IASPEI Seismic Format (ISF)

Version 2.1

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Changes from Version 1.0 to Version 2.1 of IASPEI Seismic Format

Version 2.1 is a development of version 2.0 with additional data fields for the station imformation and the extension of more ID fields to 11 digits.

Changes introduced to the ISF in Version 2.1 reflected the need to use the new IASPEI (ADSL) and existing FDSN station naming conventions. Description of ADSL can be found at www.isc.ac.uk/registries/download/IR_implementation.pdf. Additional commonly used data fields have also been introduced at the end of the existing format lines.

Formats affected include the Bulletin Phase Block, Automatic Arrival, Reviewed Arrival, Grouped Arrival and Associated Arrival, all with the same extension to the format.

Whilst making these amendments, we observed the requirement to keep the original order of parameters in ISF1.0 and IMS1.0 preserved so that the existing computer programs could continue being used. Thus, the left hand sides of all phase related lines remained undisturbed. All current changes are limited to the right hand side of relevant lines, these changes are also printed in red.

The additional data fields are:

- An option of three additional characters as an extension of the origin and arrival identification.
- The agency code (A of ADSL) of the station operator.
- The deployment code (D of ADSL) of the station.
- The location code (L of ADSL) of the station.
- The agency code of the author of arrival.
- The agency code of the reporter of the data.
- The phase channel, standard three letter FDSN code.
- The amplitude channel, standard three letter FDSN code.
- direction of long period first motion
- latitude, longitude, elevation and depth of a station

The original version of the these data types can be found in the following document:

Formats and Protocols for Messages-IMS1.0
March 1999

IDC-3.4.1Rev1
IDC DOCUMENTATION
Products and Services
S/H/I Data Messages

The pdf documents are available here:

www.isc.ac.uk/standards/isf/download/ims1_0.pdf
www.isc.ac.uk/standards/isf/download/isf2_1.pdf

Versions 1.0 and 2.0 of ISF are also available:

www.isc.ac.uk/standards/isf/download/isf2_0.pdf
www.isc.ac.uk/standards/isf/download/isf.pdf

Features of IASPEI Seismic Format

IMS1.0 compliant ISF messages comply with the IMS1.0 standard that was developed for exchanging data used to monitor the Comprehensive Test Ban Treaty. Thus, parsers that conform with the IMS1.0 standard will parse ISF messages without a fatal error, although they may ignore data in ISF extensions of IMS1.0

IMS1.0 subset IMS1.0 data types for radiogenic information and blocks for event screening are not part of ISF. Parsers than conform with the ISF standard will parse IMS1.0 messages, but may ignore information in IMS data types or blocks excluded from the ISF standard.

Formatted comments MS1.0 is extended by introducing formatting standards for additional types of data. IMS1.0 compliance is preserved by putting these formatted fields in IMS1.0 comment lines.

New sub-blocks IMS1.0 parsers are expected to ignore unknown blocks and sub-blocks, which are recognised by preceding and folowing blank lines and the content of the header line. In the Bulletin datatype, ISF introduces an Effects block with macroseismic information and a phase information sub-block, with further information about phases in the arrivals block. In the Grouped Arrivals data type, ISF introduces an arrival information sub-block with further information about phases in the arrival block.

ISC/CSOI phase names ISF messages include only seismic phase names from the phase name list maintained by the International Seismological Centre (ISC) and reviewed by the IASPEI Commission on Seismological Observation and Interpretation (CSOI). Most names correspond to ray paths in the earth. But a few (e.g., “coda” and “amp”) are used to signal special meanings for other measurements. Phases with names not in the CSOI list may be ignored by ISF parsers.

ISC/CSOI parameters Earthquake parameters and phase measurements in ISF formatted comments are only those from the lists maintained by the ISC and reviewed by the CSOI, where each is assigned a name, units and description. Units are not stated in ISF formatted comments. Parameters and measurements not in the ISC/CSOI lists may be ignored by ISF parsers. ISF writers exclude measurements not in the ISC/CSOI list from formatted comments.

FDSN channel codes In both IMS1.0 and ISF messages, the channel field is filled only with channel codes that conform with the channel naming convention of the Federation of Digital Seismograph Networks, using the instrument type, sampling rate and component names from the FDSN lists.

