac, As, Ns (normal scale)	Code	eye_obs	ccm000s0
C_H	Clouds of type Ci, Cc, Cs (normal scale)	Code	eye_obs	cch000s0
C_1	Type of lowest clouds (reduced scale)	Code	eye_obs	cc1000s0
C_2	Type of middle clouds (reduced scale)	Code	eye_obs	cc2000s0
C_3	Type of highest clouds (reduced scale)	Code	eye_obs	cc3000s0
C’	Type of cloud whose base is below the station	Code	eye_obs	cca000s0
E	State of the ground	Code	eye_obs	est000s0
EV	Evaporation	mm	agro	eva000s0
G	Global radiation	W/m^2	princ	gre000z0
G_c	Circum global radiation	W/m^2	day_values_c	gci000d0
H’	Altitude of the upper surface of clouds with base below the level of the station	Code	eye_obs	cha000s0
HGTZ	Heating-degree-day-number 20/12	˚C	month_princ	xno000m0
L	Luminosity	Code	princ	lre000s0
N	Total cloud amount	Code	eye_obs	nto000s0
N_h	Amount of all the C_L clouds and of all the C_M clouds	Code	eye_obs	nsh000s0
N_d	Density of cloudiness	Code	eye_obs	cnd000s0
N_{s1}	Amount of individual cloud layer indicated by C_L (reduced scale)	Code	eye_obs	ns1000s0
N_{s2}	Amount of individual cloud layer indicated by C_M (reduced scale)	Code	eye_obs	ns2000s0
N_{s3}	Amount of individual cloud layer indicated by C_H (reduced scale)	Code	eye_obs	ns3000s0

Tabelle 1. Variable Names

Name of Variable	Description of Variables	Unit	Table in MCH DWH System	Short Name in MCH DWH System
N’	Amount of cloud whose base is below the level of the station	Code	eye_obs	nsa000s0
P	Pressure at station level	hPa	princ	prestas0
P_R	Pressure at station level, redundant measurement	hPa	values_c	ppcstas0
P_{sl}	Pressure reduced to mean sea level	hPa	values_calc	pp0qffs0
P_{qnh}	Pressure reduced to mean sea level without consideration of temperature	hPa	values_calc	pp0qnhs0
P_{qnh500}	Pressure reduced to the 500m-level without considera-tion of temperature	hPa	values_calc	pp0500s0
R	Precipitation	mm	princ	rre150z0
R_{Ra}	Precipitation, redundant instrument; automatic	mm	values_c	ra1150z0
R_{Rc}	Precipitation, redundant instrument; conventional	mm	day_values_c	rc1150d0
RA	Radioactivity	nSievert	princ	are000z0
S	Sunshine duration	min	princ	sre000z0
S_R	Sunshine duration, redundant measurement	min	day_values_c	sa1000d0
S_a	Sunshine duration, astronomical			
S_{max}	Sunshine duration, maximal			
T	Temperature	˚C		
T_5	Air temperature, 0.05m	˚C	princ	tre005s0
T_{50}	Air temperature, 0.5m; frost warning	˚C	agro	tre050s0
T_{200}	Air temperature, 2.0m; reference	˚C	princ	tre200s0
T_{-5}	Ground temperature, -0.05m	˚C	agro	tso005s0
T_{-10}	Ground temperature, -0.1m	˚C	agro	tso010s0
T_{-20}	Ground temperature, -0.2m	˚C	agro	tso020s0
T_{-30}	Ground temperature, -0.3m	˚C	agro	tso030s0

Tabelle 1. Variable Names

Name of Variable	Description of Variables	Unit	Table in MCH DWH System	Short Name in MCH DWH System
T_{-50}	Ground temperature, -0.5m	˚C	agro	tso050s0
T_{-100}	Ground temperature, -1.0m	˚C	agro	tso100s0
T_{S0}	Temperature of snow at ground level	˚C	snow	tht000s0
T_{S1}	Temperature of snow at level 1	˚C	snow	tht001s0
T_{S2}	Temperature of snow at level 2	˚C	snow	tht002s0
T_{S3}	Temperature of snow at level 3	˚C	snow	tht003s0
T_M	Temperature of snow-height meter	˚C	snow	tsa000s0
T_d	Dew-point temperature	˚C	princ	tde200s0
T_w	Wet-bulb temperature	˚C	values_c	tps200s0
T_H	Air temperature, screen	˚C	air_temp_c	ta1200s0
T_{HUTC06}	Air temperature, screen (UTC 06)	˚C	air_temp_c	ta1200s0
T_{HUTC12}	Air temperature, screen (UTC 12)	˚C	air_temp_c	ta1200s0
T_{HUTC18}	Air temperature, screen (UTC 18)	˚C	air_temp_c	ta1200s0
T_H	Mean value of air temperature, screen	˚C		
T_{max}	maximum air temperature /inkl. halfday	˚C	day_princ	tre200dx, tre200nx, tre200jx
T_{min}	minimum air temperature /inkl. halfday	˚C	day_princ	tre200dn, tre200nn, tre200jn
T_U	Temperature of hygrometer shield	˚C	air_temp_c	ta2200s0
T_{Ac}	Temperature of, ASTA-cabin	˚C	air_temp_c	ta3200s0
T_{Ar}	Temperature of ASTA-room	˚C	air_temp_c	ta4200s0
T_x	Temperature at level x (meteorological towers)	˚C	tower	ta1tows0

Tabelle 1. Variable Names

Name of Variable	Description of Variables	Unit	Table in MCH DWH System	Short Name in MCH DWH System
T_R	Temperature, redundant measurement	˚C		
U_{200}	Relative humidity, 2.0m; reference	%	princ	ure200s0
U_H	Relative humidity, screen	%	values_c	ua1200s0
U_{HUTC06}	Relative humidity, screen (UTC 06)	%	values_c	ua1200s0
U_{HUTC12}	Relative humidity, screen (UTC 12)	%	values_c	ua1200s0
U_{HUTC18}	Relative humidity, screen (UTC 18)	%	values_c	ua1200s0
U_{Hc}	Relative humidity, corrected; screen	%		
$\overline{U}_H$	Mean value of relative humidity, screen	%		
V	Horizontal visibility at surface	Code	eye_obs	vho000s0
W_1	Past weather 1	Code	eye_obs	ww1000i0
W_2	Past weather 2	Code	eye_obs	ww2000i0
Y_r	Heating power of precipitation-gauge ring	Code	tech_info	yri150s0
Y_t	Heating power of precipitation-gauge funnel	Code	tech_info	ytr150s0
Y_+	positive control-voltage (ANETZ)	V	tech_info	yisocps0
Y_-	negative control-voltage (ANETZ)	V	tech_info	yisocos0
Y_{swTH}	status word THYGAN	Code	tech_info	ythycos0

Tabelle 1. Variable Names

Tests are classified according to group combinations. Table 2 on page 16 gives an overview of defined parameter groups.

Name of Group	Abbreviation	Parameters
Air temperature and humidity	tea	T_{200}, T_5, T_H, T_{50}, T_U, T_{Ac}, T_{Ar}, T_M, U_{200}, U_H
Soil temperature	teg	T_{-5}, T_{-10}, T_{-20}, T_{-30}, T_{-50}, T_{-100}
Snow temperature	tes	T_{S0}, T_{S1}, T_{S2}, T_{S3}
Precipitation	pre	R, R_{Ra}, R_{Rc}, s_n, s_h
Air pressure	pru	P, P_R
Sunshine	sun	S, S_R
Radiation	rad	G, G_c
Illuminance	lum	L
Wind	win	f_v, f_s, f_g, d, d_g
Lightning	lig	B_n, B_f
Ground	gro	E
Present weather	wob	ww
Weather before observation	web	W_1, W_2
Past weather	paw	w_1, w_2, w_3, w_4, w_5, w_6, w_7
Clouds, normal classification	noc	C_L, h, C_M, C_H
Clouds, recuced classification	rec	N_{s1}, N_{s2}, N_{s3}, C_1, C_2, C_3, h_{s1}, h_{s2}, h_{s3}
Clouds, base below station	bec	N', C', H'
Visibility	vis	V
Amount of total cloudiness	clo	N, N_h
Density of total cloudiness	den	N_d
Instruments	ins	Y_r, Y_t

Tabelle 2. Parameter groups

KAPITEL 4 Integrity Rules classified by Parameter Combination

This chapter gives the present set of rules which have to be applied in order to test internal consistency at MeteoSwiss. The tests are classified by test functionality. The limits are in all cases station-specific. But in some cases, the same values of the limits are applied for several or all stations.

The tests defined in the following chapters are based on two different logical ideas: to find critical values (measurements) and to discover formal errors (eye-observations)

Zeichen	Beschreibung	Description
>	grösser als	arithmetic greater then
<	kleiner als	arithmetic less then
==	gleich	arithmetic equal
!=	nicht gleich	arithmetic not equal
| ? |	Betrag	
&&	und	logical and
||	oder	logical or
∧		
∨		
(⋂)	logisches “und” für einen Vektor von Daten	logical ‘and’ for a vector of data
≥ oder >=	grösser gleich	arithmetic grater then or equal to
≤ oder <=	kleiner gleich	arithmetic less then or equal to
∪	logisches ‘oder’ für einen Vektor von Daten	logical ‘or’ for a vector of data

Tabelle 3. Zeichenerklärung

Zeichen	Beschreibung	Description
$\sum$	Summe von.. bis..	sum from.. to..
$\in$	Teil von .. (enthält)	part of ..

Tabelle 3. Zeichenerklärung

Farbe	Beschreibung	
grün	Funktionen inkl. Nummern erfasst in ‘method_group’	
gelb	Test erfasst in ‘method’ aber noch nicht in ‘method_param’	
magenta[a]	Test in ‘method_param’ und ‘method_in’ zugewiesen	27.01. 99: für ASTA 1 (La Dole) exkl Limiten für Temperaturen im SIAP Gehäuse, ASTA 2 (Payerne) ab 19.2.
magenta[b]	Limiten erfasst (resp. sta_check_nr generiert)	09.02. 99: für ASTA 1 (La Dole) für ASTA 2 Payerne, KKW Gösgen
blau[c]	Limiten erfasst (resp. sta_check_nr generiert)	26.0.3. 99: nur für ENET-Station Cham
[d]cyan	Limiten erfasst (resp. sta_check_nr generiert)	06.05. 99: nur für Ferneingabestation Delémont (95)
rot	in Kolonne ‘remarks’: Neue Tests oder Unstimmigkeiten zwischen VAMP und DABES, VAMP und Kontrolle der Augenbeobachtungen oder VAMP und FE	

TABLE 4. Farbcode für die Realisierung im MeteoSchweiz Data Warehouse System (PuMVerwaltung)

a. in Kolonne ‘Name of Test’
b. in Kolonne ‘Test (Application to)’
c. in Kolonne ‘Test (Application to)’
d. in Kolonne ‘Test (Application to)’

4.1 Limit tests

Fct Nr.	Fct name (in libpum)	Test Rule (Violation if)	Description	Name of Test	Test (Application to)	VAMP Tag	EQ Nr in FE	Retrieved from	Remarks
0	hard_soft_lower_limit	X < Lim	X must not be smaller than Lim.	iliuh	P < 600	LIU	1	Filippov, 1968; WMO 305, 1985	
				iliuh	T < - 50		7		applicable for all air Temperatures (THYGAN, Screen, VHT etc) and for Temperature in ASTA room/ cabin and SIAP cabin
				iliuh	T_5 < -50				
				iliuh	T_{max} < - 50		10		
				iliuh	T_{min} < - 50		17		
				iliuh	U < 0		30		applicable for all 2m Humidities (THYGAN, Screen, Hygrometer etc)
				iliuh	E < 0		(32)		
				iliuh	G < -7			VAMP	Einheit?
				iliuh	d < 0		33		
				iliuh	f < 0				
				iliuh	f_g < 0				
				iliuh	N < 0		(37)		may be applied to all cloud amount variables
				iliuh	N_d < 0				
				iliuh	C < 0				applicable to all cloud type codes
				iliuh	ww < 0		38		
				iliuh	w_x < 0				
				iliuh	R < 0				
				iliuh	V < 0				
				iliuh	s_n < 0 cm		(41)		

