Derivative Filter Analysis

dara@lossofgenerality.com

Data Reference

http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis.html

Data Annotations

{{"units" → "degrees_north", "actual_range" → 90.,
"long_name" → "Latitude", "standard_name" → "latitude", "axis" → "Y"},
{"units" → "degrees_east", "long_name" → "Longitude",
"actual_range" → 0., "standard_name" → "longitude", "axis" → "X"},
{"units" → "hours since 1-1-1 00:00:0.0", "long_name" → "Time",
"actual_range" → 1.76106 × 10^7, "delta_t" → "0000-00-01 00:00:00",
"avg_period" → "0000-00-01 00:00:00",
"standard_name" → "time", "axis" → "T"},
{"long_name" → "mean Daily Air temperature at sigma level 995",
"unpacked_valid_range" → 185.16, "actual_range" → 191.53,
"units" → "degK", "add_offset" → 512.81, "scale_factor" → 0.01,
"missing_value" → 32 766, "precision" → 2, "least_significant_digit" → 1,
"GRIB_id" → 11, "GRIB_name" → "TMP", "var_desc" → "Air temperature",
"dataset" → "NCEP Reanalysis Daily Averages",
"level_desc" → "Surface", "statistic" → "Mean",
"parent_stat" → "Individual Obs", "valid_range" → -32 765}}

The data is recorded, for the sake of compaction, packed into integers, and requires upacking of a simple linear form:

measurement = scale_factor × data + add_offset

Example: air.sig995.2010.nc

Surface temperature volumetric data for 2010, 3D matrix of integers:

{{{-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2
6006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2600
6,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2

```
6006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2600
6,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2
6006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2600
6,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2
6006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2600
6,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2
6006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-2600
6,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006,-26006},≪71≫,{-26271,-26271,-26271,-
26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-262
71,-26271,-26271,-26271,≪104≫,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,
-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271,-26271}},≪363≫,{≪1≫}}
```

Temperature = 0.01 × data + 512.81

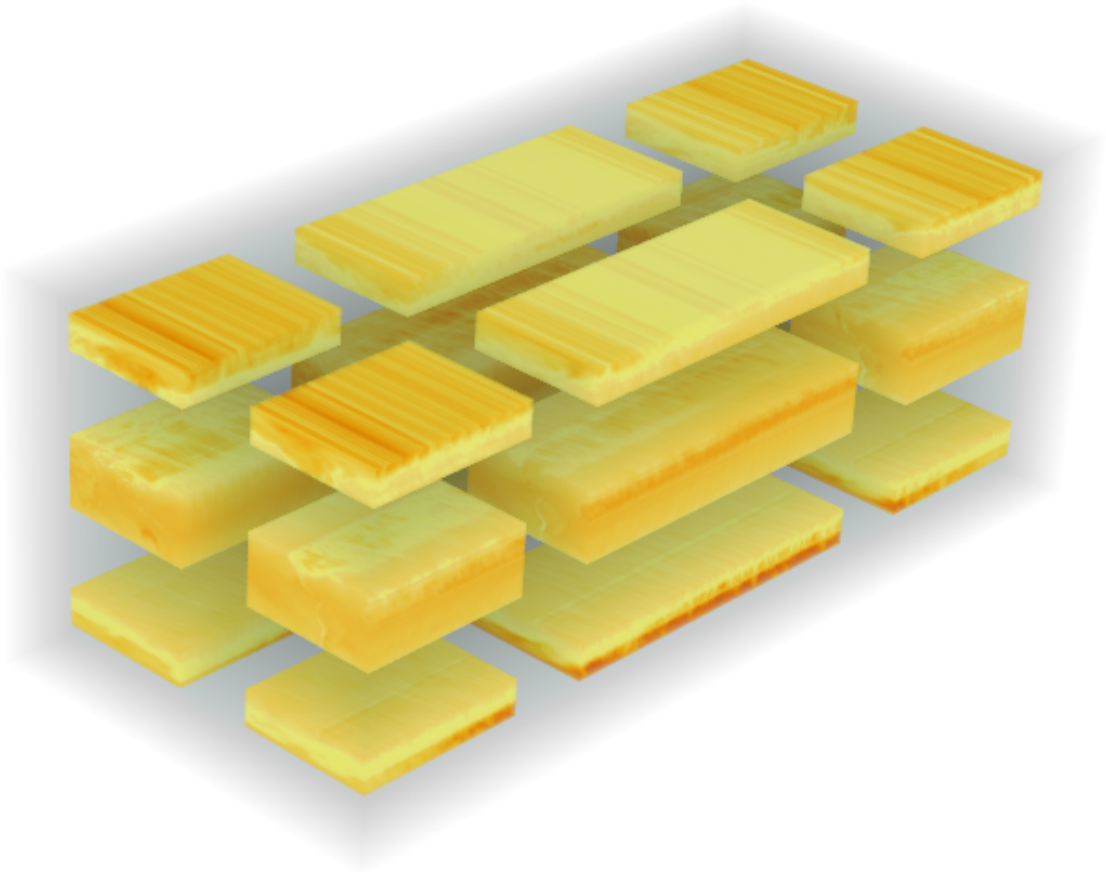
Data thus converted into floating point numbers:

```
{{{252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252
.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,25
2.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,2
52.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,
252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.7
5,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.
75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,25
2.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,2
52.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,
252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.75,252.7
5,252.75,252.75,252.75,252.75,252.75,252.75},{252.6,≪142≫,≪18≫},≪70≫,{250.1,250.1,250.1,250.
1,250.1,250.1,250.1,250.1,250.1,≪126≫,250.1,250.1,250.1,250.1,250.1,250.1,250.1,250.1,250.1}},≪3
64≫}
```

See Also:
http://www.esrl.noaa.gov/psd/data/gridded/faq.html#2
http://www.ncl.ucar.edu/Document/Functions/Contributed/short2flt.shtml

Numerical Analysis: Data

$\mu = 278.327$, $\sigma = 21.3026$, Max = 317.3, Min = 191.53



Numerical Analysis: Derivative of Data with respects to time

$\mu = -0.00058635,\ \sigma = 1.51321,\ \text{Max} = 28.6541,\ \text{Min} = -24.8915$

Remark: *Derivative of Celsius and Kelvin have the same magnitude:*

$C(t) = K(t) - 273.15 \Longrightarrow C'(t) = K'(t)$