Lessons from incompatible units of time-integrated GRIB parameters

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“Closing the GRIB-netCDF Gap”

Today I talk about
a disappointing experience in the past

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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 (“*Vanilla*”)
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 decrared “deprecated”
- Suggested to use PDT for temporal stat etc., but
  - without clear guidance
- Probable intention:
  - PDT(temporal stat Maximum) + 0-0-0 Temperature [K]
  - PDT(temporal stat Accumulation)
    + 0-1-52 Total precipitation rate [kg.m-2.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