Tabelle 5. Limit tests

Fct Nr.	Fct name (in libpum)	Test Rule (Violation if)	Description	Name of Test	Test (Application to)	VAMP Tag	EQ Nr in FE	Retrieved from	Remarks
				iliuh	$s_h < 0$ cm		(42)		
				iliuh	$B_n < 0$				
				iliuh	$B_f < 0$				
				iliuh	$L < -650$				for values between 1450...0000...0830; Einheit?
				iliuh	$L < 0$				for values between 0840 and 1440
				iliuh	$S < 0$				
				iliuh	$EV < 0$				
				iliuh	$T_{-5} < -20$				
				iliuh	$T_{-10} < -18$				
				iliuh	$T_{-20} < -16$				
				iliuh	$T_{-30} < -15$				ust
				iliuh	$T_{-50} < -13$				
				iliuh	$T_{-100} < -10$				
				iliuh	$Y_r < -10$				
				iliuh	$Y_t < -10$				
				iliuh	$Y_+ < 680$				
				iliuh	$Y_- < -516$				
				ilius	$T < Lim$		a		Lim for each station and month applicable for all 2m Temperatures (THYGAN, Screen, VHT etc) and for Temperature in ASTA room/ cabin
				ilius	$T_5 < Lim$				Lim for each station and month
				ilius	$T_{max} < Lim$		b		Lim for each station and month
				ilius	$T_{min} < Lim$		c		Lim for each station and month

Tabelle 5. Limit tests

Fct Nr.	Fct name (in libpum)	Test Rule (Violation if)	Description	Name of Test	Test (Application to)	VAMP Tag	EQ Nr in FE	Retrieved from	Remarks
				ilius	U < Lim		XXX[d]		Lim: 20% for lowland stations, 10% for stations above 800 m asl.; applicable for all 2m Humidities (THYGAN, Screen, Hygrometer etc)
				ilius	RA < Lim				Lim for each station Limiten von Leonrdi NAZ?
1	hard_soft_upper_limit	X > Lim	X must not exceed Lim.	ilioh	P > 1050	LIO	2	Filippov, 1968; WMO 305, 1985	
				ilioh	T > 50		8		applicable for all 2m Temperatures (THYGAN, Screen, VHT etc) and for Temperature in ASTA room/ cabin
				ilioh	T_5 > 50				
				ilioh	T_{max} > 50		11		
				ilioh	T_{min} > 50		18		
				ilioh	h > 90				falsche Limite, korrekt 9.0
				ilioh	h_{sx} > 99				wieso nur oben hart?
				ilioh	V > 89				
				ilioh	U > 100		31		applicable for all 2m Humidities (THYGAN, Screen, Hygrometer etc)
				ilioh	E > 9		(32)		
				ilioh	d > 360		34		
				ilioh	f > 40 kn/50m/s		35 VAMP		VAMP=30 m/s
				ilioh	f_g > 250 kn/ 60 m/s		36 VAMP		Limit of 250 kn for FE Stations is much too high! VAMP=35 m/s

Tabelle 5. Limit tests

Fct Nr.	Fct name (in libpum)	Test Rule (Violation if)	Description	Name of Test	Test (Application to)	VAMP Tag	EQ Nr in FE	Retrieved from	Remarks
				ilioh	N > 1.125		(37)		applicable to all cloud amount variables
				ilioh	C > 9				applicable to all cloud type codes
				ilioh	ww > 99		39		
				ilioh	w_x > 2				
				ilioh	R > 500 mm		40	after Dössegger, 1978 (increased limit)	for daily values
				ilioh	R > 350 mm			ust	for semi daily values
				ilioh	R > 21.0				for 10’ values; Limit from VAMP=15.0
				ilioh	s_n > 150 cm		(41)		Limite in Müller 1987 ist 400 cm (200 cm erfasst)
				ilioh	s_h > 400 cm		(42)		Limite in Müller 1987 ist 800 cm (erfasst)
				ilioh	EV > 15 mm		43	Dössegger 1978	Limite in VAMP: 20 mm (Tageswert?)
				ilioh	EV > 2.0 mm			ust	for hourly values
				ilioh	N_d > 6				
				ilioh	G > 7			VAMP	for values between 2040...0340, Einheiten?
				ilioh	G > 1500			VAMP	for values between 0350...2030
				ilioh	B_n > 99				
				ilioh	B_f > 99				
				ilioh	L > 0			VAMP	for values between 2040...0340, Einheiten?
				ilioh	L > 300				for values between 0350...2030
				ilioh	S > 0				for values between 2040...0340

Tabelle 5. Limit tests

Fct Nr.	Fct name (in libpum)	Test Rule (Violation if)	Description	Name of Test	Test (Application to)	VAMP Tag	EQ Nr in FE	Retrieved from	Remarks
				ilioh	S > 10				for values between 0350...2030
				ilioh	T_{-5} > 30				
				ilioh	T_{-10} > 28				
				ilioh	T_{-20} > 26				
				ilioh	T_{-30} > 25				
				ilioh	T_{-50} > 23				
				ilioh	T_{-100} > 20				
				ilioh	Y_{+} > 860				
				ilioh	Y_{-} >-510				
				ilios	H' > h_s + Lim H' > 2		XXX		Lim in der Regel 100 m, bei gewissen Stationen (JFJ, Gemmi) mehr. Der erste Test muss evtl zu den Konsistenztests umplaziert werden.
				ilios	s_n > 99 (ust)		XXX	DDR 1987	Lim: 100 cm for stations below 800 m asl: 300 cm for stations above 800 m asl
				ilios	s_h > 200 (ust)		XXX	DDR 1987	Lim: 100 cm for stations below 800 m asl: 400 cm for stations above 800 m asl
				ilios	T > Lim		1		Lim for each station and month; applicable for all 2m Temperatures (THYGAN, Screen, VHT etc) and for Temperature in ASTA room/ cabin
				ilios	T_5 > Lim				Lim for each station and month
				ilios	T_{max} > Lim		1		Lim for each station and month
				ilios	T_{min} > Lim		1		Lim for each station and month
				ilios	f_s > Lim				Lim for each station and month

Tabelle 5. Limit tests

Fct Nr.	Fct name (in libpum)	Test Rule (Violation if)	Description	Name of Test	Test (Application to)	VAMP Tag	EQ Nr in FE	Retrieved from	Remarks
				ilios	f_g > Lim		XXX		Lim: 80 kn for lowland stations, 140 kn for stations above 800 m asl.
				ilios	R > Lim		1		Lim for each station and month
				ilios	RA > Lim				Lim for each station
				ilios	f_{kn} > Lim		XXX		unnötig
				ilios	G > Lim				
				ilios	L > Lim				

Tabelle 5. Limit tests

a. weiche Limiten im stationsspezifischen Teil
b. weiche Limiten im stationsspezifischen Teil
c. weiche Limiten im stationsspezifischen Teil
d. XXX means ‘not yet implemented‘

4.2 Variability

4.2.1 Maximum Variability

Fct Nr.	Fct name (in libpum)	Test Rule (Violation if)	Description	Name of Test	Test (Application to)	VAMP Tag	EQ Nr in FE	Retrieved from	Remarks
2	hard_soft_jump	$\|X_t - X_{t-1}\| > Lim$	Difference between two subsequent values must not exceed Lim						Test may be applied using hard (wide) and soft (narrow) limits.
				ivarmaxh	$\|P_t - P_{t-1}\| > Lim$		3...6	Dössegger, 1978; WMO 305, 1985	Lim = 12 if t - t_{-1} = 12 h Lim = 8 if t - t_{-1} = 6h
				ivarmaxh	$\|T_t - T_{t-1}\| > 20$ K		9	Dössegger, 1978; WMO 305, 1985	applicable to T measured in intervals of 6 or 12 h
				ivarmaxh	$\|T_{max,t} - T_{max,\ t-1}\| > 20$ K		12	after Dössegger, 1978	
				ivarmaxh	$\|T_{min,t} - T_{min,\ t-1}\| > 15$ K		19	after Dössegger, 1978	
				ivarmaxh	$\|T_t - T_{t-1}\| > 5$ K	VTL		VAMP	applicable to T measured in intervals of 10’ applicable for all 2m Temperatures (THYGAN, Screen, VHT etc)
				ivarmaxh	$\|T_{5t} - T_{5t-1}\| > 15$K	VTG		VAMP	
				ivarmaxh	$\|U_t - U_{t-1}\| > 30\%$	VUU		VAMP	applicable for all 2m Humidities (THYGAN, Screen, Hygrometer etc)
				ivarmaxh	$\|P_t - P_{t-1}\| > 4$ hPa	VPP		VAMP	
				ivarmaxh	$\|T_{-5t} - T_{-5t-1}\| > 4$K	VTB		VAMP	
				ivarmaxh	$\|T_{-10t} - T_{-10t-1}\| > 4$K	VTB		VAMP	
				ivarmaxh	$\|T_{-20t} - T_{-20t-1}\| > 3$K	VTB		VAMP	

Tabelle 6. Maximum Variability checks

Fct Nr.	Fct name (in libpum)	Test Rule (Violation if)	Description	Name of Test	Test (Application to)	VAMP Tag	EQ Nr in FE	Retrieved from	Remarks
				ivarmaxh	$\|T_{-50t} - T_{-50t-1}\| > 2K$	VTB		VAMP	
				ivarmaxh	$\|T_{-100t} - T_{-100t-1}\| > 1K$	VTB		VAMP	
				ivarmaxs	$s_{h06UTC} - s_{h18UTCprevday} < Lim$		XXX	DDR 1987	Lim is dependent on station and month
				ivarmaxs	$s_{h18UTC} - s_{h06UTC} < Lim$		XXX	DDR 1987	Lim is dependent on station and month

Tabelle 6. Maximum Variability checks

Anleitung zur Erfassung dieser Tests im MeteoSchweiz Data Warehouse System (PuMVerwaltung):

Die Limite, die zum “Prüfparameter” gehört, ist die Länge des Vergleichsbandes (Lim_1 = Anzahl Werte, in der Regel = 2)

Es muss in jedem Fall der Prüfparameter auch als Vergleichsparameter auf Position 2 erfasst werden. Die zugehörige Limite ist dann die Limite (Bandbreite = Lim_2)

4.2.2 Dead-band check

Fct Nr.	Fct name (in libpum)	Test Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr in FE	Retrieved from	Remarks
3	hard_soft_dead	$\|X_t - X_{t-j}\| < Lim_2$ where: $j=1..Lim_1-1$	The differences between one value in a row and the first value in this row must be greater than a limit. The length of the row is specified by a second limit	ivarminh					
				ivarminh	$\|d_t - d_{t-j}\| < 0.1$ where: $Lim_1=6$	VDD		VAMP	
				ivarminh	$\|f_t - f_{t-j}\| < 0.1$ where: $Lim_1=6$	VFF		VAMP	
				ivarminh	$\|T_t - T_{t-j}\| < 0.1$ where: $Lim_1=6$	VTL		VAMP	
				ivarminh	$\|T_{5t} - T_{5t-j}\| < 0.1$ where: $Lim_1=6$	VTG		VAMP	
				ivarminh	$\|U_t - U_{t-j}\| < 0.1$ where: $Lim_1=6$	VUU		VAMP	Test is not fully identical to VAMP
				ivarminh	$\|T_{-5t} - T_{-5t-j}\| < 0.1$ where: $Lim_1=6$	VTG		VAMP	Limit was undef in VAMP?
				ivarmins					
				ivarmins	$\|P_t - P_{t-j}\| < 0.1$ where: $Lim_1=12$	VPP		VAMP	

Tabelle 7. Dead-band check

Anleitung zur Erfassung dieser Tests im MeteoSchweiz Data Warehouse System (PuMVerwaltung):
Die Limite, die zum “Prüfparameter” gehört, ist die Länge des Vergleichsbandes (Lim_1 = Anzahl Werte)
Es muss in jedem Fall der Prüfparameter auch als Vergleichsparameter auf Position 2 erfasst werden. Die zugehörige Limite ist dann die Limite (Bandbreite = Lim_2)

