

Lessons from incompatible units of time-integrated GRIB parameters

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ECMWF Workshop on
“Closing the GRIB-netCDF Gap”

Today I talk about
a disappointing experience in the past

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not to blame somebody

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a disappointing experience in the past
not to blame somebody
just to learn from the history.



Once upon a time
there were a splendid group of experts
trying to expand GRIB Edition 1

parameter table

GRIB 1: 256 entries

local extensions heavily used

GRIB 2: 256^3 entries

discipline – category – parameter

parameter table

D-C-P	Parameter	Units
0-0-0	Temperature	K
0-0-4	Maximum temperature	K
0-0-5	Minimum temperature	K
0-1-1	Relative Humidity	%
0-1-8	Total precipitation	kg.m-2
0-1-52	Total precipitation rate	kg.m-2.s-1
0-19-10	Turbulence	Code Table
1-1-2	Probability of 0.01 inch precipitation	%

product definition templates (PDTs)

- Framework to describe identity of a 2D data
 - Parameter
 - Vertical location
 - Time
 - Instrument parameters (ex radar)
 - Chemical constituents
 - Processing to generate the data
- Up to 256^2 templates

PDT's

Octets 6-7	Meaning
0	Instantaneous (“ <i>Vanilla</i> ”)
1	Vanilla + Ensemble single member
2	Vanilla + Ensemble stat
5	Vanilla + Probability forecast
8	Temporal stats
9	Temporal stats + Probability forecast
11	Temporal stats + Ensemble single member
12	Temporal stats + Ensemble stat
20	Vanilla + Radar
31	Vanilla + Satellite imagery
40	Vanilla + Chemical substance or particles

Sounds great. Really.

And were approved through due procedures.

But the story starts from here.

Old Practice

- Vanilla template for processed parameters
 - 0-0-4 Maximum temperature [K]
 - 0-1-8 Total precipitation [kg.m⁻²]
- Intuitive but
- Lacking metadata
 - time period for max/accumulation

2008 Attempt to “rectify” the situation

- Processed parameters declared “deprecated”
- Suggested to use PDT for temporal stat etc., but
 - without clear guidance
- Probable intention:
 - $\text{PDT}(\text{temporal stat Maximum}) + 0-0-0 \text{ Temperature [K]}$
 - $\text{PDT}(\text{temporal stat Accumulation})$
+ 0-1-52 Total precipitation rate [$\text{kg.m}^{-2}.\text{s}^{-1}$]
→ amount [kg.m^{-2}]

Mess about units

- Intention
 - temporal accumulation multiplies unit by [s]
- Regulation
 - simply said units are defined by parameter table
- Mixed style
 - Accumulated parameter with PDT accumulation
- Other interpretation
 - temporal accumulation multiplies by time span (ex. 3600 s for hour)

2012 solution

- Deprecation retracted
 - We cannot change vast archive
 - Old style permitted as exception
- “Intended” interpretation clarified
 - as exception to parameter-unit relation
- Ugly compromise
 - Exception of exception
 - Like patches for complex software

Lesson 0

- For those who map GRIB-something
- Please note this unit issue
- Maybe more issues, probably

Lesson 1

- Unit of measurement is essential property
 - Changed by some processing
- Be careful about framework to describe processed data
 - CF seems to be aware
 - New framework, new care

Lesson 2

- Abstract rule is risky
unexpected impact may be hiding
- Really error-prone
if many rules are combined
- Suggestion:
 - Testing up to impact on concrete level

Lesson 3

- Excellent people and formal procedures sometimes passes “buggy” rules
- Sometimes we need to change
- But data archive remains

Summary

- Many ways in GRIB2 to encode time-processed data
- Unit of measurement is essential
- Beware pitfall of abstract rules
- Data archive cannot be changed