ISF event type codes The list of ISF event type codes, used in the origin block of the Bulletin datatype, are a superset of the IMS1.0 event types. ISF parsers may parse codes not in the list as “uk” (unknown).

WDC/ISC agency codes ISF author fields all begin with internationally recognised agency codes. Further characters in author fields follow an underscore (_). The World Data Center/Denver for Seismology (WDC) and the ISC jointly maintain a list of recognised agency codes.

WDC/ISC station codes Each phase line contains either an an internationally recognised station code or network code. The WDC and ISC jointly maintain lists of recognised station and network codes. Within its own network, each agency assigned an internationally recognised network code is free to assign station codes that conform with existing standards. ISF writers will not write phases with network/station codes that are not internationally recognised. ISF parsers may ignore phases with network/station codes that are not internationally recognised.

ISF Comments

In ISF, an important extension of IMS1.0 is a set of rules for formatting comments to exchange types of data that are not accommodated in IMS1.0. The objective of the ISF standard is to allow recipients to utilise the full set of parameters in each message with minimal risk of misinterpretation. It would be possible to write an IMS1.0 message with custom, free-form comments containing data for which ISF includes special-purpose formatted comments. Such a message would not violate any of the ISF rules. Nevertheless, such messages fail to meet the ISF objectives, and might be described as incompletely formatted.

Comment Markers

Each ISF comment conforms with the IMS1.0 rules for comments within a bulletin:

- Each comment must be on a separate line
- Each comment line must begin with a single blank space
- Each comment must be enclosed within parentheses

Beyond the IMS1.0 comment rules the ISF standard includes additional rules to distinguish formatted comments. After the blank space and open parenthesis on each line, as required by IMS1.0, in an ISF formatted comment

- the first line begins with a hash mark (#) followed by a keyword identifying the type of formatted comment.
- each additional required line begins with a hash mark (#) and blank space at least as long as the keyword.
- each optional line begins with a plus sign (+) and blank space at least as long as the keyword.

On encountering the first line of an ISF formatted comment, a comment parser may be invoked. An ISF formatted comment parser must continue reading additional lines as part of the same ISF comment until encountering either a new ISF formatted comment, an unformatted comment, or a non-comment line.

Comment Terminators

The IMS1.0 standard does not state how parsers should handle bulletin comments that fail to be terminated with a close parenthesis. Such lines do not conform with the IMS1.0 standard and, conceivably, a strict IMS1.0 parser could reject that entire message as improperly formatted. In contrast, ISF comments are terminated by a carriage return. In order to conform with IMS1.0,

- ISF parsers are required to ignore a close parenthesis at the end of a comment line.
- ISF writers are required to insert a close parenthesis at the end of a comment line.

The IMS1.0 standard does not state whether or not pairs of parentheses are allowed within the outermost pair marking a comment. An IMS1.0 parser that ignores nesting of parentheses might terminate a comment at the first close parenthesis and neglect additional information on the line. The ISF standard avoids conflicts with this allowable behaviour by not requiring parentheses within any formatted comment. Nevertheless, unformatted comments in ISF messages may happen to include nested parentheses. This is allowed in ISF and provides no difficulty for ISF parsers, which define a comment as all characters between an initial open parenthesis and a carriage return, apart from an optional close parenthesis at the end of the comment.

Alignment

A fully compliant ISF writer aligns strings at the left side of character fields and aligns both integers and floating point numbers at the right side of numeric fields. A fully compliant ISF parser reads strings and numbers anywhere in a field, truncating both leading and trailing spaces before parsing. ISF writers do not use tab characters to align data in fields. ISF parsers may ignore any line that includes a tab character, and thus ignore any block or sub-block with a tab character in the header.

HTML Comments

Comments incorporating HyperText Markup Language (HTML) include or provide links to further information avilaible on the internet related to particular data in the ISF message. Since they may provide information related to any type of data, HTML comments are permitted in any block or sub-block of any data type of an ISF message. In order to minimize unnecessary text around images and links that can be included using HTML, there is no keyword for HTML comments. Instead, ISF parsers should recognise that lines beginning " (<" are comments containing HTML, so that the recipient may choose to use the HTML separately, such as automated retrieval of additional information, incorporation into other products, or separate storage for later use. There is no limit on the number of characters in an HTML comment since they are generally meant to be interpreted by HTML-capable applications rather then viewed as test. Note that additional HTML tags at the beginning or end of an ISF message may be required in order for the HTML within ISF comments to be used by web browsers or other HTML-capable applications.