4.3 Consistency between measurements

4.3.1 Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
4	absolut_diff_gt	$\|X_1 - X_2\| > Lim_1$	Difference between parameter X1 and X2 may not be > Lim						**ACHTUNG**: Bei der Ablage auf im MCH DWH Sysstem wird Lim1 auf die Position 1, d.h. zusammen mit dem 'Prüfparameter' abgelegt. Die Limite zum Vergleichsparameter wird als 'NULL' eingegeben.
				iteatea1	$\|T_{200} - T_H\| > 5$	KTT		pld51	
				iteatea2	$\|T_{200} - T_U\| > 5$	KTT		pld52	
				iteatea3	$\|T_{200} - T_{Ac}\| > 5$	-		pld53	
				iteatea4	$\|T_{200} - T_{Ar}\| > 5$	-		pld54	
				iteatea5	$\|T_{200} - T_5\| > 15$	KTT		pld55	
				iteatea6	$\|T_{200} - T_{50}\| > 10$	-		pld56	
				iteatea7	$\|T_5 - T_{50}\| > 10$	-		pld57	
				iteatea8	$\|T_{200} - T_M\| > 5$	-		pld58	
				iteatea10	$\|U_{200} - U_H\| > 30$	-		pld501	Limite unterscheiden nach Berg-/Flachland-station oder konservative Feuchtegrösse für den Vergleich verwenden.
				iteatea25	$\|T - T_R\| > 0.8$	-			alte Test Nr 321, nur für Türme?
				iteateg1	$\|T_5 - T_{-5}\| > 30$	KTB		VAMP	
				itegteg1	$\|T_{-5} - T_{-10}\| > 5$	KTB		pld1	
				itegteg2	$\|T_{-10} - T_{-20}\| > 5$	KTB		pld2	
				itegteg3	$\|T_{-20} - T_{-30}\| > 5$	-		pld3	

Tabelle 8. Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
				itegteg4	$\|T_{-20} - T_{-50}\| > 5$	KTB		pld3	
				itegteg5	$\|T_{-30} - T_{-50}\| > 5$	-		pld4	
				itegteg6	$\|T_{-30} - T_{-100}\| > 5$	-		pld4	
				itegteg7	$\|T_{-50} - T_{-100}\| > 5$	KTB		pld5	
				iprepre1	$\|R - R_{Ra}\| > 5$	-		pld106	
				iprepre2	$\|R_{Rc} - R_{Ra}\| > 5$	-		pld107	
				isunsun1	$\|S - S_R\| > 0$	-		pld301	
5	lt_and_lt	$(X_1 <= Lim_1)$ && $(X_2 <= Lim_2)$	X_2 must be more than Lim_2 if X_1 is less than Lim_1	iteains1	$(T_{200} <= 0.0)$ && $(Y_t <= 0)$	KHR		pld901	1. Bei diesem Test muss auch die Sonnenscheindauer berücksichtigt werden, d.h. wenn Sonne auf Niederschlagskübel scheint, kann die Temperatur unter Null sein, und die Heizung trotzdem ausgeschaltet 2. Der programmierte Test entspricht nicht der Spezifikation!!!
				iteains3	$(T_{200} <= 0.0)$ && $(Y_r <= 0)$	KHR		pld903	1. Bei diesem Test muss auch die Sonnenscheindauer berücksichtigt werden, d.h. wenn Sonne auf Niederschlagskübel scheint, kann die Temperatur unter Null sein, und die Heizung trotzdem ausgeschaltet 2. Der programmierte Test entspricht nicht der Spezifikation!!!
6	gt_and_lt	$(X_1 > Lim_1)$ && $(X_2 < Lim_2)$	X_2 must be more than Lim_2 if X_1 is more than Lim_1	iteapre1	$(R > 0.0)$ && $(U_{200} < 70)$	KRU		pld102	
				iradlum1	$(G > 30)$ && $(L < 10)$	-		pld306	Einheiten G: W/m2 Anpassung:5.2000 alt: Lim_1=10

Tabelle 8. Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
				iradlum2	(G > 15) && (L < 0)	-		pld307	Einheiten G: W/m2 Anpassung:5.2000 alt: Lim_1=5
				ipregro1	(R > 0) && (E < 1)	-		pld104	
				ipregro2	(s_h > 0) && (E <= 4)	-	100, 105?	chi46 pld620 kaa55	in FE Eq. 100, 105 heisst der Test: (s_h > 0) && (E < 6) evtl. Test von ern brauchen, der neben der Schnee-decke auch den Erdbodenzustand 'gefroren' und 'vereist' berücksichtigt.
				ivisvis1	(V>50)&&(V<56)	-			
				inocnoc3	(h >50)&&(h <56)	-			!!! ACHTUNG: neu, war in ern's Doku bis anhin nicht drin, harter Test
				irecrec5	(h_{sx}>50) && (h_{sx}<56)	-			harter Test
				ipreclo1	(R > 0)&&(N < 0.625)	-		pld103	ist neu hier, war vorher in 3.6.1., welches jetzt gestrichen ist (alt N < 5)
127	sum_gt_and_lt	(X_1 > Lim_1) && (X_2 < Lim_2)	X_2 must be more than Lim_2 if X_1 (sum of last hour) is more than Lim_1	ipregro3	$\left(\left(\sum_0^5 R\right) > 3\right) \wedge E < 1$	-		chi	neue Funktion: Niederschlag der letzten Stunde
7	gt_and_gt	(X_1 > Lim_1) && (X_2 > Lim_2)	X_2 must be less than Lim_2 if X_1 is more than Lim_1	ipresun1	(R > 0) && (S > 9)	KRS		pld101	in VAMP Lim_2 is ==10
				isunlig1	(S > 5) && (B_n > 0)	-		pld304	
				iteains2	(T_{200} >= 5.0) && (Y_t > 10.0)	KHR		pld902	

Tabelle 8. Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
				iteains4	(T_{200} >= 5.0) && (Y_r > 10.0)	KHR		pld904	
				iteapre3	(T > 10) && (s_n > 0)	KSH	45	VAMP	
				isunclo1	(S > 0) && (N > 0.875)	-		pld305	war vorher in 3.6.2, welches jetzt gelöscht ist alt: N > 7
8	eq_and_gt	(X_1 = Lim_1) && (X_2 > Lim_2)	X_2 must be less than Lim_2 if X_1 is equal Lim_1	isunrad1	(S = 0) && (G > Lim_2)	KGS		pld302	Lim_2= 3.82 Test for lowland stations (neu 360 W/m2) Lim_2 = 5.2 for mountain stations (neu 500 W/m2) Anpassung:5.2000 alt: Lim_2=230 resp. 312 Einheit der Limite von G unklar; welche Höhe als Grenze?
				iprelig1	(R = 0) && (B_n > 0)	KRB		pld108	eine sep Fkt für R<Lim_1 && B_n >= Lim_2 ist vorhanden (clightning_without_precip)
				ivisclo1	(N=1.125) && (V > 10)	KAA		pld626	
9	eq_and_lt	(X_1 = Lim_1) && (X_2 < Lim_2)	X_2 must be more than Lim_2 if X_1 is equal Lim_1	isunrad2	(S = 10) && (G < 30)	KGS		pld303	Test for all stations
10	greater_than	X_1 > X_2	X_1 must be smaller than X_2	iwinwin2	f_s > f_g	-		pld203	
				iwinwin5	f_v > f_g	KFF		VAMP	
				irecclo1	N_{s1} > N	-		kaa95	sep Fkt allenfalls vorhanden (lrclds_gt_cldcov)
				irecclo2	N_{s2} > N	-		kaa96	sep Fkt allenfalls vorhanden (mrclds_gt_cldcov)

Tabelle 8. Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
				irecclo3	$N_{s3} > N$	-		kaa97	sep Fkt allenfalls vorhanden (hrclds_gt_cldcov)
				icloclo1	$N_h > N$	KAA		kaa80 pld627	
11	lower_than	$X_1 < X_2$	X_1 must be more than X_2	iradrad1	$G_c < G$	-		pld308	
				irecrec3	$h_{s2} < h_{s1}$	-		kaa92	
				irecrec4	$h_{s3} < h_{s2}$	-		kaa93	
				iwebweb1	$W_1 < W_2$	-		kaa45 pld659	
				iprepre8	$s_h < s_n$	KSH		kaa56	war in ern's Sammlung nicht drin
12	gt_and_eq_or_eq_and_ne	$((X_1 > Lim_1)$ && $(X_2 = Lim_2))$ || $((X_1 = Lim_1)$ && $(X_2$!= $Lim_2))$		iwinwin3	$(f_v > 0)$&&$(d = 0)$ ||$((f_v=0)$ &&$(d!=0))$	KDD	101, 102	pld204	entspricht nicht exakt der ursprünglichen Doku von ern
				iwinwin4	$(f_s > 0)$ && $(d = 0)$ ||$((f_s=0)$ &&$(d!=0))$	-		pld205	entspricht nicht exakt der ursprünglichen Doku von ern
				iwinwin9	$(f_g > 0)$ && $(dg = 0)$ ||$((f_g=0)$ &&$(dg!=0))$	-		pld205	neu: ust
15	diff_gt								

Tabelle 8. Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
16	fsnow_with_high_temp	6z: $\left(\frac{\sum_{t=0}^{71} T_{200(t)}}{72} \geq 5 \right)$ $\wedge ((s_n^{\,0} - s_n^{\,-1}) > 0)$ 18z $\left(\frac{\sum_{t=0}^{71} T_{200}^{\,-t}}{72} \geq 5 \right)$ $\wedge (s_n^{\,0} > 0)$	If the mean air temperature of the last 12 hours exceeds 5 degrees there may be no fresh snow.	iteapre2	see consistency rule	VOT		pld60 (chi1)	Dieser Test ist nicht richtig implementiert. Er sollte heissen: Wenn Neuschnee > 0, dann muss die Temperatur in der entsprechenden Periode mindestens einmal kleiner als 5 Grad gewesen sein (bzw. es dürfen nicht alle Temperaturen im entsprechenden Zeitraum grösser als 5 Grad gewesen sein), d.h.: 6z, 18z $(s_n > 0) \wedge (\bigcap_0^{71} T \geq 5, 0)$ in Phase 2 wie oben implementieren dlo: Aufwandschätzung Funktion 16 falsch!
23	tsnow_increase_more_than_fsnow	6z: $(s_n - s_n^{-1}) < (s_h - s_h^{-1})$ 18z: $s_n < (s_h - s_h^{-1})$	Within two measurements snow cover cannot increase more than the corresponding new snow depth.	iprepre3		VOH	98	chi43 (kaa125 pld61)	

Tabelle 8. Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
24	snow_melted_too_much	6z: $(s_n - s_n^{-1} - 10) > (s_h - s_h^{-1})$ 18z: $(s_n - 10) > (s_h - s_h^{-1})$	Within two measure-ments snow cover can-not diminish (compress) more than 10 cm.	iprepre4		-	XXX	chi42	
25	little_precip_and_too_much_snow	$\left(\sum_0^{71} R \leq 5\right) \wedge \left(s_n \geq \left(3 \cdot \sum_0^{71} R\right)\right)$	New snow depth depends on the amount of precipitation (water equivalent)	iprepre5	6z: (R <= 5) && ($(s_n - s_n^{-1}) >= (3 * R)$) 18z: (R <= 5) && ($s_n >= (3 * R)$)	-	XXX	chi	Einheit von R [mm] Einheit von s_n [cm] R in coloumn 'Tests' equals the precipitation sum of the last 12 hours.
26	lotof_precip_and_too_much_snow	$\left(\sum_0^{71} R > 5\right) \wedge \left(s_n \geq \left(2 \cdot \sum_0^{71} R\right)\right)$	New snow depth depends on the amount of precipitation (water equivalent)	iprepre6	6z: (R > 5) && ($(s_n - s_n^{-1}) >= (2 * R)$) 18z: (R > 5) && ($s_n >= (2 * R)$)	-	XXX	chi	Einheit von R [mm] Einheit von s_n [cm] R in coloumn 'Tests' equals the precipitation sum of the last 12 hours
27	more_fsnow_than_tsnow	6z: $((s_n - s_n^{-1}) > 0)$ && $(s_h < (s_n - s_n^{-1}))$ 18z: $(s_n > 0)$ && $(s_h < s_n)$	Total snow cover may not be smaller than new snow depth	iprepre7		VOH	97	chi41	Only for stations below 800 m, because where s_h is high (in the mountains) this test will never or seldom fail Test ist nicht exakt identisch mit VAMP Code nicht vollständig (hap)! $(s_n - s_n^{-1}) > 0$ fehlt
37	vwspeed_swspeed_outof_prop	$\left(\frac{f_v}{f_s} > 1\right) \vee \left(\frac{f_v}{f_s} < 0.83\right)$		iwinwin1		-		pld202	ENET

