



# SAO.XML 5.0

new format for ionogram-scaled data

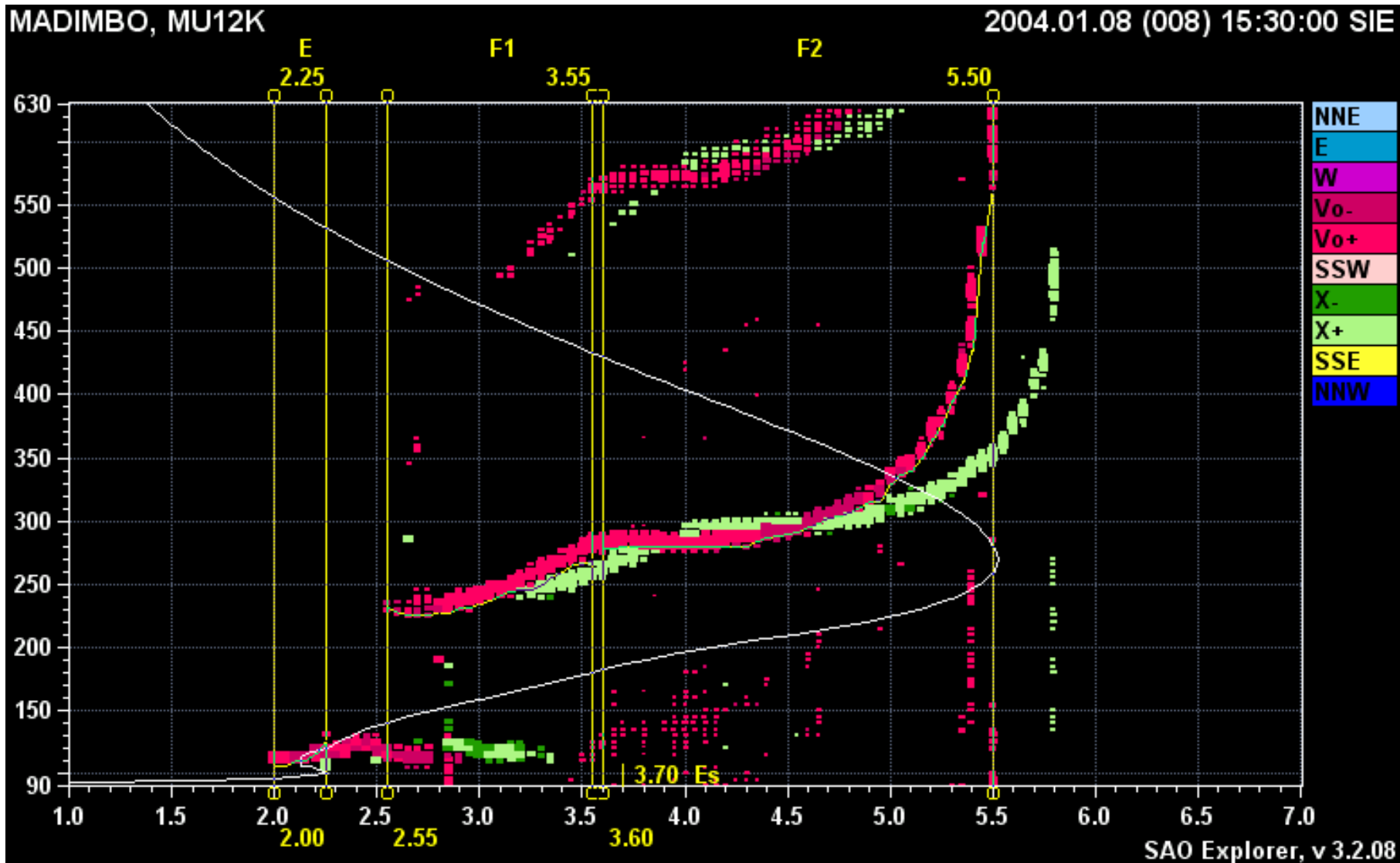
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# Ionogram-scaled data



