UMass Lowell
Center for Atmospheric Research

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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New Delhi, India
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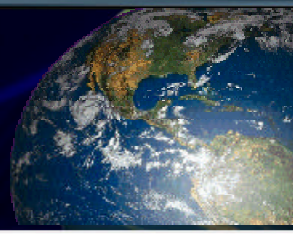
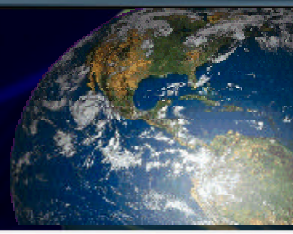
OUTLINE



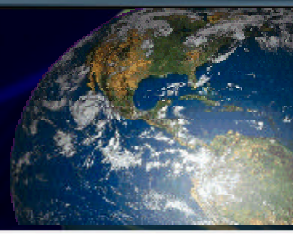
- Why change?
- Key concepts of new SAO format
- Highlights of XML technology
- Current implementation
- XML concerns and answers

Previous SAO Versions



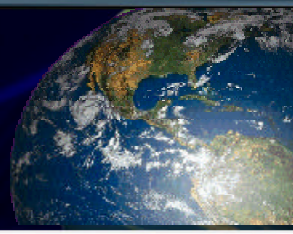
- SAO (1989)
- SAO II (1990)
- SAO III (1993)
- SAO IV (1996)
- SAO 4.2 (1998) – current network standard
- SAO 4.3 (2001) – for manually edited data in DIDBase
- SAO 5 (2005) – proposed new

Why change?



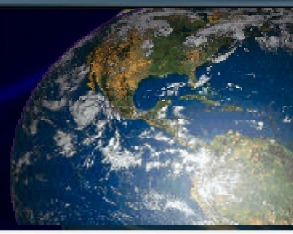
- Need to add new data to SAO
  - Uncertainty intervals for ionospheric characteristics and profiles (for data assimilation via Kalman filters)
  - Growing number of characteristics
- Need to make SAO user-friendly
- Improved outreach to other ionosonde systems and ionospheric data providers and modelers

Key Concepts for New SAO



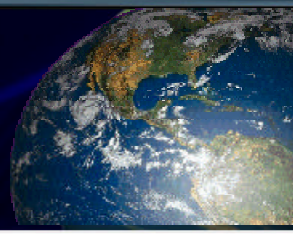
- Expandable for new things to be added
- If expanded, SAO must remain upward compatible.
- Here is an illustration:
  - Someone introduces a new element to existing SAO format (e.g., *foF3* value)
  - Old software reads the new file and skips the unknown element *foF3*
  - Only those who are interested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

Key Concepts for New SAO (2)



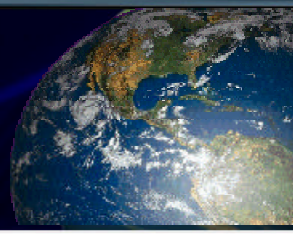
- User-friendly, easy to read and understand :
  - Self-explanatory
  - Documented with metadata (descriptive information, such as names, units, attributes)
  - Readable by non-specialized software
- Variable amount of “metadata”
  - Fully descriptive output for data exchange with fellow fields
  - Reduced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

Key Concepts for New SAO (3)



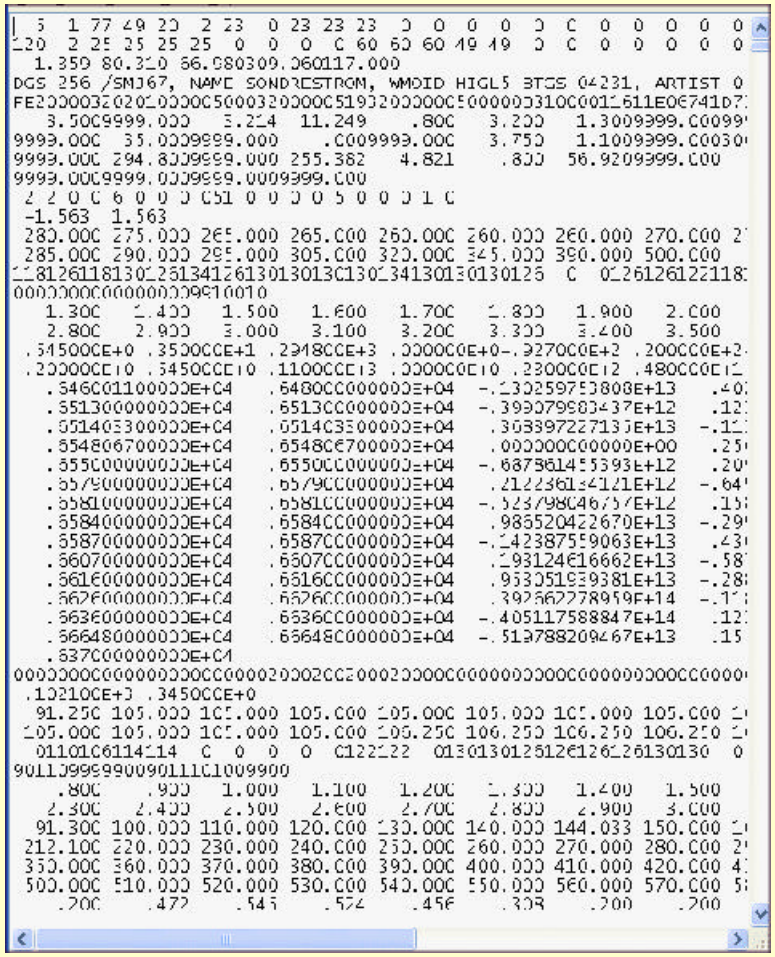
- Where possible, keep it simple
  - For users
  - For computer programmers