Tabelle 8. Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
		extremum(X_t, X_{t-1},X_{t-2},...) - X_{extrem} > Lim	The extreme value (min, max) of the readings at specific observation terms may exceed the extreme value for this period only by a very small amount.	iteatea11	max(T_{H06UTC}, T_{H12UTC}, T_{H18UTC}) - $T_{max18UTC}$ > 0.3 K	-	13	KLIBER	Phase 2 dlo: Aufwandschätzung
				iteatea12	max($T_{H18UTCprevday}$, T_{H06UTC}) - $T_{max06UTC}$ > 0.3 K	-	14	Dösseg-ger, 1978 (KLIBER)	
				iteatea13	min(T_{H06UTC}, T_{H12UTC}, T_{H18UTC}) - $T_{min18UTC}$ > 5 K	-	29	Dösseg-ger, 1978 (KLIBER)	
		X_{extrem} - extremum(X_t, X_{t-1},X_{t-2},...) > Lim	The maximum value for a given period may exceed the readings at the observation terms in this period only by Lim.	iteatea14	$T_{max06UTC}$ - max($T_{H18UTCprevday}$, T_{H06UTC}) > 10 K	-	15	Dösseg-ger, 1978 (KLIBER)	Phase 2 dlo: Aufwandschätzung
				iteatea15	$T_{max18UTC}$ - max(T_{H06UTC}, T_{H12UTC}, T_{H18UTC}) > 10 K	-	16	Dösseg-ger, 1978 (KLIBER)	
				iteatea16	$T_{min06UTC}$ - min($T_{H18UTCprevday}$, T_{H06UTC}) > 0.3K	-	20	Dösseg-ger, 1978 (KLIBER)	

Tabelle 8. Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
				iteatea17	$T_{min18UTC}$ - min(T_{H06UTC}, T_{H12UTC}, T_{H18UTC}) > 0.3 K		21	Dösseg-ger, 1978 (KLIBER)	
		$X_1 - X_2 < Lim$	X_2 may exceed X_1 only by Lim	iteatea18	$T_{H18UTCprevday}$ - $T_{min06UTC}$ < -0.3 K		22	Dösseg-ger, 1978 (KLIBER)	Phase 2 dlo: Aufwandschätzung
				iteatea19	T_{H06UTC} - $T_{min06UTC}$ < -0.3 K		24	Dösseg-ger, 1978 (KLIBER)	
				iteatea20	$T_{min18UTC}$ - T_{H06UTC} > 0.3 K		26	Dösseg-ger, 1978 (KLIBER)	
				iteatea21	$T_{min18UTC}$ - T_{H12UTC} > 0.3 K		27	Dösseg-ger, 1978 (KLIBER)	
				iteatea22	$T_{min18UTC}$ - T_{H18UTC} > 0.3 K		28	Dösseg-ger, 1978 (KLIBER)	
		$X_1 - X_2 > Lim$	X_2 may not be greater than X_1 + Lim	iteatea23	$T_{H18UTCprevday}$ - $T_{min06UTC}$ > 15 K		23	Dösseg-ger, 1978 (KLIBER)	Phase 2 dlo: Aufwandschätzung
				iteatea24	T_{H06UTC} - $T_{min06UTC}$ > 15 K		25	Dösseg-ger, 1978 (KLIBER)	
111	func_322	$ax(X, X_R) > Lim_1 \wedge \lvert X - X_R \rvert > Lim_2$		iwinwin6	$ax(f, f_R) > ms^{-1} \wedge \lvert f - f_R \rvert > \dot{0}, 7ms^{-1}$			AZEN	alte Test Nr 322

Tabelle 8. Consistency between two measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
112	func_323	$max(X, X_R) > Lim_1 \wedge \left(\left\lvert\frac{X}{X_R} - 1\right\rvert > Lim_2 \vee \lvert X - X_R\rvert > Lim_3\right)$		iwinwin7	$max(f, f_R) > 1ms^{-1} \wedge \left(\left\lvert\frac{f}{f_R} - 1\right\rvert > \dot{0},28 \vee \lvert f - f_R\rvert > 0,7ms^{-1}\right)$			AZEN	alte Test Nr 323
113	func_324	$max(f, f_R) > Lim_1 \wedge ((\lvert d - d_R - 180\rvert) > Lim_2 (\lvert d - d_R + 180\rvert) > Lim_2)$		iwinwin8	$max(f, f_R) > 1ms^{-1} \wedge ((\lvert d - d_R - 180\rvert) > 14deg \vee (\lvert d - d_R + 180\rvert) > 14deg)$			AZEN	alte Test Nr 324

Tabelle 8. Consistency between two measurements

4.3.2 Consistency between three measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
13	gt_and_absolut_diff_gt	$(X_1>=Lim_1)\&\&\|X_2 - X_3\|>Lim_2$	The difference between X2 and X3 must not exceed Lim2, if X1 is more or equal Lim1.	itespre1	$(s_h >= 30)$ && $\|T_{S1} - T_{S0}\| > 3.0$	-	pld6	
				itespre2	$(s_h >= 55)$ && $\|T_{S2} - T_{S0}\| > 3.0$	-	pld7	
				itespre3	$(s_h >= 100)$ && $\|T_{S3} - T_{S0}\| > 3.0$	-	pld8	
14	red2_nbetween_red1_and_3	$((X_1 > X_2)$ && $(X_1 > X_3))$ || $((X_1 < X_2)$ && $(X_1 < X_3))$	The algorithm is testing whether parameter X1 lies between X2 and X3	iteatea9	X_1: T_{50} X_2: T_{200} X_3: T_5	-	pld59	Test muss neu spezifiziert werden. Es kann sein dass die 50 cm Temperatur um einige wenige Zehntel ausserhalb des durch die 2m und 5 cm Temperatur vorgegebenen Toleranz-bands liegt. Phase 2! dlo: Aufwandschätzung

Tabelle 9. Consistency between three measurements

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
114	func_325	(1) ∧ (2) where (1): $(\underbrace{(\lvert T_x - (T'_{x-1} + Lim_1)\rvert > Lim_2)}$ and (2): $(\underbrace{(\lvert T_x - (T'_{x+1} - Lim_1)\rvert > Lim_2)}$ and: $T' = (T + T_R)/2$		iteatea26	see consistency rule T: ta1tows0 T_R: ta2tows0 Lim_1: 1..2°C Lim_2: 3...4 °C		AZEN	alte Test Nr. 325 the indices x denote the level of the tower: x-1 = level below the actual level x+1 = level above the actual level If the test is performed for data of the lowest level, (1) is omitted. If the test is performed for the uppermost level, (2) is omitted. Station 55: Lim1 = 1.0, Lim2 = 3.0 Station 60: Lim1 = 1.0, Lim2 = 3.0 Station 61: Lim1 = 2.0, Lim2 = 4.0 Station 64: Lim1 = 1.0, Lim2 = 3.0
				iteatea27	see consistency rule T: ta2tows0 T_R: ta1tows0 Lim_1: 1..2°C Lim_2: 3...4 °C		AZEN	alte Test Nr. 325 the indices x denote the level of the tower: x-1 = level below the actual level x+1 = level above the actual level If the test is performed for data of the lowest level, (1) is omitted. If the test is performed for the uppermost level, (2) is omitted. Station 55: Lim1 = 1.0, Lim2 = 3.0 Station 60: Lim1 = 1.0, Lim2 = 3.0 Station 61: Lim1 = 2.0, Lim2 = 4.0 Station 64: Lim1 = 1.0, Lim2 = 3.0

Tabelle 9. Consistency between three measurements

4.3.3 Consistency between measurements and sensor status words

Fct Nr.

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks	Fct Nr.
			If the THYGAN status-word takes a value between 5000 and 5999 then the relative humidity violates a hard limit.	iteains7	U > -1.0ε+11 && Y_{swTH} > 4999 && Y_{swTH} <6000				any value of the relative humidity has to be flagged.
126	thyg_sens_status	$X_1 > Lim_1$ && $X_1 < Lim_2$ && $X_2 = Lim_3$ && $X_2 - (X_2 + X_{2\ t-1})/2 < Lim_4$	If the THYGAN status-word takes a value between 2000 and 3999 and the absolute difference of the relative humidity between the actual value and the arithmetic mean of the actual and the previous value is smaller than 30% then the relative humidity violates a hard limit.	iteains8	U > -1.0e+10 && U - (U + U_{t-1})/2 < 30% && Y_{swTH} > 1999 && Y_{swTH} < 4000				any value of the relative humidity has to be flagged.
			If the THYGAN status-word takes a value between 6000 and 6999 and the absolute difference of the relative humidity between the actual value and the arithmetic mean of the actual and the previous value is smaller than 30% then the relative humidity violates a hard limit.	iteains9	U > -1.0e+10 && U - (U + U_{t-1})/2 < 30% && Y_{swTH} > 5999 && Y_{swTH} < 7000				

Tabelle 10. Consistency between measurements and sensor status words

4.4 Consistency between present weather and measurements

4.4.1 Consistency between present weather and air temperature/ humidity

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
17	snow_obsd_with_high_temp	(ww∈ {48, 49, 56, 57, 66, 69, 72...78}) && (T_{200} > 2.0)	If air temperature is > X then there may be neither snow flurry, fog, hoarfrost, freezing drizzle, freezing rain nor snowfall.	iteawob1		KAT	69,70	chi18 (kaa160 pld601)	!!!ACHTUNG: inhaltliche und formale Änderung!!! In VAMP lautet dieser Test: (ww ∈ {70...79}) && (T_{200} >= 5.0)
115	sno_obsd_with_high_temp_2	(ww ∈ {48, 49, 56, 57, 66, 67}) && (T_{200} > 2.0)	If air temperature is > X then there may be neither snow flurry, fog, hoarfrost, freezing drizzle nor freezing rain.	iteawob7				chi	neu
116	sleet_obsd_with_high_temp	(ww ∈ {68, 69}) && (T_{200} > 7.0)	If air temperature is > X then there may be no sleet.	iteawob8				chi	neu
18	snowshower_obsd_with_high_temp	(ww ∈ {83-88}) && (T_{200} > 5.0)	If air temperature is > X then ther may be no shower of rain/snow.	iteawob2		-	71	chi19 (kaa160 pld602)	!!!ACHTUNG: formale Änderung!!!
19	rain_obsd_with_low_temp	(ww ∈ {50-55, 58-65, 80-82, 91, 92}) && (T_{200} < -2.0)	If air temperature is < X then there may be no rain.	iteawob3		-	73,74	chi21 (kaa160 pld603)	!!!ACHTUNG: formale Änderung!!

Tabelle 11. Consistency between present weather and air temperature/ humidity

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernei n-gabe	Retrieved from	Remarks
20	fog_obsd_with_dry_air	(ww ∈ {42-49}) && !((T_{200} < 0)&&(U_{200} <= 85))|| !((T_{200} <= -15)&&(T_{200} >= 0)&&(U_{200} <= 75)) || !((T_{200} > -15)&&(U_{200} <= 70))	If there is fog and air-temperature >= 0 then humidity must be >= X If there is fog and air temperature > -15 and less than 0 then humid-ity must be >= Y If there is fog and air temperature =< -15 then humidity must be >= Z	iteawob4		KAU	75	chi22 (kaa161 pld604)	Description unvollständig !!!ACHTUNG: formale Änderung!! In VAMP lautet dieser Test: ww ∈ {41...49)&&U<85 Testlogik?
21	precip_obsd_with_dry_air	(ww ∈ {50-75, 80-99}) && !((T_{200} < 0)&&(U_{200} <= 80))|| !((T_{200} <= -15)&&(T_{200} >= 0)&&(U_{200} <= 75))|| !((T_{200} > -15)&&(U_{200} <= 70))	If precipitation is observed and airtemper-ature >= 0 then humi ity must be >= X If precipitation is observed and air tem-perature > -15 and less than 0 then humidity must be >= Y If precipitation is observed and air tem-perature =< -15 then humidity must be >= Z	iteawob5		KAA	76,77	chi23 (kaa162 pld607)	description unvollständig !!!ACHTUNG: formale Änderung!!! In VAMP lautet dieser Test (ww ∈ {50-75, 80-99}) && U_{200} < 70 Testlogik?
22	little_snow_with_high_temp	(ww ∈ {36-39}) && T > 6.0	if there is light snowfall, snow drift (Schneetreiben) snow sweep (Schneefegen) then air temperature must be below X degrees.	iteawob6		-	72	chi	!!!ACHTUNG: formale Änderung!!!

