

# SAO Version 5

## BASED ON XML STANDARD



Bodo Reinisch, Ivan Galkin, Grigori Khmyrov  
University of Massachusetts Lowell, Center for Atmospheric Research

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# OUTLINE




- Why change?
- Key concepts of new SAO format
- Highlights of XML technology
- Current implementation
- XML concerns and answers

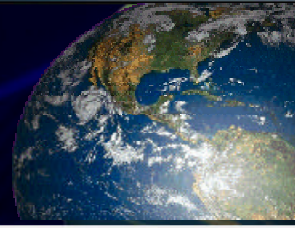


# Previous SAO Versions



- SAO (1989)
  - SAO II (1990)
  - SAO III (1993)
  - SAO IV (1996)
  - SAO 4.2 (1998) – current network standard
  - SAO 4.3 (2001) – for manually edited data in DIDBase
  - SAO 5 (2005) – proposed new
- 

# Why change?



- Need to add new data to SAO
  - Uncertainty intervals for ionospheric characteristics and profiles (for data assimilation via Kalman filters)
  - Growing number of characteristics
- Need to make SAO user-friendly
- Improved outreach to other ionosonde systems and ionospheric data providers and modelers

# Key Concepts for New SAO



- Expandable for new things to be added
- If expanded, SAO must remain upward compatible.
- Here is an illustration:
  - Someone introduces a new element to existing SAO format (e.g., *foF3* value)
  - Old software reads the new file and skips the unknown element *foF3*
  - Only those who are interested in newly added element *foF3* modify their reading software

# Key Concepts for New SAO (2)



- User-friendly, easy to read and understand :
  - Self-explanatory
  - Documented with metadata (descriptive information, such as names, units, attributes)
  - Readable by non-specialized software
- Variable amount of “metadata”
  - Fully descriptive output for data exchange with fellow fields
  - Reduced output shall be provided for space savings. Omitted attributes are assumed default.
    - e.g., [MHz] units for frequencies

# Key Concepts for New SAO (3)




- Where possible, keep it simple
  - For users
  - For computer programmers



# XML: Miracle Solution to Our Needs



- XML technology
    - Expandable for new data elements
    - Upward compatible: old software reads new format releases, skipping unknown elements
    - Contents are self-explanatory and/or documented
    - Format is supported by various software libraries
    - Can be viewed in any Internet browser
  - Format concepts and technical details are currently discussed in the community
- 



# SAO 4.3 versus SAO-XML 5



```
| 5 1 77 49 23 2 23 0 23 23 23 3 0 0 0 3 C 0 0 0 0 0 0
| 20 2 25 25 25 0 0 0 C 60 50 60 19 19 3 C 0 0 0 0 0 0
| 1.359 80.320 56.080309.060117.000
DGS 256 /SM167, NAME SONDRCESTRON, WMOID HIGL5 BTGS 04231, ARTIST 0
FE2000032020000C5000320000C519320000C5000003100001611E0E74107.
3.5009999.000 5.224 11.249 .800 3.200 1.3009999.00099
9999.000 35.0009999.000 .0009999.000 3.750 1.1009999.00030
9999.000 294.8009999.000 255.382 4.821 .800 56.9209999.000
9999.0009999.0009999.000
| 2 2 0 C 6 0 0 3 51 0 0 3 0 5 0 0 1 C
-1.563 1.563
280.000 275.000 265.000 265.000 260.000 260.000 270.000 2
285.000 290.000 295.000 305.000 320.000 345.000 390.000 500.000
| 28126118130.25134126130130130134130130130125 C 0.26126122118
00000000000000090010010
| 1.300 2.400 1.500 1.600 1.700 1.800 1.900 2.000
2.800 2.900 3.000 3.100 3.200 3.300 3.400 3.500
.345000CE+0 .35000CE+1 .294800CE+3 .000000CE+0-.327000CE+2 .200000CE+2
.200000CE+0 .345000CE+0 .110000CE+3 .000000CE+0 .230000CE+2 .480000CE+1
.5460001000000E+C4 .648000000000E+04 -.230259753808E+13 -.40'
.5513000000000E+C4 .6513000000000E+04 -.399379983437E+12 -.12'
.5514033000000E+C4 .6514033000000E+04 .308397227133E+13 -.12'
.5548067000000E+C4 .6548067000000E+04 .000000000000E+00 .25'
.5550000000000E+C4 .6550000000000E+04 -.687951455393E+12 -.20'
.5579000000000E+C4 .6579000000000E+04 .212236134121E+12 -.64'
.5581000000000E+C4 .6581000000000E+04 -.523798046757E+12 -.15'
.5584000000000E+C4 .6584000000000E+04 .988520422670E+13 -.29'
.5587000000000E+C4 .6587000000000E+04 -.42387559063E+13 -.43'
.5607000000000E+C4 .6507000000000E+04 .293124E16662E+13 -.58'
.5616000000000E+C4 .6516000000000E+04 .9335159381E+13 -.28'
.5627000000000E+C4 .6527000000000E+04 .397562778959E+14 -.11'
.5636000000000E+C4 .6536000000000E+04 -.405117588847E+14 -.12'
.5664800000000E+C4 .6564800000000E+04 -.513788209467E+13 -.15'
.6370000000000E+C4
00000000000000000000000200200200000000000000000000000000000000
| 1.02100CE+3 .34500CE+0
91.250 105.000 105.000 105.000 105.000 105.000 105.000 105.000
| 105.000 105.000 105.000 105.000 105.000 105.000 105.000 105.000
01101C6114.14 C 0 0 C122122 0130130126126126130130 0
9011399999009011110099900
|.800 1.000 1.100 1.200 1.300 1.400 1.500
2.300 2.400 2.500 2.600 2.700 2.800 2.900 3.000
91.300 100.000 110.000 120.000 130.000 140.000 144.033 150.000
212.100 220.000 230.000 240.000 250.000 260.000 270.000 280.000
330.000 360.000 370.000 380.000 390.000 400.000 410.000 420.000
500.000 510.000 520.000 530.000 540.000 550.000 560.000 570.000
|.200 .472 .545 .574 .456 .308 .200 .200
```