# Ionospheric characteristics

Title	Value	Q	D	Flags	Characteristic description
foF2	5.525	/		V	F2 layer critical frequency
hmF2	268.4	/		V	Peak height F2-layer
foF2p	7.69	/	/	P	Predicted value of foF2
h`F	225.3	/		V	Minimum virtual height of F trace
QF	NoValue	/		V	Average range spread of F-layer
scale F2	60.4	/		V	Scale height at the F2-peak
foF1	3.57	/		V	F1 layer critical frequency
foF1p	NoValue	/	/	P	Predicted value of foF1
hmF1	181.3	/		V	Peak height F1-layer
foE	2.26	/		EV	E layer critical frequency
foEp	2.46	/	/	P	Predicted value of foE
hmE	99.3	/		V	Peak height of E-layer
foEs	3.70	/		V	Es layer critical frequency
TEC	9.8	/		V	Total electron content
type Es	NoValue	/		V	Type Es
fminF	2.55	/		EV	Minimum frequency of F-layer echoes
h`F2	277.9	/		V	Minimum virtual height of F2 trace
h`E	105.0	/		V	Minimum virtual height of E trace
fmin	2.00	/		V	Minimum frequency of ionogram echoes
fminE	2.00	/		V	Minimum frequency of E-layer echoes
FE	.20	/		V	Frequency spread beyond foE
FF	NoValue	/		V	Frequency spread between fxF2 and fxl
QE	NoValue	/		V	Average range spread of E-layer
foP	NoValue	/		V	Highest ordinary wave critical frequency of F region patch trace
h`P	NoValue	/		V	Minimum virtual height of the trace used to determinate foP
foEa	NoValue	/		V	Critical frequency of auroral E-layer
fminEs	2.30	/		V	Minimum frequency of Es-layer
h`Es	107.0	/		V	Minimum virtual height of Es trace

# SAO – Standard Archive Output format

- Text file format to store
  - Scaled ionospheric characteristics
  - Station description
  - Measurement parameters
  - Traces
  - Profiles
  - Edit flags



# Additional groups

- MUF tables for given set of distances
- List of restricted frequencies
- Uncertainty or Error Bar
  - inner and outer profile boundaries

# Additional ionospheric characteristics

50. Es type for layer 2
51. Es type for layer 3
52. RS
53. FS
54. ftEs
55. foE2
56. h'E2
57. foF0.5
58. h'F0.5
59. foF1.5
60. h'F1.5
61. foF3
62. h'F3

- User-defined (varying from site to site)?
- Uncertainty or Error Bar attributes

# Other suggestions

- Support new measurement parameters of digisondes
- Other ionosondes
- Radars data
- Average profiles (like ARP)
- Data from ionospheric models