Tabelle 11. Consistency between present weather and air temperature/ humidity

4.4.2 Consistency between present weather and precipitation

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
28	heavy_precip_obsd_ynot_msd	(ww ∈ {54, 55, 59, 62, 63, 64, 65, 81-84, 92}) && (R < Lim)	If the precipitation is < X then there may no heavy or moderate rain be observed.	iprewob1		KAR	78, 79	chi24 (kaa163 pld605 pld606)	!!!ACHTUNG: formale Änderung!!! In VAMP lauetet dieser Test: (ww ∈ {50...75, 80...99}) && (R = 0.0)
29	no_precip_obsd_but_msd	(R > 0.0) && (ww < 50)	Precipitation may not be > X if observer reports precipitation at the station for present weather or during the last hour.	iprewob2		-		pld105	

Tabelle 12. Consistency between present weather and precipitation

4.4.3 Consistency between present weather and sunshine duration

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
36	precip_obsd_with_sunshine	(ww = 50-75, 80-99) && ($S^0+S^{-1}+S^{-2}+S^{-3}+S^{-4}+S^{-5}$ = 60)	If there is any form of precipitation then sunshine duration within the last hour can not be 60min.	isunwob1		KAS	kaa164 pld609	

Tabelle 13. Consistency between present weather and sunshine duration

4.4.4 Consistency between present weather and wind

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
38	storm_obsd_y not_msd	(ww ∈ {9, 30-39}) && (f_s < 4.63)	If windspeed is below X then there may be no storm, no snow drifting (Schneetreiben) and no snow sweep (Schneefe-gen)	iwinwob1		-	68	chi20	Take care of the unit of windspeed!!!

Tabelle 14. Consistency between present weather wind

4.4.5 Consistency between present weather and lightning

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
39	clightning_or_ thstorm_missi ng	((ww = 17, 95-99) && (B_n = 0) || (!(ww = 17, 95-99) && (B_n > 0))	If there is close light-ning then a thunder storm must be reported	iligwob1		-	kaa165 pld615	
40	clightning_or_ thstorml6_mis sing	((ww = 29, 91-94) && ((B_n^0+B_n^{-1}+B_n^{-2}+B_n^{-3}+B_n^{-4}+B_n^{-5}) = 0) || (!(ww = 29, 91-94) && ((B_n^0+B_n^{-1}+B_n^{-2}+B_n^{-3}+B_n^{-4}+B_n^{-5}) > 0))	If there was a thunder storm during the last hour (but not at the moment of observation), there may be no close lightning at the moment of observation, but there must be close lightning during the period 60min to 10min before observation.	iligwob2		-	kaa166 pld616	

Tabelle 15. Consistency between present weather and lightning

4.5 Consistency between past weather and measurements

4.5.1 Consistency between past weather and precipitation (stations of synoptic network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
30	precip_bobs_msd_ynot_obsd	6z, 12z, 18z, 24z: $\left(\sum_{t=0}^{35} R_t \geq 0.3\right) \wedge ((W_1 < 5) \wedge (W_2 < 5))$ 3z, 9z, 15z, 21z: $\left(\sum_{t=0}^{17} R_t \geq 0.3\right) \wedge ((W_1 < 5) \wedge (W_2 < 5))$	If precipitation is >= X then there must be any form of precipitation in the past weather.	ipreweb1	see consistency rule	-	kaa155 pld624	

Tabelle 16. Consistency between past weather and precipitation (stations of synoptic network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
31	precip_bobs_obsd_ynot_msd	6z, 12z, 18z, 24z: $\left(\sum_{t=0}^{35} R_t = 0\right) \wedge$ $((W_1 \in \{5, 6, 7, 8\}) \vee$ $(W_2 \in \{5, 6, 7, 8\}))$ 3z, 9z, 15z, 21z: $\left(\sum_{t=0}^{17} R_t = 0\right) \wedge$ $((W_1 \in \{5, 6, 7, 8\}) \vee$ $(W_2 \in \{5, 6, 7, 8\}))$	If precipitation is 0 then there may not be any form of precipitation in the weather before the observation.	ipreweb2	see consistency rule	-	kaa156 pld625	!!! ACHTUNG auf formale Änderungen im Vergleich zur Doku von ern !!!

Tabelle 16. Consistency between past weather and precipitation (stations of synoptic network)

4.5.2 Consistency between past weather and precipitation (stations of climatological network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
32	precip_past_msd_ynot_obsd	6z: $\left(\left(\sum_{t=0}^{71} R_t\right) \geq 0.3\right) \wedge$ $(w_1 = 0) \wedge$ $_2 = 0) \wedge$ $_3 = 0))$ 12z, 18z: $\left(\sum_{t=0}^{35} R_t > 0.3\right) \wedge$ $((w_1 = 0) \wedge$ $(w_2 = 0) \wedge$ $(w_3 = 0))$	If the precipitation sum of the last 12 or 6 hours is equal or larger than X then there must have been any form of pre-cipitation (rain, snow, hail etc.) in the past weather.	iprepaw1		VWR	93, 103	chi37 (kaa150 pld621)	in VAMP ist die Limite 0.1

Tabelle 17. Consistency between past weather and precipitation (stations of climatological network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernei n-gabe	Retrieved from	Remarks
33	precip_past_obsd _ynot_msd	6z: $\left(\sum_{t=0}^{71} R_t = 0.0\right) \wedge$ $((w_1 \neq 0) \vee$ $(w_2 \neq 0) \vee$ $(w_3 \neq 0))$ 12z, 18z: $\left(\sum_{t=0}^{35} R_t = 0.0\right) \wedge$ $((w_1 \neq 0) \vee$ $(w_2 \neq 0) \vee$ $(w_3 \neq 0))$	If the precipitation sum of the last 12 or 6 hours is 0 then there may not have been any form of precipitation in the past weather.	iprepaw2		VWR	94	chi38 kaa151 pld622)	
34	dew_past_with_pr ecip	$((R_0+R_{-1}+R_{-2}+R_{-3}+R_{-4}+R_{-5})> 0.3)$ && $(w_6 != 0)$	If there was dew or hoarfrost in the past weather then precipita- tion sum of the last hour may not be > Y.	iprepaw3		-		kaa152 pld623	

Tabelle 17. Consistency between past weather and precipitation (stations of climatological network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
35	fsnow_without_precip_past_6	6z: $((s_n - s_n^{-1}) > 0) \wedge \left((w_2 = 0) \vee \left(\sum_{t=0}^{71} R_t = 0\right)\right)$	If there is new snow in the morning there must have been precipitation within the last 12 hours.	iprepaw4		VOR/ VOW	95, 96	chi39 chi40	Array für s_N
	fsnow_without_precip_past_18	18z: $(s_n > 0) \wedge \left(((w_2 = 0) \wedge (w_{2-1} = 0)) \vee \left(\sum_{t=0}^{71} R_t = 0\right)\right)$	If there is new snow in the evening there must have been precipitation within the last 12 hours.	iprepaw6		VOR/ VOW	95, 96	chi39 chi40	Array für w_2
117	rain_bobs_msd_ynot_past	6z: $\left(\sum_{t=0}^{71} R_t > 5\right) \wedge (w_1 = 1)$ 12z, 18z: $\left(\sum_{t=0}^{35} R_t > 5\right) \wedge (w_1 = 1)$	If lot of rain is measured rain must be observed.	iprepaw5		VWR	-	VAMP	!!!ACHTUNG: neue Funktion, die bisher in ern's Library nicht vorhanden ist!!!

Tabelle 17. Consistency between past weather and precipitation (stations of climatological network)

4.5.3 Consistency between past weather and temperature or humidity (stations of climatological network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein -gabe	Retrieved from	Remarks
118	rain_bobs_with_low_temp	6z: $(w_1 \neq 0) \wedge (\bigcap_0^{71} T < 1, 0)$ 12z, 18z: $(w_1 \neq 0) \wedge (\bigcap_0^{35} T < 1, 0)$	If drizzle or rain is given in past weather, all temperatures in the respective interval have to be above 1 C.	iteapaw1	see consistency rule	VWT	-	VAMP	!!!ACHTUNG: neue Funktion, die bisher in ern's Library nicht vorhanden ist!!!
119	solid_precip_bobs_with_high_temp	6z: $(w_2 \neq 0) \wedge (\bigcap_0^{71} T \geq 5, 0)$ 12z, 18z: $(w_2 \neq 0) \wedge (\bigcap_0^{35} T \geq 5, 0)$	If rain-snow or snowfall is given in past weather, all temperatures in the respective interval have to be 5 C or less.	iteapaw2	see consistency rule	VWT		VAMP	!!!ACHTUNG: neue Funktion, die bisher in ern's Library nicht vorhanden ist!!!
120	rainsnow_bobs_with_low_temp	6z: $(w_2 = 1) \wedge (\bigcap_0^{71} T < 1, 0)$ 12z,18z $(w_2 = 1) \wedge (\bigcap_0^{35} T) < 1, 0$	If rain-snow is given in past weather, all temperatures in the respective interval have to be above 1 C.	iteapaw3	see consistency rule	VWT		VAMP	!!!ACHTUNG: neue Funktion, die bisher in ern's Library nicht vorhanden ist!!!
121	thin_fog_bobs_with_dry_air	6z: $(w_5 = 1) \wedge (\bigcap_0^{71} U < 75, 0)$ 12z, 18z: $(w_5 = 1) \wedge (\bigcap_0^{35} U < 75, 0)$	If "fozzy" is given in past weather, all relative humidities in the respective interval have to be above 75%.	iteapaw4	see consistency rule	VWU		VAMP	!!!ACHTUNG: neue Funktion, die bisher in ern's Library nicht vorhanden ist!!!

Tabelle 18. Consistency between past weather and temperature or humidity (stations of climatological network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein -gabe	Retrieved from	Remarks
122	dense_fog_bobs_with_dry_air	6z: $(w_5 = 2) \wedge (\bigcap_0^{71} U < 85, 0)$ 12z, 18z: $(w_5 = 2) \wedge (\bigcap_0^{35} U < 85, 0)$	If fog is given in past weather all relative humidities in the respective interval have to be above 85%.	iteapaw5	see consistency rule	VWU		VAMP	!!!ACHTUNG: neue Funktion, die bisher in ern's Library nicht vorhanden ist!!!
123	smooth_hfrost_bobs_with_high_temp	6z: $(w_6 = 2) \wedge (\bigcap_0^{71} T_5 > 0)$ 12z, 18z: $(w_6 = 2) \wedge (\bigcap_0^{35} T_5 > 0)$	If hoarfrost is given in past weather, all temperatures in the respective interval have to be below 0 C.	iteapaw6	see consistency rule	VWU		VAMP	!!!ACHTUNG: neue Funktion, die bisher in ern's Library nicht vorhanden ist!!!

