VALIDATION REPORT

New BUFR sequence for describing the "First five" Fourier components of the directional wave spectrum

**1. Responsible Organizations**

Leading organization (if any): JCOMM/DBCP

Participating organization(s): UK National Oceanography Centre (NOC), Scripps Institution of Oceanography (SIO)

**2. Requirements and Purposes**

In order for a wave observing system to satisfy the widest range of activities the "First five" Fourier components of the directional spectral wave field are required (e.g. Swail et al., 2010). These are defined as the wave energy and the first four coefficients (a1, b1, a2, and b2) of the Fourier series defining the directional distribution of that energy for each frequency band.

Swail, V. & Co-Authors (2010). "Wave Measurements, Needs and Developments for the Next Decade" in *Proceedings of OceanObs’09: Sustained Ocean Observations and Information for Society (Vol. 2),* Venice, Italy, 21-25 September 2009, Hall, J., Harrison, D.E. & Stammer, D., Eds., ESA Publication WPP-306, doi:10.5270/OceanObs09.cwp.87

**3. Description of Proposal**

See attachment

**4. Declaration of Validation Complete**

Proposal has been Validated.

Participating organizations: UK National Oceanography Centre, Scripps Institution of Oceanography

Proof documents:

**5. Proposed Implementation Date and Procedure**

Implementation date: November 2019

Applicable procedure: Fast-track

**6. Summary of Discussion and Result**

Major comments:

1) Incorrect reference value for proposed Table B entries specified in original proposal, values updated= incorporated in the proposal

2) Scale and bid width of existing Table B entries increased using operators compared to original proposal = incorporated in the proposal

**7. Remarks**

New wave sensors onboard drifting buoys have a 1/256 bandwidth. To fully resolve this in the message Table C operators have been used to increase the scale factor and bit width for the frequency related elements to 8 and 22 respectively.

*Validation Details:*

Test file 1:waverider\_test\_data.bin, waverider\_test\_data.txt

Test file 2:dws-drifter-first5\_v2.bufr, dws-drifter-first5.dat

Software

NOC: bespoke Python encoder / decoder

SIO:TBC

NOC encoding software and test files can be found at:

<https://github.com/DavidBerryNOC/BUFR_python_waves>

**PROPOSAL**

Add new entries to BUFR Table B

**Class 42 (Oceanographic elements)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table Reference | Element name | BUFR | | | | CREX | | |
| Unit | Scale | Reference value | Data width (bits) | Unit | Scale | Data width (characters) |
| F XX YYY |
| 0 42 011 | a1 coefficient of the directional Fourier series | Numeric | 4 | -20000 | 15 | Numeric | 4 | 6 |
| 0 42 012 | b1 coefficient of the directional Fourier series | Numeric | 4 | -20000 | 15 | Numeric | 4 | 6 |
| 0 42 013 | a2 coefficient of the directional Fourier series | Numeric | 4 | -20000 | 15 | Numeric | 4 | 6 |
| 0 42 014 | b2 coefficient of the directional Fourier series | Numeric | 4 | -20000 | 15 | Numeric | 4 | 6 |
| 0 42 015 | Check factor K | Numeric | 2 | 0 | 12 | Numeric | 2 | 4 |

Add new entry to BUFR Table D

**Category 15 (Oceanographic report sequences)**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **First five Fourier components of the wave spectrum** |  |
| 3 15 010 | 1 12 000 | Delayed replication of 12 descriptors |  |
|  | 0 31 001 | Delayed descriptor replication factor |  |
|  | 2 01 144 | Add 16 bits to the width for each data element in Table B | Add 16 bits to width |
|  | 2 02 133 | Add 5 to the scale for each data element in Table B | Add 5 to scale |
|  | 0 22 080 | Waveband central frequency (Hz) |  |
|  | 0 22 096 | Spectral band width (Hz) |  |
|  | 0 22 069 | Spectral wave density (m2 Hz-1) |  |
|  | 2 02 000 | Cancel add 5 to scale |  |
|  | 2 01 000 | Cancel add 16 to width |  |
|  | 0 42 011 | a1 coefficient of the directional Fourier series | First moment of the directional wave spectrum |
|  | 0 42 012 | b1 coefficient of the directional Fourier series | First moment of the directional wave spectrum |
|  | 0 42 013 | a2 coefficient of the directional Fourier series | Second moment of the directional wave spectrum |
|  | 0 42 014 | b2 coefficient of the directional Fourier series | Second moment of the directional wave spectrum |
|  | 0 42 015 | Check factor K | Inverse of wave ellipticity |