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Design and functionality of the new climatological database at DMI

DMI has designed and implemented a new climatological database ClimaDB and developed a new data generation system based on data from the new observational database ObsDB. New features are data versions and parameter labelling.

The poster illustrates the database design and the automatic generation of the derived values: daily, monthly, yearly, countrywide and extremes, including notification of updated observations in ObsDB.

Design and functionality of the new climatological database at DMI Hanne M. Jensen and Kirsten Rajakumar, Data and Climate Division, Danish Meteorological Institute



Element numbers

are used as a unique way to identify derived values and dealing with daily, monthly, yearly, country wise, normal reference and extreme conditions. Some element numbers with description, attibutes and usage are shown below.

lem no	derived code	descrip dates	s locations misc product type	units	method				
101	С	Mean temperature	c_temp_rh	degrees C	mean				
101	d	Mean temperature		degrees C	mean				
101	e	Mean temperature		dearees C	mean				
101	l m	Mean temperature		degrees C	mean				
101	l I								
101	Ind			aegrees C	mean				
101	Inm	Mean temperature		degrees C	mean				
101		Mean temperature		degrees C	mean				
201			c temp rh	%	mean				
201	ld	Mean relative humidity		%	mean				
201				/0	mean				
201	l m	Mean relative humidity		%	mean				
201	Ind	Mean relative humidity		%	mean				
201	l nm	Mean relative humidity		%	mean				
201	l y	Mean relative humidity		%	mean	Defir	nition tables	s for the table with	element numbers
301	l c	Mean wind speed (10 minutes average)	c_wind	m/s	mean				
301	d	Mean wind speed (10 minutes average)		m/s	mean	aenvea_co			woring the country as a whole)
301	l m	Mean wind speed (10 minutes average)		m/s	mean	C	country	countrywide values (climate values co	overing the country as a whole)
301	Ind	Mean wind speed (10 minutes average)		m/s	mean	d	daily	daily climate values	
301	nm	Mean wind speed (10 minutes average)		m/s	mean	е	extreeme	extremes of monthly climate values	
301	l y	Mean wind speed (10 minutes average)		m/s	mean	m	monthly	monthly climate values	
401		Mean pressure	c_pp	hPa	mean				
401	d	Mean pressure		hPa bDa	mean	nd	normals _daily	normals for daily climate values	
401			+	hDo	mean	nm	normals monthly	normals for monthly climate values	
401		Mean pressure	+	hPa	mean	У	yearly	yearly climate values	
401			+	hPa bPa	mean	dates		locations	mise
401 550	n y Did	Accumulated radiation (chootral range: 305, 2800 nm)	+	M 1/m**2	sum	uates			mise
550		Accumulated radiation (spectral range:305-2800 nm)	+	M 1/m**2	sum				
550		Accumulated radiation (spectral range:305-2800 nm)	+ + +	M I/m**2	sum	Indication of	of whether the element is	Indication of whether the element is	Indication of whether the element is associated
601		Accumulated precipitation		Mm	sum	associated when a deri	with a date specifying vative value is measured	associated with a location that specifies where a derivative value is measured	with another attribute than date or location. If for example have a direction associated with
601	ld	Accumulated precipitation, with accumulation period in hours	×	Mm	eum				speed
601	le	Accumulated precipitation		Mm	sum				
601	l m	Accumulated precipitation with accumulation period in hours	X	Mm	sum				
601	nm	Accumulated precipitation		Mm	sum	L		1	
				1	1				



301	d Mean wind speed (10 minutes average)		m/s	mean	derived_code derived_type	definition	
301	m Mean wind speed (10 minutes average)		m/s	mean	c country	countrywide values (climate values co	overing the country as a whole)
301	nd Mean wind speed (10 minutes average)		m/s	mean	d daily	daily climate values	
301	nm Mean wind speed (10 minutes average)		m/s	mean	e extreeme	extremes of monthly climate values	
301	y Mean wind speed (10 minutes average)		m/s	mean			
401	c Mean pressure	c_pp	hPa	mean	m monthly	monthly climate values	
401	d Mean pressure		hPa	mean	and a second a della	a success to find the line strength of the sector	
401	m Mean pressure		hPa	mean	nd normals daily	normals for daily climate values	
401	nd Mean pressure		hPa	mean	nm normals_monthly	normals for monthly climate values	
401	nm Mean pressure		hPa	mean	y yearly	yearly climate values	
401	y Mean pressure		hPa	mean	dates	locations	misc
550	d Accumulated radiation (spectral range:305-2800 nm)		MJ/m**2	sum			
550	m Accumulated radiation (spectral range:305-2800 nm)		MJ/m**2	sum			
550	y Accumulated radiation (spectral range:305-2800 nm)		MJ/m**2	sum	Indication of whether the element is	Indication of whether the element is	Indication of whether the element is associated
601	c Accumulated precipitation		Mm	sum	associated with a date specifying when a derivative value is measured	associated with a location that specifies where a derivative value is measured	with another attribute than date or location. It can, for example have a direction associated with wind
					when a derivative value is measured	where a derivative value is incustred	speed
601	d Accumulated precipitation with accumulation period in hours	x	Mm	sum			
601	e Accumulated precipitation		Mm	sum			
601	m Accumulated precipitation with accumulation period in hours	x	Mm	sum			
601	nm Accumulated precipitation		Mm	sum			
601	y Accumulated precipitation with accumulation period in hours	x	Mm	sum			

Informations about the stations

ClimaDB has its own subset of stations information, mainly to keep it independent in case StatDB is unavailable. The selected data is transferred once a day from StatDB to the table stat_cat in ClimaDB.