Tabelle 18. Consistency between past weather and temperature or humidity (stations of climatological network)

4.6 Consistency between state of the ground and measurements

4.6.1 Consistency between state of the ground and temperature

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
124	eq_or_eq_and_gt	(E==3 || E==4) && T > 6	if the temperature is high the ground may not be frozen.	igrotea1	see consistency rule	-	99		neu
		(E==8 || E==9) && T > 2	if the temperature is high the ground may not be covered with try snow.	igrotea2	see consistency rule	-	104		neu

Tabelle 19. Consistency between state of the ground and temperature

4.7 Consistency between observations

4.7.1 Consistency between present weather and state of the ground

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernei n-gabe	Retrieved from	Remarks
41	precip_obsd_ with_dry_grd	(ww > 50) && (ww ∉ {60, 70, 76, 78}) && (E = 0)	If there is precipitation (but neither ice prism nor single snow flakes) then state of the ground may not be ‘dry’.	igrowob1		-	61	chi11 (kaa50 pld617)	!!!ACHTUNG: inhaltliche und formale Änderung!!!
42	sflurry_obsd_ without_grd_s now	(ww∈ {36...39}) && (E <= 4)	If there is snow flurry then state of the ground may not be dry, wet or frozen without snow or ice.	igrowob2		-	62	chi12 (kaa51 pld618)	!!!ACHTUNG: formale Änderung!!!
43	snow_obsd_wi thout_snow_la yer	(ww ∈ {75, 86}) && (E <= 5)	If there is moderate or heavy snowfall, then ground must be cov- ered by snow.	igrowob3		-	63	chi13 (kaa52 pld619)	!!!ACHTUNG: formale Änderung!!!

Tabelle 20. Consistency between present weather and state of the ground

4.7.2 Consistency between present weather and past weather (past weather in SYNOP Code; stations of synoptic network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
44	sstorm_snowfl_atobs_ynot_bobs	6z, 12z, 18z, 24z: ((ww^{-2} = 30-35, 38, 39) || (ww^{-1} = 30-35, 38, 39)) && ((W$_1$ < 3) && (W$_2$ < 3)) 3z, 9z, 15z, 21z: (ww^{-1} = 30-35, 38, 39)) && ((W$_1$ < 3) && (W$_2$ < 3))		iwobweb1		-	kaa110	
45	fog_atobs_ynot_bobs	6z, 12z, 18z, 24z: ((ww^{-2} = 42-49) || (ww^{-1} = 28, 42-49)) && ((W$_1$ < 4) && (W$_2$ < 4)) 3z, 9z, 15z, 21z: (ww^{-1} = 42-49)) && ((W$_1$ < 4) && (W$_2$ < 4))		iwobweb2		-	kaa111	
46	drizzle_atobs_ynot_bobs	6z, 12z, 18z, 24z: ((ww^{-2} = 50-57) || (ww^{-1} = 24, 50-57)) && ((W$_1$ < 5) && (W$_2$ < 5)) 3z, 9z, 15z, 21z: (ww^{-1} = 50-57)) && ((W$_1$ < 5) && (W$_2$ < 5))		iwobweb3		-	kaa112	

Tabelle 21. Consistency between present weather and past weather (stations of synoptic network)

47	rain_atobs_ynot_bobs	6z, 12z, 18z, 24z: ((ww^{-2} = 58-67, 91-92) || (ww^{-1} = 58-67, 91-92)) && ((W$_1$ < 6) && (W$_2$ < 6)) 3z, 9z, 15z, 21z: (ww^{-1} = 58-67, 91-92)) && ((W$_1$ < 6) && (W$_2$ < 6))	iwobweb4	-	kaa113
48	sleet_snow_atobs_ynot_bobs	6z, 12z, 18z, 24z: ((ww^{-2} = 70-75, 68, 69) || (ww^{-1} = 70-75, 68, 69)) && ((W$_1$ < 7) && (W$_2$ < 7)) 3z, 9z, 15z, 21z: (ww^{-1} = 70-75, 68, 69)) && ((W$_1$ < 7) && (W$_2$ < 7))	iwobweb5	-	kaa114

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
49	shower_atobs_ynot_bobs	6z, 12z, 18z, 24z: $((ww^{-2} = 80\text{-}90) \|\|$ $(ww^{-1} = 25\text{-}27, 80\text{-}90)) \&\&$ $((W_1 < 8) \&\& (W_2 < 8))$ 3z, 9z, 15z, 21z: $(ww^{-1} = 80\text{-}90)) \&\&$ $((W_1 < 8) \&\& (W_2 < 8))$		iwobweb6		-	kaa115	
50	thstorm_atobs_ynot_bobs	6z, 12z, 18z, 24z: $((ww^{-2} = 17, 95\text{-}99) \|\|$ $(ww^{-1} = 17, 91\text{-}94, 95\text{-}99))$ $\&\&$ $((W_1 < 9) \&\& (W_2 < 9))$ 3z, 9z, 15z, 21z: $(ww^{-1} = 17, 95\text{-}99)) \&\&$ $((W_1 < 9) \&\& (W_2 < 9))$		iwobweb7		-	kaa116	

Tabelle 21. Consistency between present weather and past weather (stations of synoptic network)

4.7.3 Consistency between present weather and past weather (past weather in climatological code; stations of synoptic network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
51	solid_precip_atobs_ynot_past	6z: ((ww^{-4} = 93, 94) || (ww^{-3} = 93, 94) || (ww^{-2} = 93, 94) || (ww^{-1} = 93, 94) || (ww = 93, 94)) && ((w_2 = 0) && (w_3 = 0)) 12z, 18z: ((ww^{-2} = 93, 94) || (ww^{-1} = 93, 94) || (ww = 93, 94)) && ((w_2 = 0) && (w_3 = 0))	sleet, snow, hail or small hail must be coded in the past weather until now and at time of observation	iwobpaw1		(KAA)	kaa100	In VAMP ist diese Funktionalität in Testfkt 56 enthalten
52	drizzle_atobs_ynot_past	6z: ((ww^{-4} = 50-57) || (ww^{-3} = 24, 50-57) || (ww^{-2} = 24, 50-57) || (ww^{-1} = 24, 50-57) || (ww = 24, 50-57)) && (w_1 != 1) 12z, 18z: ((ww^{-2} = 50-57) || (ww^{-1} = 24, 50-57) || (ww = 24, 50-57)) && (w_1 != 1)	If there is drizzle during the observation time then there also must have been drizzle in the past weather.	iwobpaw2		KAA	kaa101 (chi26) (pld647)	!!!ACHTUNG: inhaltliche Änderung (!=1 statt < 1)

Tabelle 22. Consistency between present weather and past weather (past weather in climatological code, stations of synoptic network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
53	rain_atobs_ynot_past	6z: ((ww^{-4} = 58-67, 80-82, 91, 92, ~~95, 97~~) || (ww^{-3} = 21, 25, 58-67, 80-82, 91, 92, ~~95, 97~~) || (ww^{-2} = 21, 25, 58-67, 80-82, 91, 92, ~~95, 97~~) || (ww^{-1} = 21, 25, 58-67, 80-82, 91, 92, ~~95, 97~~) || (ww = 21, 25, 58-67, 80-82, 91, 92, ~~95, 97~~)) &&(w$_1$!= 2) 12z, 18z: ((ww^{-2} = 58-67, 80-82, 91, 92, ~~95, 97~~) || (ww^{-1} = 21, 25, 58-67, 80-82, 91, 92, ~~95, 97~~) || (ww = 21, 25, 58-67, 80-82, 91, 92, ~~95, 97~~)) &&(w$_1$!= 2)	If there is drizzle, rain, showers, hail or hoar-frost hail at time of observation then there must have been rain in the past weather.	iwobpaw3		KAA	kaa102 (chi27) (pld648)	In VAMP lautet die Liste für ww: 58...67, 80...82, 89...92, 95...97, 99
54	sleet_snow_atob_ynot_past	6z: ((ww^{-4} = 68, 69, 83, 84, ~~93, 94~~) || (ww^{-3} = 26, 68, 69, 83, 84, ~~93, 94~~) || (ww^{-2} = 26, 68, 69, 83, 84, ~~93, 94~~) || (ww^{-1} = 26, 68, 69, 83, 84, ~~93, 94~~) || (ww = 26, 68, 69, 83, 84, ~~93, 94~~)) && (w$_2$!= 1) 12z, 18z: ((ww^{-2} = 68, 69, 83, 84, ~~93, 94~~) || (ww^{-1} = 26, 68, 69, 83, 84, ~~93, 94~~) || (ww = 26, 68, 69, 83, 84, ~~93, 94~~)) && (w$_2$!= 1)	If there is sleet, drizzle, shower, hail or small hail then there must have been rain with snow in the past weather.	iwobpaw4		KAA	kaa103 (chi28) (pld649)	!!!ACHTUNG: inhaltliche Änderung!!! (!=1 statt < 1)

Tabelle 22. Consistency between present weather and past weather (past weather in climatological code, stations of synoptic network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
55	snow_atobs_ynot_past	6z: ((ww^{-4} = 70-75, 77, 85, 86) ‖ (ww^{-3} = 22, 70-75, 77, 85, 86) ‖(ww^{-2} = 22, 70-75, 77, 85, 86) ‖ (ww^{-1} = 22, 70-75, 77, 85, 86) ‖ (ww = 22, 70-75, 77, 85, 86)) && (w_2 != 2) 12z, 18z: ((ww^{-2} = 70-75, 77, 85, 86) ‖ (ww^{-1} = 22, 70-75, 77, 85, 86) ‖ (ww = 22, 70-75, 77, 85, 86)) && (w_2 != 2)	If there is snowfall, hoarfrost, hail or snow showers, then there must have been snow in the past weather.	iwobpaw5		KAA	kaa104 (chi29) (pld650)	In VAMP lautet die Liste für ww: 70...75, 77, 79, 85...88
56	shail_hail_atobs_ynot_past	6z: ((ww^{-4} = 87-90, 96, 99) ‖ (ww^{-3} = 27, 87-90, 96, 99) ‖ (ww^{-2} = 27, 87-90, 96, 99) ‖ (ww^{-1} = 27, 87-90, 96, 99) ‖ (ww = 27, 87-90, 96, 99)) && (w_3 != 2) 12z, 18z: ((ww^{-2} = 87-90, 96, 99) ‖ (ww^{-1} = 27, 87-90, 96, 99) ‖ (ww = 27, 87-90, 96, 99)) && (w_3 != 2)	If there is hoarfrost, hail, rain or snow then there must have been observed at last one of these phenomenons.	iwobpaw6		KAA	kaa105 (chi30) (pld651)	In VAMP lautet die Liste für ww: 87...90, 93, 94, 96, 99 !!!ACHTUNG: inhaltliche Änderung!!!

Tabelle 22. Consistency between present weather and past weather (past weather in climatological code, stations of synoptic network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
57	fog_atobs_ynot_past	6z: ((ww^{-4} = 42-49) || (ww^{-3} = 28, 42-49) || (ww^{-2} = 28, 42-49) || (ww^{-1} = 28, 42-49) || (ww = 28, 42-49)) && (w_5 != 2) 12z, 18z: ((ww^{-2} = 42-49) || (ww^{-1} = 28, 42-49) || (ww = 28, 42-49)) && (w_5 != 2)	If there is ‘fog’ in present weather then there must have been ‘fog’ in the past weather.	iwobpaw7		KAA	kaa106 (chi31**)** (pld652)	
58	hfrost_atobs_ynot_past	6z: ((ww^{-4} = 48-49) || (ww^{-3} = 48-49) || (ww^{-2} = 48-49) || (ww^{-1} = 48-49) || (ww = 48-49)) && (w_7 != 1) 12z, 18z: ((ww^{-2} = 48-49) || (ww^{-1} = 48-49) || (ww = 48-49)) && (w_7 != 1)	If there is ‘fog’ in present weather with deposition/formation of ‘hoarfrost’ then there must have been ‘hoar-frost’ in the past weather.	iwobpaw8		KAA	kaa107 (chi32) (pld653)	!!!ACHTUNG: inhaltliche Änderung!!! (!=1 statt < 1)

Tabelle 22. Consistency between present weather and past weather (past weather in climatological code, stations of synoptic network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
59	icing_rain_atobs_ynot_past	6z: ((ww^{-4} = 56-57, 66-67) ‖ (ww^{-3} = 24, 56-57, 66-67) ‖ (ww^{-2} = 24, 56-57, 66-67) ‖ (ww^{-1} = 24, 56-57, 66-67) ‖ (ww = 24, 56-57, 66-67)) && (w_7 != 2) 12z, 18z: ((ww^{-2} = 56-57, 66-67) ‖ (ww^{-1} = 24, 56-57, 66-67) ‖ (ww = 24, 56-57, 66-67)) && (w_7 != 2)	If there is ‘freezing drizzle’ or ‘freezing rain’ then there must have been ‘ice’ in past weather.	iwobpaw9		KAA	kaa108 (chi33) (pld654)	
60	rain_snow_atobs_ynot_past	6z: ((ww^{-4} = 95, 97) ‖ (ww^{-3} = 95, 97) ‖ (ww^{-2} = 95, 97) ‖ (ww^{-1} = 95, 97) ‖ (ww = 95, 97)) && ((w_1 != 2) && (w_2 < 1)) 12z, 18z: ((ww^{-2} = 95, 97) ‖ (ww^{-1} = 95, 97) ‖ (ww = 95, 97)) && ((w_1 != 2) && (w_2 < 1))	rain, sleet, snow	iwobpaw10			kaa109	

Tabelle 22. Consistency between present weather and past weather (past weather in climatological code, stations of synoptic network)

4.7.4 Consistency between present weather and past weather (past weather in climatological code; stations of climatological network)

The functions described in ths chapter are completely identical to those in Kapitel 4.7.3. Since these functions are used here in a completely different context, they are listed here again.