Netscape

```
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<URSI ID="07" Name="MUF(3000)" Val="31.241" Units="MHz"/>
<URSI ID="42" Name="fmin" Val="1.7" Units="MHz" Flag="edited"/>
<URSI ID="20" Name="foE" Val="3.30" Units="MHz" Flag="edited" Bound="0.15" BoundaryType="3sigma"/>
<URSI ID="30" Name="foE2" Val="17.3" Units="MHz" Flag="edited" UpperBound="19.5" LowerBound="16.8"
BoundaryType="10sigma"/>
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BoundaryType="1sigma" QL="Y" DL="N"/>
<Modeld Name="foEp" Val="3.68" Units="MHz" ModelName="CCIR-79"/>
<Modeld Name="foF2p" Val="9.53" Units="MHz" ModelName="URSI-88" ModelOptions="NoScreen"/>
<Custom Name="Delta-foF2" Units="MHz" Val="0.07" Description="Correction to foF2 from profile inversion
algorithm"/>
</CharacteristicList>
- <TraceList Num="2">
+ <Trace Type="standard" Layer="F2" Polarization="O" Num="76">
+ <FrequencyList Type="float" SigFig="5" Units="MHz" Description="Nominal Frequency"><FrequencyList>
- <RangeList Type="float" SigFig="4" Units="km" Description="Group Range">
206 04 204 2 202 36 202 36 204 2 209 72 217 08 234.44 231.8 235.48 241.0 246.51 251.04 255.72 259.4 261.24
263.08 268.6 270.44 272.38 275.96 275.96 279.64 285.16 288.84 292.52 294.36 298.04 301.72 303.56 305.4 309.08
310.92 316.44 318.28 320.12 323.8 323.8 333.5 335.5 338.0 340.5 343.5 344.5 346.5 349.0 352.0 354.0 357.0 361.0
364.0 367.0 370.0 374.0 381.0 384.0 387.0 391.0 394.0 398.0 402.0 406.0 410.0 414.0 419.0 424.0 430.0 434.2
445.24 458.12 469.16 483.88 502.28 524.36 579.56 655.0
</RangeList>
+ <AmplitudeList Type="integer" SigFig="3" Units="dB" NoValue="0" Description="Relative
Amplitude"></AmplitudeList>
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Staff"></DopplerShiftList>
</Trace>
+ <Trace Type="standard" Layer="E" Polarization="O" Num="22"></Trace>
</TraceList>
- <ProfileList Num="1">
- <Profile Type="vertical" Algorithm="NHPC" AlgorithmVersion="4.21">
- <Tabulated Num="48">
- <AltitudeList Units="km">
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1.353 80.310 6  
DG5-256 /SMJ67,  
FE20C00320201000  
3.5009999.000  
9999.000 35.000  
9999.000 294.800  
9999.0009999.000  
2 2 0 0 6 0 0 0  
-1.563 1.563  
230.000 275.000  
235.000 290.000  
1131261181301261  
C000C00000000000  
1.300 1.400  
2.800 2.900  
.545000E+0 .350  
.200000E+0 .545  
.645001100000  
.651300000000  
.651403300000  
.654806700000  
.655000000000  
.657900000000  
.658100000000  
.658400000000  
.658700000000  
.660700000000  
.661600000000  
.662600000000  
.663600000000  
.665480000000  
.637000000000  
C000C00000000000