🔲 Edit	Data - nanogʻ	l (nanoq1:5432) - climadb - state	at.stat_cat						
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; 🔳 🛛	🤊 🧑 🖻 (🛍 📕 🝸 💡 👔 No limit	✓						
	statid [PK] integer	start_time [PK] timestamp without time zone	end_time [PK] timestamp without time zone	country text	name [PK] text	lat double precision	long double precision	height double precision	report_type [PK] character(10)
1	613500	1987-07-02 00:00:00	1996-05-10 00:00:00	Danmark	FLAKKEBJERG II	55.3259628962572	11.3887566129715	33	clima_aut
2	613500	1996-05-10 00:00:00	2001-05-29 00:00:00	Danmark	FLAKKEBJERG II	55.3215728783455	11.3880196008291	32	clima_aut
3	613500	2001-06-06 00:00:00	infinity	Danmark	FLAKKEBJERG	55.3215728783455	11.3880196008291	32	synop
*									
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3 rows.									

Labels

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Every value in ClimaDB has a label that gives the user an overview of the process from observations to derived value and thereby also a sort of "quality label" to be used in the subsequent use and validation of data.

The mathematic composition of the label fields is: Label = O*1.000.000 + M*100.000 + L*10.000 + V*1.000 + C*10 + QBelow is shown some of the information from a label to daily values.

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Daily-, monthly and yearly values

Every night a programme runs to calculate the daily values from the day before. Shortly after a programme runs to recalculate the monthly values for the actual month.

If a daily value is updated after the routine run of calculation, a trigger function ensures that the corresponding monthly values are recalculated.

Like wise a trigger function ensures, that an updated monthly value causes a recalculation of the corresponding yearly values and country wise values.

ie <u>E</u> dit	t <u>V</u> iew ኞ 🍙	Help	7 9	No limit	*					
	statid integer	the_date date	elem_no smallint	end_hour smallint	max_no_obs smallint	elem_val real	label bigint	calc_date timestamp without time zone	dato timestamp without time zone	misc real
1	613500	2009-09-01	101	23	24	19.9542	12	2009-09-02 02:33:51.430498	-	
2	613500	2009-09-01	201	23	24	68.2917	19	2009-09-02 02:33:52.941376		
3	613500	2009-09-01	301	23	24	4.62083	19	2009-09-02 02:33:54.97233		
4	613500	2009-09-01	401	23	24	1009.52	11	2009-09-02 02:34:04.523033		
5	613500	2009-09-01	550	23	24	18.306	19	2009-09-02 02:34:04.927583		
6	613500	2009-09-01	601	23	24	4.2	10	2009-09-02 02:34:05.279168		24

Nout time zone date

Versions

When a value in ClimaDB is updated, trigger functions cause the old value to be moved to version tables with information about the date interval, where this value was valid. In this way we have documentation of all values that on a given time has been delivered to customers or used for statistics.

alue of git	Digit 7	Digit 6	Digit 5	Digit 4	Digit 3 og 2	Digit 1
	Observation info (O)	Miscellaneous (M)	Lock (L)	Verification (V)	Calculation (C)	Preceding Quality Control (Q)
	The precipitation sum is set to 0, but the observa- tion was < 0.1 mm	Historical value transferred from Ingres klimadb	Must not be updated or deleted	Element number not defined in Cavemet*	Daily calcula- tion OK, no missing obser- vations	All QC flags on ob- servations = cer- tainly or probably correct
	The snow depth is set to 0, but the observation was < 0.5 cm	Value trans- ferred from In- gres klimadb		Checked by Ca- vemet* daily	Missing obser- vations	One or more QC flags on observa- tions ≠ certainly or probably correct
				Checked by Cavemet* yearly	Possible unre- liable	

*Cavemet is software that perfoms quality control of daily values by analyzing both the timeseries and the data from similar near-by stations.



Countrywide values

The table monthly_country contains country-wise values. As an example Mean Temperature is a calculated climate value that can represent the mean temperature for the country as a whole. Another example is *Highest* temperature representing the highest temperature measured any place in the country. The Highest temperature has attributes describing where and when the temperature is measured.

The calculations and extremes are based on the monthly values from the monthly tables.

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	id [PK] bigserial	region_no integer	yyyy smallint	mm smallint	elem_no smallint	elem_val real	label bigint	calc_date timestamp without time zone
1	152465	0	2009	9	101	14.2249	0	2009-10-01 08:45:01
2	152485	0	2009	9	201	80.7888	0	2009-10-01 08:45:01
3	152499	0	2009	9	301	5.44932	0	2009-10-01 08:45:01
4	152451	0	2009	9	401	1017.58	0	2009-10-01 08:45:01
*								