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Test	Name of Test	VAMP Tag	EQ Nr Fernei n-gabe	Retrieved from	Remarks
51	solid_precip_atobs_ynot_past	((ww^{-1} = 93, 94) || (ww = 93, 94)) && ((w_2 = 0) && (w_3 = 0))	sleet, snow, hail or small hail		iwobpaw1	-		kaa100	
52	drizzle_atobs_ynot_past	((ww^{-1} = 50-57) || (ww = 24, 50-57)) && (w_1 != 1)	If there is drizzle during the observation time then there also must have been drizzle in the past weather.		iwobpaw2	-	81	kaa101 (pld647)	
53	rain_atobs_ynot_past	((ww^{-1} = 58-67, 80-82, 91, 92, ~~95-97, 99~~) || (ww = 21, 25, 58-67, 80-82, 91, 92, ~~95-97, 99~~)) && (w_1 < 2)	If there is drizzle, rain, rainshowers, hail or snow pellets at time of observation then there must have been rain in the past weather.		iwobpaw3	-	82,83	kaa102 (pld648)	!!!ACHTUNG: inhaltliche Änderung!!!
54	sleet_snow_atob_ynot_past	((ww^{-1} = 68, 69, 83, 84, ~~93, 94~~) || (ww = 26, 68, 69, 83, 84, ~~93, 94~~)) && (w_2 != 1)	If there is sleet, drizzle, shower, hail or small hail then there must have been rain with snow in the past weather.		iwobpaw4	-	84	kaa103 (pld649)	!!!ACHTUNG: inhaltliche Änderung!!!
55	snow_atobs_ynot_past	((ww^{-1} = 70-75, 77, 85, 86) || (ww = 22, 70-75, 77, 85, 86)) && (w_2 != 2)	If there is snowfall, hoarfrost hail or snow showers, then there must have been snow in the past weather.		iwobpaw5	-	85,86	kaa104 (pld650)	!!!ACHTUNG: inhaltliche Änderung!!!

Tabelle 23. Consistency between present weather and past weather (past weather in climatological code, stations of climatological network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Test	Name of Test	VAMP Tag	EQ Nr Fernei n-gabe	Retrieved from	Remarks
56	shail_hail_atobs_ynot_past	(ww^{-1} = 87-90, 96, 99) || (ww = 27, 87-90, 96, 99)) && (w_3 != 2)	If there is hoarfrost, hail, rain or snow then there must have been observed at least one of these phenomenon.		iwobpaw6	-	87, 88	kaa105 (pld651)	!!!ACHTUNG: inhaltliche Änderung!!!
57	fog_atobs_ynot_past	((ww^{-1} = 42-49) || (ww = 28, 42-49)) && (w_5 != 2)	If there is fog then there must have been fog in the past weather.		iwobpaw7	-	89	kaa106 (pld652)	!!!ACHTUNG: inhaltliche Änderung!!!
58	hfrost_atobs_ynot_past	((ww^{-1} = 48-49) || (ww = 48-49)) && (w_7 != 1)	If there is fog with continuing construction of hoarfrost then there must have been hoarfrost in the past weather.		iwobpaw8	-	90	kaa107 (pld653)	
59	icing_rain_atobs_ynot_past	((ww^{-1} = 56-57, 66-67) || (ww = 24, 56-57, 66-67)) && (w_7 != 2)	If there is freezing drizzle or freezing rain then there must have been ice.		iwobpaw9	-	91	kaa108 (pld654)	!!!ACHTUNG: inhaltliche Änderung!!!
60	rain_snow_atobs_ynot_past	((ww^{-1} = 95, 97) || (ww = 95, 97)) && ((w_1 != 2) && (w_2 < 1))	rain, sleet, snow		iwobpaw10	-		kaa109	

Tabelle 23. Consistency between present weather and past weather (past weather in climatological code, stations of climatological network)

4.7.5 Consistency between present weather and cloud genera (detailed classification)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
61	thstorm_obsd_without_cb	(ww ∈ {17, 95 ... 99} && (C_L != 3, 9) && (C_L != -1)[a]	If there is a thunderstorm with or without precipitation then ther must be any type of cumulonimbus.	iwobnoc1		-	kaa40 pld610	
62	heavy_precip_obsd_ynot_cb_fract	(ww = 82) && (C_L != 3, 7, 9) && (C_L != -1)	If there is heavy precipitation then there must be any type of cumulonimbus or fractus.	iwobnoc2		-	kaa41 pld611	
63	precip_visib_without_cl_cm	(ww ∈ {14 ... 16} && ((C_L = 0) || (C_L = -1)) && ((C_M = 0) || (C_M =))	If there is precipitation visible (but not reaching the point of observation) there must be clouds of type C_L and C_M.	iwobnoc3		-	kaa42 pld612	
64	decrs_cldcov_with_incrs_clds	(ww < 3) && ((C_H = 4, 5, 6) || (C_M = 5))	If sky did not change or cloud coverage has decreased then no clouds of increasing characteristic (C_H = 4, 5 or 6, or C_M =5) may be observed.	iwobnoc4		-	kaa43 pld613	
65	incrs_cldcov_with_decrs_clds	(ww = 3) && (C_H != 4) && (C_H != 5) && (C_H != 6) && (C_M != 5)	If cloud coverage is growing then clouds with increasing characteristics (C_H = 4, 5, 6 or C_M = 5) must be observed.	iwobnoc5		-	pld614 (kaa44)	‘kaa44’ modified to ‘pld614’

Tabelle 24. Consistency between present weather and cloud genera (detailed classificaiton)

a. -1 means here ‘not observable’ and is equivalent to ‘/’ in the SYNOP Code (FM-12, WMO 306)

4.7.6 Consistency between present weather and visibility (given in SYNOP Code)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
66	fog_obsd_but_high_vr	(ww ∈ {42...49}) && (V >= 10)		iwobvis1		KAA	46	chi2 kaa20 pld635	!!!ACHTUNG: formale und inhaltliche Änderung!!!
67	faint_precip_obsd_but_high_vr	(ww ∈ {50, 51, 56, 58, 60, 61 66, 68, 70, 71, 77, 79, 80, 83, 85, 87, 89, 91, 93}) && (V > 80)		iwobvis2		KAA	47-49	chi3 (pld636 kaa21)	!!!ACHTUNG: formale Änderung!!! in VAMP lautet die Liste für ww: 50,51,56,58,60,61,66,68,70,71,77,79,89,91,93
68	mod_precip_obsd_but_high_vr	(ww ∈ {52, 53, 59, 62, 63}) && (V > 70)		iwobvis3		KAA	50	chi4 (kaa22 pld637)	!!!ACHTUNG: formale Änderung!!! In VAMP lautet die Liste für ww: 52,53,59,62,63,80,83
69	heavy_precip_obsd_but_high_vr	(ww ∈ {54, 55, 57, 64, 65, 67, 69, 72, 73, 81, 82, 84, ~~85~~, 87, 90, 92, 95}) && (V > 60)	If there is weak drizzle, rainfall, shower, shower with hail or moderate snowfall then visibility must be <= X.	iwobvis4		KAA	51-54	chi5 (kaa23 pld638)	!!!ACHTUNG: formale und inhaltliche Änderung!!! In VAMP lautet die Liste für ww: 54, 55, 57, 64, 65, 67, 69, 72, 73, 81, 82, 84, 85, 87, 90, 92
70	solid_precip_obsd_but_high_vr	(ww ∈ {74, 75, 86, 88, 94, 96, 97, 99}) && (V > 50)	If there is heavy snow-fall, snow shower, hail or hoarfrost hail then visibility must be <= X.	iwobvis5		KAA	55-56	chi6 (kaa24 pld639)	!!!ACHTUNG: formale Änderung!!! In VAMP lautet die Liste für ww: 74, 75, 86, 88, 94-97, 99
71	no_precip_fog_obsd_but_low_vr	(ww < 39) && (V < 10)	If there is neither rain nor fog at time of obser-vation then visibility may not be < Y.	iwobvis6		KAA	60	chi10 (pld633)	
72	haze_obsd_but_vr_out_of_bounds	(ww ∈ {5, 10}) && (V>65 || V <10)		iwobvis7		(KAA)	57	chi7 (kaa25 kaa26)	!!!ACHTUNG: formale Änderung!!! In VAMP heisst der entsprechende Test ww=10 && V > 70

Tabelle 25. Consistency between present weather and visibility

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
73	no_spec_feat_obsd_but_low_vr	(ww ∈ {1,2,3) && (V < 65)		iwobvis8		-	58	chi8 kaa27	!!!ACHTUNG: formale Änderung!!!
74	heavy_sflurry_obsd_but_high_vr	(ww = 39) && (V >= 10)		iwobvis9		-	59	chi9 (kaa28)	

Tabelle 25. Consistency between present weather and visibility

4.7.7 Consistency between present weather and total amount of cloud cover

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernei n-gabe	Retrieved from	Remarks
75	no_sky_obsd_ with_cldover_ info	(ww ∈ {43, 45, 47, 49}) && (N != 9/8, -1)[a]	If there is fog and the sky is not visible then cloudiness can not be observed.	iwobclo1		KAA	64	chi14 kaa60 pld640	!!!ACHTUNG: formale Änderung!!!
76	sky_obsd_wit hout_cldover_ info	(ww ∈ {42, 44, 46, 48}) && (N = 9/8, -1)	If there is fog or ice fog and the sky is visible then cloudiness has to be observed.	iwobclo2		KAA	65	chi15 kaa61 pldk641	!!!ACHTUNG: formale Änderung!!
77	clds_obsd_wit hout_cldover	(ww ∈ {3, 14-17, 50-75, 77-99}) && (N = 0.0)		iwobclo3		(KAA)	66, 67	chi16 kaa62	!!!ACHTUNG: formale Änderung!!
								VAMP	In VAMP ist Test 77 auf 2 Tests aufgeteilt: ww ∈ {50...75} && N < 6 Phase 2 dlo: Aufwandschätzung
								VAMP	In VAMP ist Test 77 auf 2 Tests aufgeteilt: ww ∈ {80...99} && N < 4 Phase 2 dlo: Aufwandschätzung

Tabelle 26. Consistency between present weather and total amount of cloud cover

a. -1 means here ‘not observable’ and is equivalent to ‘/’ in the SYNOP Code (FM-12, WMO 306)

4.7.8 Consistency between present weather and the density of clouds

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	EQ Nr Fernein-gabe	Retrieved from	Remarks
78	fog_obsd_with_low_clddens	((ww ∈ { 42-49}) && (N_d < 3))	If there is fog then density of cloudiness may not be < 3.	iwobden1		KAA	XXX	chi25 kaa65 pld644	
79	fog_at_stat_but_no_fog_obsd	(N_d >=3) && ((ww <= 42) && (ww != 17))	If station is in fog then there must be fog or ice fog (cross check).	iwobden2		KAA	80	kaa66 (pld646)	!!!ACHTUNG: inhaltliche Änderung!!!