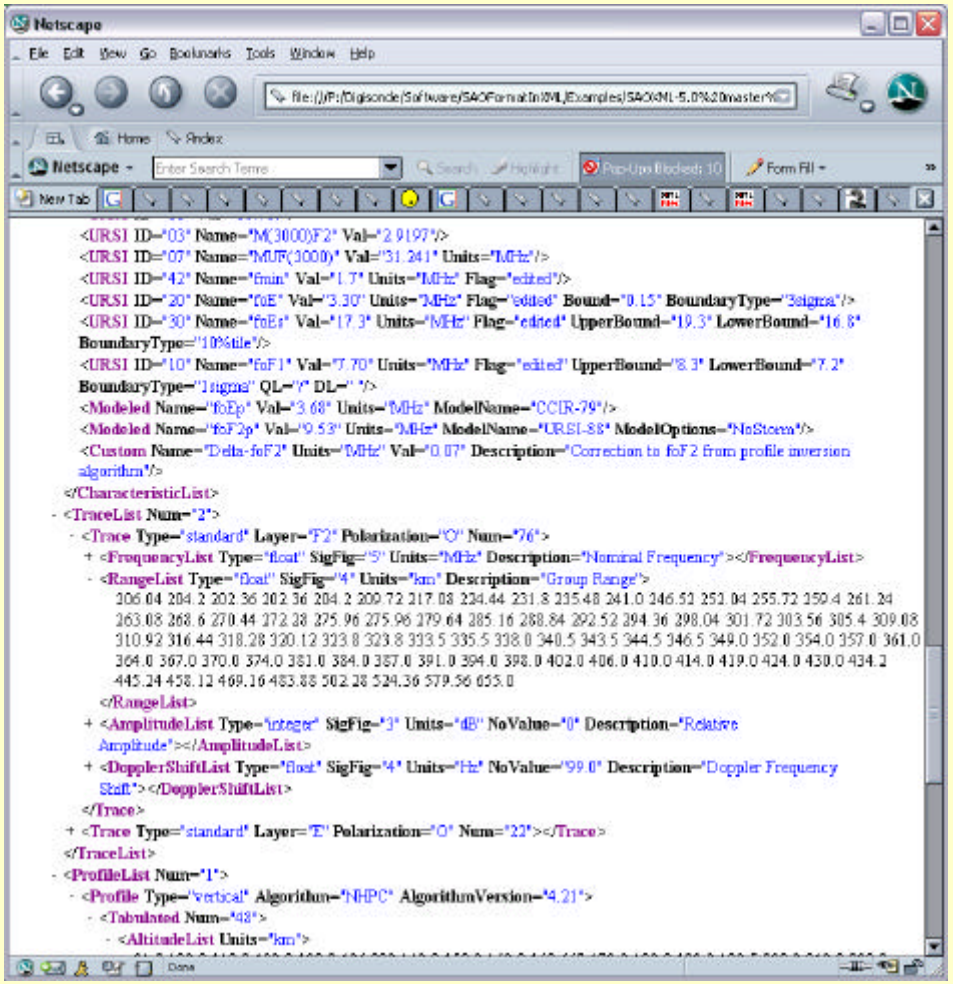
XML: Miracle Solution to Our Needs

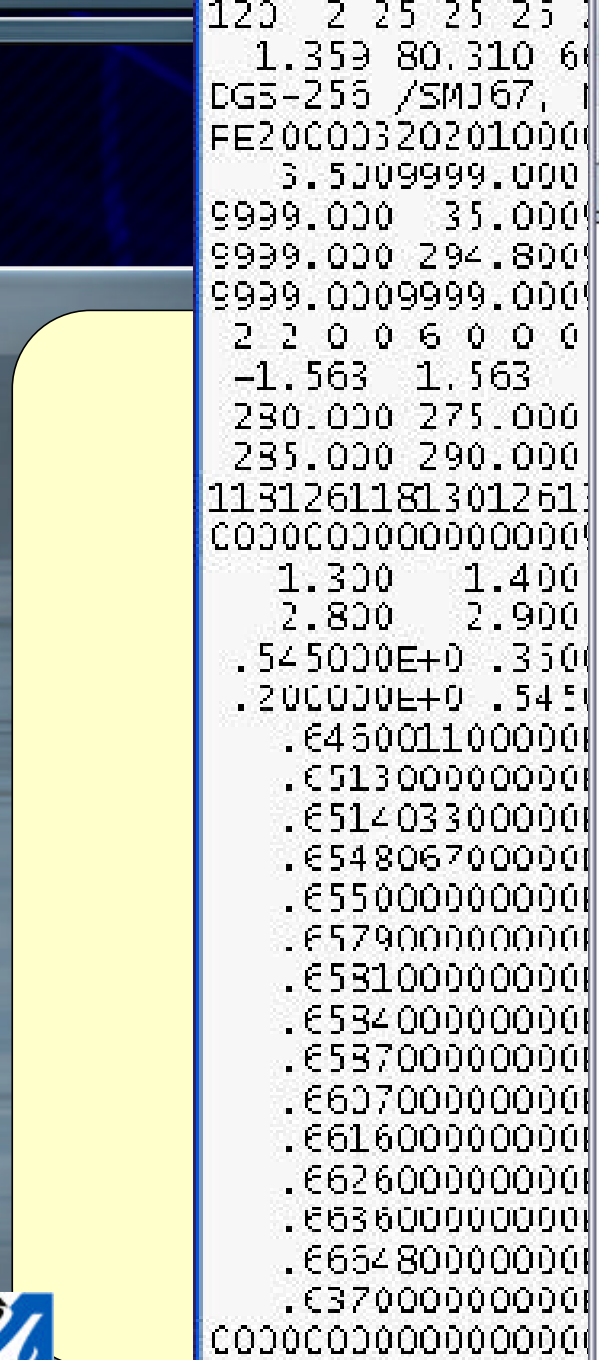


- XML technology
  - Expandable for new data elements
  - Upward compatible: old software reads new format releases, skipping unknown elements
  - Contents are self-explanatory and/or documented
  - Format is supported by various software libraries
  - Can be viewed in any Internet browser
- Format concepts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

SAO 4.3 versus SAO-XML 5







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123  2 25 25 25 2
  1.359 80.310 6
DGS-256 /SMJ67, I
FE20C0332020100
   3.5009999.000
9939.000  35.000
9939.000 294.800
9939.0009999.000
 2 2 0 0 6 0 0 0
-1.563  1.563
 230.000 275.000
 235.000 290.000
113126118130126
C0C0C0C0000000
   1.300   1.400
   2.800   2.900
.545000E+0 .350
.200000E+0 .545
   .6450011000
   .6513000000
   .6514033000
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   .6550000000
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C0C0C0C0000000
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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" Boun
<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=" "/>
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<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