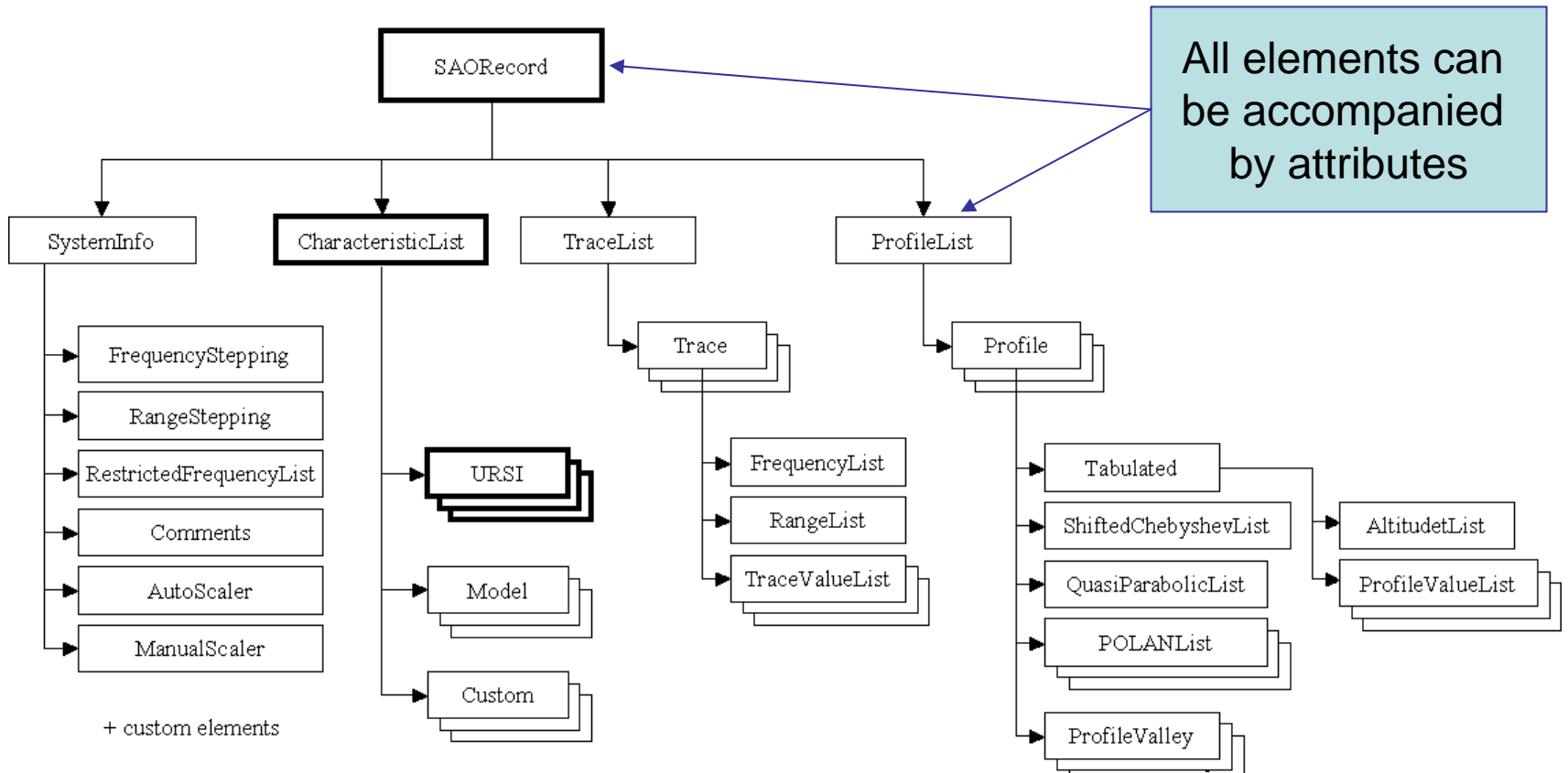
# SAO format requirements

- A plain text format
- Forward compatible - flexibility to add new groups and ionospheric characteristics without changing software
- Additional measurement attributes and friendly representation – not compressed like in preface
- Notes and comments
- Formal validation

# Extensible Markup Language XML

- + Existing standard
- + Standard libraries for many languages are available
- + Recommended format for data exchange
- + Supported by web-browsers and simple text editors

# Tree-structure of XML



Minimum set of elements shown in bold.

# SAO.XML 5.0 example

```

<SAORecordList>
- <SAORecord FormatVersion="5.0" StartTimeUTC="2007-04-25 -115 00:00:00.000" URSICode="MHJ45"
  StationName="MILLSTONE HILL" GeoLatitude="42.6" GeoLongitude="288.5" Source="Ionosonde"
  SourceType="DPS-4S" ScalerType="manual">
+ <SystemInfo UMLStationID="042"></SystemInfo>
+ <CharacteristicList Num="23"></CharacteristicList>
+ <TraceList Num="1"></TraceList>
+ <ProfileList Num="1"></ProfileList>
</SAORecord>
+ <SAORecord FormatVersion="5.0" StartTimeUTC="2007-04-25 -115 00:07:30.000" URSICode="MHJ45"
  StationName="MILLSTONE HILL" GeoLatitude="42.6" GeoLongitude="288.5" Source="Ionosonde"
  SourceType="DPS-4S" ScalerType="manual"></SAORecord>
+ <SAORecord FormatVersion="5.0" StartTimeUTC="2007-04-25 -115 00:15:00.000" URSICode="MHJ45"
  StationName="MILLSTONE HILL" GeoLatitude="42.6" GeoLongitude="288.5" Source="Ionosonde"
  SourceType="DPS-4S" ScalerType="manual"></SAORecord>
</SAORecordList>