```
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Home Index
Netscape Enter Search Terms Search Highlight Pop-Ups Blocked:
New Tab
<URSI ID="03" Name="M(3000)F2" Val="2.9197"/>
<URSI ID="07" Name="MUF(3000)" Val="31.241" Units="MHz"/>
<URSI ID="42" Name="fmin" Val="1.7" Units="MHz" Flag="edited"/>
<URSI ID="20" Name="foE" Val="3.30" Units="MHz" Flag="edited" Bound="0.15" Bound
<URSI ID="30" Name="foEs" Val="17.3" Units="MHz" Flag="edited" UpperBound="19.3
BoundaryType="10%tile"/>
<URSI ID="10" Name="foF1" Val="7.70" Units="MHz" Flag="edited" UpperBound="8.3"
BoundaryType="1sigma" QL="/" DL="/" />
<Modeled Name="foEp" Val="3.68" Units="MHz" ModelName="CCIR-79"/>
<Modeled Name="foF2p" Val="9.53" Units="MHz" ModelName="URSI-88" ModelOption
<Custom Name="Delta-foF2" Units="MHz" Val="0.07" Description="Correction to foF2
algorithm"/>
</CharacteristicList>
- <TraceList Num="2">
- <Trace Type="standard" Layer="F2" Polarization="O" Num="76">
+ <FrequencyList Type="float" SigFig="5" Units="MHz" Description="Nominal Frequen
- <RangeList Type="float" SigFig="4" Units="km" Description="Group Range">
206.04 204.2 202.36 202.36 204.2 209.72 217.08 224.44 231.8 235.48 241.0 246.52 2
263.08 268.6 270.44 272.28 275.96 275.96 279.64 285.16 288.84 292.52 294.36 298.
310.92 316.44 318.28 320.12 323.8 323.8 333.5 335.5 338.0 340.5 343.5 344.5 346.5
364.0 367.0 370.0 374.0 381.0 384.0 387.0 391.0 394.0 398.0 402.0 406.0 410.0 414.
445.24 458.12 469.16 483.88 502.28 524.36 579.56 655.0
</RangeList>
+ <AmplitudeList Type="integer" SigFig="3" Units="dB" NoValue="0" Description="Re
Amplitude"></AmplitudeList>
+ <DopplerShiftList Type="float" SigFig="4" Units="Hz" NoValue="99.0" Description="
Shift"></DopplerShiftList>
</Trace>
+ <Trace Type="standard" Layer="E" Polarization="O" Num="22"></Trace>
</TraceList>
```

# DTD and Syntax Checking




- D T D will be provided  
= Document Type Definition  
Collection of syntax rules

Every SAOXML 5 file can be checked for compliance with the syntax rules.

# XML Concerns



- XML is data exchange format, not data storage format
    - Data size overhead
      - XML is ASCII
      - XML stores descriptive information
    - Actual volume increase is ~30% over SAO 4.3
    - But our data volumes are small, and the community is already comfortable with data storage in ASCII
  - Reading code is more complex
    - UMLCAR shall provide source code examples
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# SAOXML Discussion



- Major contributors to the format specification
    - Terrence Bullett : AFRL, INAG
    - Richard Stamper : UKSSDC, COST 296
    - Rob Redmon, Ray Conkright, Eric Kihn, Nick Zabolotin : NGDC/CIRES
    - Martin Jarvis : BAS
    - Iwona Stanislawska, SRC, COST
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# SAO 5 Specification



- <http://ulcar.uml.edu/SAOXML>
  - **Format Specification V2.00, October 2005**
  - **DTD master specification**
  - **Sample SAOXML file**