      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
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  + <DopplerShiftList Type="float" SigFig="4" Units="Hz" NoValue="99.0" Description="
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  </Trace>
 + <Trace Type="standard" Layer="E" Polarization="O" Num="22"></Trace>
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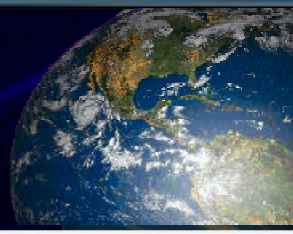
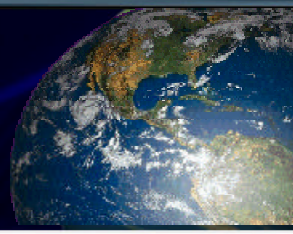
DTD and Syntax Checking



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

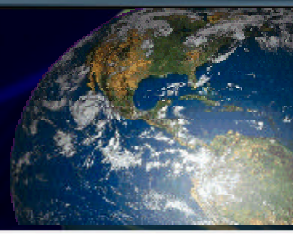
Every SAOXML 5 file can be checked for compliance with the syntax rules.

XML Concerns



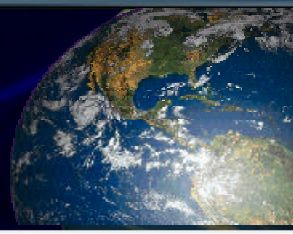
- XML is data exchange format, not data storage format
  - Data size overhead
    - XML is ASCII
    - XML stores descriptive information
  - Actual volume increase is ~30% over SAO 4.3
  - But our data volumes are small, and the community is already comfortable with data storage in ASCII
- Reading code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

SAOXML Discussion



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

SAO 5 Specification



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