```

Easy to skip one Element (including unknown one)

```

<SystemInfo UMLStationID="042"></SystemInfo>
<CharacteristicList Num="23">
  <URSI ID="00" Val="5.6" Name="foF2" Units="MHz" QL="/" DL=" " Flag="validated"/>
  <URSI ID="03" Val="3.327" Name="M(D)" QL="/" DL=" " Flag="validated"/>
  <URSI ID="07" Val="18.632" Name="MUF(D)" Units="MHz" QL="/" DL=" " Flag="validated"/>
  <URSI ID="42" Val="2.1" Name="fmin" Units="MHz" QL="/" DL=" " Flag="validated"/>
  <URSI ID="80" Val="2.1" Name="fminF" Units="MHz" QL="/" DL=" " Flag="validated"/>
  <URSI ID="51" Val="6.6" Name="fxI" Units="MHz" QL="/" DL=" " Flag="validated"/>
  <URSI ID="16" Val="228.75" Name="h`F" Units="km" QL="/" DL=" " Flag="validated"/>
  <URSI ID="04" Val="228.75" Name="h`F2" Units="km" QL="/" DL=" " Flag="validated"/>
  <Custom Name="DownF" Val="1.5" Description="Lowering of F-trace to the leading edge" Units="km"/>
  <URSI ID="86" Val="0.4" Name="FF" Units="MHz" QL="/" DL=" " Flag="validated"/>
  <URSI ID="88" Val="5.3" Name="fMUF" Units="MHz" QL="/" DL=" " Flag="validated"/>
  <URSI ID="89" Val="320.461" Name="h` (fMUF)" Units="km" QL="/" DL=" " Flag="validated"/>
  <Modeled Name="foEp" Val="0.865" Units="MHz" ModelName="CCIR-79"/>
  <URSI ID="61" Val="2.1" Name="f(h`F)" Units="MHz" QL="/" DL=" " Flag="validated"/>
  <URSI ID="60" Val="2.1" Name="f(h`F2)" Units="MHz" QL="/" DL=" " Flag="validated"/>
  <URSI ID="92" Val="265.307" Name="hmF2" Units="km" QL="/" DL=" " Flag="validated"/>
  <URSI ID="93" Val="226.798" Name="zhalfNm" Units="km" QL="/" DL=" " Flag="validated"/>
  <Modeled Name="foF2p" Val="5.086" Units="MHz" ModelName="URSI-88" ModelOptions="NoStorm"/>
  <URSI ID="94" Val="54.581" Name="yF2" Units="km" QL="/" DL=" " Flag="validated"/>
  <URSI ID="71" Val="4.822" Name="TEC" Units="TECU" QL="/" DL=" " Flag="validated"/>
  <URSI ID="09" Val="29.002" Name="scale F2" Units="km" QL="/" DL=" " Flag="validated"/>
  <URSI ID="D0" Val="53.9" Name="B0" Units="km" QL="/" DL=" " Flag="validated"/>
  <URSI ID="D1" Val="2.24" Name="B1" QL="/" DL=" " Flag="validated"/>

```

# XML document definition language (Schema)

- Schema formally describes structure of XML files
- Element's
  - Attribute list
  - Data type
  - Subelements
    - Single
    - Multiple
    - Order
- It is many alternatives
- SAO.XML has pretty simple structure
- Document Type Definition (DTD) format been selected
- UMLCAR created DTD document SAOXML-5.0.1.dtd

# XML validation

- To validate SAO.XML files add **DOCTYPE** tag to the XML file
- Run validation program

```
<?xml version="1.0"?>  
<!DOCTYPE SAORecordList SYSTEM "http://umlcar.uml.edu/SAOXML/SAOXML-5.0.1.dtd">  
<SAORecordList>  
...  
</SAORecordList>
```

One of the validator we use is at

<http://www.stg.brown.edu/service/xmlvalid/>

# SAOXML on the web

- <http://umlcar.uml.edu/SAOXML/>



[Format Specification Proposal](#)

[SAO XML 5.0.1: One Record example](#)

[SAO XML 5.0.1: Document Type Definition \(DTD\)](#)

[SAO XML 5.0.1: DTD included into SAOXML Record](#)

[SAO XML 5.0.1: DTD referenced from SAOXML Record](#)

# SAOXML format contributors

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