DORIS Data Exchange Format
Version 2.2 (June 2008)
Standard Exchange Format for Range-Rate Observations

2025.11.14: corrected processing equation (Eq. 2)

Columns	Subset	Description
1-7		Satellite identification
8-9		Measurement type 34 = USB doppler 38 = Tranet doppler 39 = DORIS doppler (up link, on board receiver)
10-11		Time system indicators
	10	0 = ground received time 1 = satellite transponder/transmitter time 2 = ground transmitted time 3 = satellite received time
	11	0 = UT0 1 = UT1 2 = UT2 3 = UTC (USNO) 4 = A-1 (USNO) 5 = TAI (BIH) 6 = A-S (Smithsonian) 7 = UTC (BIH) 8 = GPS 9 = station dependent correction required
12-16		Station ID Fourth letter indicates Alcatel (A) or Starec (B) antenna
17-32		Time observation (beginning of count)
	17-18	Year minus 1900 if greater than 90 Year minus 2000 if less than or equal 90
	19-21	Day of year (January 1 = Day 1)
	22-26	Seconds from midnight
	27-32	Fractional part of seconds (microseconds)

33-35		Preprocessing indicators
	33	0 = ionosphere correction applied 1 = ionosphere correction not applied
	34	0 = troposphere correction applied 1 = troposphere correction not applied
	35	0 = point considered to be good 1 = point edited during pre-processing 2 = point edited during post-processing 3 = point edited: null Doppler measurement, possibly erroneous 4 = point edited: 3.0 beacon in restart mode (RS=1)
36-45		Count interval in 0.1 microseconds
46-56		Range rate in micrometers/second
57-66		Meteorological data
	57-60	Surface pressure (millibars)
	61-63	Surface temperature (degrees kelvin)
	64-66	Relative humidity (percent)
67-72		Observation standard deviation (micrometers/second)
73-80		Ionospheric refraction correction (micrometers/second)
81-87		Tropospheric refraction correction (micrometers/second)
88-90		Meteorological data source, beacon type
	88	Beacon type 1 = permanent network 2 = field experiment 3 = others
	89	Meteorological data source 0 = measured parameter 1 = pressure from a model 3 = temperature from a model 4 = pressure and temperature from a model 5 = humidity from a model 6 = pressure and humidity from a model 8 = temperature and humidity from a model 9 = pressure, temperature, and humidity from a model
	90	Channel indicator First generation receiver (SPOT-2, SPOT-3, SPOT-4 & TOPEX/POSEIDON) 1 = channel 1 Second generation receiver (Jason-1, SPOT-5 & ENVISAT)

		1 = channel 1 2 = channel 2 3 = channel 1 & 2 (2 channels performing measurements on the same station) DGXX receiver (starting with Jason-2) i = channel i (i=1 to 7)
91-96		Center of mass correction (micrometers/second) including both effects: satellite and beacon

Specifications on the DORIS data format:

- Time for DORIS = beginning of count interval

- Range rate has been computed using the following equation:

  Eq. 1

V(r) = c/f(bea)[(f(bea)-f(sat))-D/dt]

= [c/f(bea)][f(bea)-f(sat)] + [c/f(bea)][-D/dt] *(Eq. 1)*

with V(r) = range rate m/s

dt = count interval (s)

D = cycle count

c = 299792458 m/s

f(bea)= nominal beacon frequency (change from Version 1)

no relativity correction has been applied

f(sat)= best estimate of the actual satellite frequency

long term on-board frequency drift taken into account

relativity correction applied

- Because the true frequency offset between f(bea) and f(sat) will be slightly different from the nominal value, a bias is typically estimated for each station pass.

- The corresponding processing equation for Version 2.1 and 2.2 data is (*)

V(r) = c(df(bea)/fbea - df(sat)/fsat) + c[{1 + df(bea) /f(bea)}/f(bea)][-D/dt] *(corrected Eq. 2)*

= bias + [c/f(bea)][-D/dt] + [df(bea)/f(bea)][c/f(bea)][-D/dt]

where df(bea)= difference between actual beacon frequency and the nominal value used to generate the data

df(sat)= difference between actual satellite frequency and the best available estimate used to generate the data

Important note for Version 2.1 & 2.2 processing:

Previous to Version 2.1, the beacon frequency was the best available estimate of the actual frequency. In Version 2.1 & 2.2, the nominal value of the beacon frequency is used instead.

For beacons where the offset between the actual and nominal frequency is large, the last term in Eq. 2 may not be insignificant. It is recommended that the df(bea) term be explicitly included in the processing, where the quantity df(bea) is determined from the pass bias estimate. Since df(sat) will usually be small, the pass bias estimate will mainly reflect the beacon frequency offset. This value can be used to improve the measurement model by the addition of the term (add to the computed range-rate or subtract from the observed range-rate)

df(bea)[c/f(bea)][-D/dt]

where df(bea) is inferred from the pass bias and (c/f(bea)(-D/dt) is simply the range-change over the count interval dt. When df(bea) is small, as in the case of Version 1 DORIS data, this term will have no significant effect. It is only when df(bea) is large that a range-rate dependent error is encountered.

All corrections (ionosphere, troposphere, and center of mass) should be added to observed values or subtracted from computed values

(*) previously

V(r) = c(df(bea)/fbea - df(sat)/fsat) + c[{1 + df(bea)}/f(bea)][-D/dt] *(Eq. 2)*

= bias + [c/f(bea)][-D/dt] + df(bea)[c/f(bea)][-D/dt]