Tabelle 27. Consistency between present weather and the density of clouds

4.7.9 Consistency between the two positions of past weather (past weather in SYNOP Code)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
80	one_bobs_not_observable	(W_1 != -1) && (W_2 != -1)[a]	There must be at least one observation about the weather before the observation.	iwebweb2		-	kaa46 (pld660)	
81	lotof_cldcov_bobs1_ynot_bobs2	(W_1 = 2) && (W_2 < 2)	If more than half of the sky is clouded during the whole period then the cloudiness can not have partly changed to less than half of the sky.	iwebweb3		-	kaa47 pld661	
82	medium_cldcov_bobs1_ynot_bobs2	(W_1 = 1) && (W_2 = 0)	If the sky is covered only halfly or less during the whole period then the other code may not indicate a coverage of more than a half.	iwebweb4		-	kaa48 pld662	

Tabelle 28. Consistency between the two posistions of past weather (past weather in SYNOP Code)

a. -1 means here ‘not observable’ and is equivalent to ‘/’ in the SYNOP Code (FM-12, WMO 306)

4.7.10 Consistency between past weather in SYNOP Code and past weather in climatological code

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
83	drizzle_bobs_ynot_past	$((W_1 = 5) \| (W_2 = 5)) \&\& (w_1 < 1)$	If there was drizzle before the observation then there must have been drizzle or rain in the past weather.	iwebpaw1		-	kaa120 pld655	
84	rain_bobs_ynot_past	$((W_1 = 6) \| (W_2 = 6)) \&\& (w_1 < 2)$	If there was rain before the observation then there must have been rain in the past weather.	iwebpaw2		-	kaa120 pld656	
85	snow_bobs_ynot_past	$((W_1 = 7) \| (W_2 = 7)) \&\& (w_2 < 1)$	If there was snow or sleet before the observation then there must have been snow or sleet in the past weather.	iwebpaw3		-	kaa121 pld657	
86	shower_bobs_ynot_past	$((W_1 = 8) \| (W_2 = 8)) \&\& ((w_1 < 2) \&\& (w_2 < 1) \&\& (w_3 < 1))$	If there was shower before the observation then there must have been rain, sleet, snow, small hail or hail in the past weather.	iwebpaw4		-	kaa122 pld658	

Tabelle 29. Consistency between past weather in SYNOP Code and past weather in climatological code

4.7.11 Consistency between total amount of clouds and past weather (past weather in SYNOP Code; only for stations of synoptic network)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
87	sky_covered_bobs_ynot_atobs	6z, 12z, 18z, 24z: $((N^{-2} <= 4/8) \|\|$ $(N^{-1} <= 4/8) \|\|$ $(N <= 4/8)) \&\&$ $((W_1 = 2) \|\| (W_2 = 2))$ 3z, 9z, 15z, 21z: $((N^{-1} <= 4/8) \|\|$ $(N <= 4/8)) \&\&$ $((W_1 = 2) \|\| (W_2 = 2))$		iwebclo1		-	kaa117	!!!ACHTUNG: inhaltliche Änderung!!!
88	sky_clear_bobs_ynot_atobs	6z, 12z, 18z, 24z: $((N^{-2} > 4/8) \|\| (N^{-1} > 4/8) \|\|$ $(N > 4/8)) \&\& ((W_1 = 0) \||$ $(W_2 = 0))$ 3z, 9z, 15z, 21z: $((N^{-1} > 4/8) \|\| (N > 4/8))$ $\&\&$ $((W_1 = 0) \|\| (W_2 = 0))$		iwebclo2		-	kaa118	!!!ACHTUNG: inhaltliche Änderung!!!

Tabelle 30. Consistency between total amount of clouds and past weather (past weather in SYNOP Code; only for stations of synoptic network)

4.7.12 Consistency between different positions of cloud genera (detailed classification)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
89	no_lmclds_but_low_cldheight	((C_L = 0) && (C_M = 0)) && (h != 9)		inocnoc1		-	kaa78	
90	no_lowclds_but_uppclds_unobs	((C_L = 0) && (C_M != 0-9)) || ((CL = 0) && (CM = 0) && (CH != 0-9))		inocnoc2		-	kaa89	

Tabelle 31. Consistency between different positions of cloud genera (detailed classification)

4.7.13 Consistency between cloud genera (detailed classificaiton and cloud genera (10 genera classification)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
91	nors_clds_or_rcds_clds_unobs	((C_L = 0 || C_L = -1) && (C_M = 0 || C_M = -1) && (C_H = 0 || C_H = -1) && (N_{s1} != -1)) || ((C_L = 1-9) || (C_M = 1-9) || (C_H = 1-9) && (N_{s1} = -1))[a]	If there are no clouds in any layer then there may no clouds be described or vice versa	inocrec1		-	kaa74	
92	nomatch_rcd_clds_and_nors_clds	(((C_L = 0 || C_L = -1) && ((C_1 = 6-9) || (C_2 = 6-9) || (C_3 = 6-9))) || (((C_M = 0 || C_M = -1) && ((C_1 = 3-5) || (C_2 = 3-5) || (C_3 = 3-5))) || (((C_H = 0 || C_H = -1) && ((C_1 = 0-2) || (C_2 = 0-2) || (C_3 = 0-2)))	If there are no clouds on a certain level then there may also not be any typical clouds of this level.	inocrec2		-	kaa79	

Tabelle 32. Consistency between cloud genera (detailed classification) and cloud genera (10 genera table)

a. -1 means here ‘not observable’ and is equivalent to ‘/’ in the SYNOP Code (FM-12, WMO 306)

4.7.14 Consistency between total amount of clouds and cloud genera (detailed classification)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
93	no_low_cldcov_but_lmclds	(N_h = 0.0) && ((C_L != 0) || (C_M != 0))	Total amount of C_L and C_M clouds may not be = 0 if there are such clouds.	inocclo1		-	kaa75	
94	no_lmclds_but_low_cldcov	(N_h != 0.0) && ((C_L = 0) && (C_M = 0))	Total amount of C_L and C_M clouds may not be > 0 if there are no such clouds	inocclo2		-	kaa76	
95	tot_low_cldcov_but_hclds	(N_h = 8/8) && (C_H != -1)	if sky is covered by clouds in strato- or altolayer then are no cirrus clouds observable.	inocclo3		-	kaa77	
96	no_hclds_but_high_cldcov	((N_h = 0) && (N ∈ {1/8...8/8})) && (C_H = 0 || h !=9 ||C_L !=0 || C_M !=0)	checking amounts of clouds	inocclo4		KAA	kaa82	
97	cldcov_unobs_but_clds_obsd	((N = 9/8, -1) && (h = -1) && (N_h = 9/8, -1)) && ((C_L != -1) || (C_M != -1) && (C_H != -1))	checking amounts of clouds	inocclo5		-	kaa83	
98	little_hclds_but_little_cldcov	((C_L = 0) && (C_M = 0) && (C_H = 5)) && (N > 3/8)	Cloud layer is not yet 45 degrees above horizon.	inocclo6			kaa84	
99	tot_hclds_but_little_cldcov	(C_H = 7) && (N < 7/8)		inocclo7		-	kaa85	
100	lotof_hclds_but_little_cldcov	(((C_L = 0) && (C_M = 0) && (C_H = 8)) && (N ∉ {8/8, 9/8) || (((C_L = 0) && (C_M = 0) && (C_H = 6)) && (N ∈ {0, 0.125, 0.25}))		inocclo8		-	kaa86	

Tabelle 33. Consistency between total amount of clouds and cloud genera (detailed classification)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
101	mhclds_vis_y not_obsd	(((C$_L$ = 0) && (C$_M$ > 0) && (N$_h$ < 0.75)) && (C$_H$!= 0-9)) || (((C$_L$ > 0) && (C$_M$ = 0) && (N$_h$ < 0.75)) && (C$_H$!= 0-9)) || (((C$_L$ > 0) && (N$_h$ < 0.75)) && (C$_H$!= 0-9))	Highest cloud layer should be observable through lower clouds that don't cover the whole sky.	inocclo9		-	kaa87	
102	mhclds_invis_ but_obsd	((C$_L$ > 0) && (N$_h$ = 1.0)) && ((C$_M$ = 0-9) || (C$_H$ = 0-9))	Clouds in alto layer are not observable through fully sky covering clouds in stratus layer.	inocclo10		-	kaa88	
103	no_cldcov_but _clds	(N = 0.0) && (N$_h$ = 0.0) && ((C$_L$!= 0) || (C$_M$!= 0) || (C$_H$!= 0))&&h !=9)		inocclo11		KAA	pld628	!!!ACHTUNG!!! Erweiterung im Vgl. mit ern's Version!!! (h eingeführt)

Tabelle 33. Consistency between total amount of clouds and cloud genera (detailed classification)

4.7.15 Consistency between cloud amount of cloud genera and cloud genera (10 genera classification)

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
104	lrclds_with_little_mrclds_cb	($N_{s1} > 0$) && ($N_{s2} < 0.375$) && (C_2 != 9)		irecrec1		-	kaa90	
105	mrclds_with_little_hrclds_cb	($N_{s2} > 0$) && ($N_{s3} < 0.625$) && ($C_3 = 9$)		irecrec2		-	kaa91	

Tabelle 34. Consistency between cloud amount and cloud genera (10 genera classification)

4.7.16 Consistency between cloud amount of cloud genera and total amount of clouds

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
106	sum_rclds_lt_cldcov	($N_{s1} + N_{s2} + N_{s3}$) < N		irecclo4		-	kaa98	

Tabelle 35. Consistency between cloud amount of cloud genera and total amount of clouds

4.7.17 Consistency between genus of clouds whose base is below the level of the station and station height

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
107	altocld_below_stat	(C' = 4) && (h_s < 2000)		ibecbec1		-	(pld630) kaa35	Stationshöhe wie berücksichtigen?
		(C' = 3) && (h_s >=2000)		ibecbec2		-	kaa36	!!!ACHTUNG: Test neu, bisher in ern's Doku nicht enthalten!!! Testfunktion ist bereits vorhanden. Verwende 'eq_and_gt'

Tabelle 36. Consistency between genus of clouds whose base is below the level of the stations and the altitude of their upper surface

4.7.18 Consistency between genus of clouds whose base is below the level of the station and the total amount of clouds

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
108	no_cldcov_but_cldbnd_above_stat	(N = 0.0) && (H'*100 > h_s)		ibecclo1		-	pld632, kaa37	

Tabelle 37. Consistency between genus of clouds whose base is below the level of the station and the total amount of clouds

4.7.19 Consistency between the amount of clouds of a specific genus and the total amount of clouds

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
109	low_cldcov_or_tot_cldcov_unobs	(N = 1.125, NULL) && (N_h != 1,125, NULL) || (N != 1,125, NULL) && (N_h = 1.125, NULL)		icloclo2		-	kaa81	

Tabelle 38. Consistency between the amount of clouds of a specific genus and the total amount of clouds

4.7.20 Consistency between total amount of clouds and the density of clouds

Fct Nr.	Fct name (in libpum)	Consistency Rule (Violation if)	Description	Name of Test	Test	VAMP Tag	Retrieved from	Remarks
110	no_cldcov_but_high_clddens	(N = 0.0) && ($N_d \notin \{0, 3\}$)		icloden1		-	chi34 (kaa70)	!!!ACHTUNG: inahaltliche Änderung!!!

Tabelle 39. Consistency between total amount of clouds and the density of clouds

4.8 Obsolete Tests

	Rule Tag					
Quality Bytes	**Combination**	**No**	**Violation if**	**Retrieved from**	**Description**	**Comments**
102	iprelig	2	$(B_f > 0) \wedge \left(\sum_{t=-2}^{2} R^t = 0 \right)$	proposition of mki	Far lightning and no precipitation at observation time and during the 2 intervalls before and after is not possible	Realtime testing is not possible, since future precipitation values wouldn't be available.

Tabelle 40. All Rules Concerning Precipitation with Lightning

KAPITEL 5 References

[chi] Häberli C., Chassot A.: *Tests de plausibilité pour chaque paramètre.* Internal document of the Swiss meteorological institute, Zurich, April 13, 1996

[kaa] Müller G.: *Kontrolle der Augenbeobachtungen ANETZ.* Internal document of the Swiss meteorological institute, Zurich, June 18, 1987

[pld] Kiene M.: *Plaustests des DABES-Teilbereichs 'Prüfung und Mutation' (PuM).* Internal document of the Swiss meteorological institute, Zurich, August 18, 1996

[KLIBER] Dössegger und Kamm:

[VAMP] Verarbeitung von ANETZ-Daten mit METEOR-Programmen (SIEMENS System) an der SMA von 1980 - 1999.