Example: Bulletin with HTML Comments

```
<HTML>
<BODY>
<PRE>
DATA_TYPE BULLETIN ISF2.1:short
 (<A HREF="http://www.seismology.harvard.edu/cgi-bin/CMT/form"><IMG SRC=<http://www.seismology.harvard.edu/top_sm.gif></A>)
Event      934906 Kuril Islands, Russia
   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az Depth   Err Ndef Nsta Gap  mdist  Mdist Qual   Author      OrigID
1997/08/03 19:40:19.60   0.50        43.7300  147.4900   6.7 3.208   0  48.0                      2.00   4.00     uk JMA        2010572536
 (#PRIME)
 (<A HREF="ftp://www.iris.edu/">Spyder waveforms</A>)

Sta     Dist EvAz Phase         Time      TRes Azim AzRes    Slow   SR ...
JNK     2.02 267.0          19:41:16.2
 (<MAILTO="autodrm@anywhere.ac.ch">Waveforms from Swiss Seismological Service by e-mail)
JAK     2.17 251.0          19:41:21.5
JAR     2.74 262.0 P        19:41:03.0     0.8

STOP
</PRE>
</BODY>
</HTML>
```

Bulletin Data Type

Event Title Block

Table: Event Title Block

Record	Position	Format	Description
1	1-5	a9	`Event`
(data)	7-17	**a11**	Event identification number
	19-83	a65	Geographic region

Origin Block

Event Type Codes

Event type codes are used in columns 116-117 in origin lines. Most ISF event type codes are composed of a leading character that indicates the confidence with which the type of the event is asserted and a trailing character that gives the type of the event. The leading characters are

- `s` = suspected
- `k` = known
- `f` = felt (implies known)
- `d` = damaging (implies felt and known)

The trailing characters are

- `c` = meteoritic event
- `e` = earthquake
- `h` = chemical explosion
- `i` = induced event
- `l` = landslide
- `m` = mining explosion
- `n` = nuclear explosion
- `r` = rock burst
- `x` = experimental explosion

```
d     6440
f   198947
k  4217134
s  1541640
c       61
e  5085430
h   339604
i   163418
l      167
m   329388
n     2952
r    37038
x     6125
```

A chemical explosion might be for mining or experimental, and it is possible to conceive of other types of events that might be assigned two or more different event type codes. This is deliberate, and matches the ambiguous identification of events in existing databases. The leading and trailing characters may be used in any combination. In addition, an ISF writer uses the the code “uk“ for events of unknown type while ISF parsers recognise both “uk“ and “u “ as events of unknown type and “ls” as known landslides.

Table: Origin Block

Record	Position	Format	Description
1	4-7	a4	`Date`
(header)	15-18	a4	`Time`
	27-29	a3	`Err`
	33-35	a3	`RMS`
	37-44	a8	`Latitude`
	46-54	a9	`Longitude`
	57-60	a4	`Smaj`
	63-66	a4	`Smin`
	69-70	a2	`Az`
	72-76	a5	`Depth`
	80-82	a3	`Err`
	84-87	a4	`Ndef`
	89-92	a4	`Nsta`
	94-96	a3	`Gap`
	99-103	a5	`mdist`
	106-110	a5	`Mdist`
	112-115	a4	`Qual`
	119-124	a6	`Author`
	131-136	a6	`OrigID`
2	1-10	i4,a1,i2,a1,i2	epicenter date (yyyy/mm/dd)
(data)	12-22	i2,a1,i2,a1,f5.2	Epicenter time (hh:mm:ss.ss)
	23	a1	Fixed flag (f = fixed origin time solution, blank if not a fixed origin time)
	25-29	f5.2	Origin time error (seconds, blank if fixed origin time)
	31-35	f5.2	Root mean square of time residuals (seconds)
	37-44	f8.4	Latitude (negative for South)
	46-54	f9.4	Longitude (negative for West)
	55	a1	Fixed flag (f = fixed epicenter solution, blank if not a fixed epicenter solution)
	57-60	f4.1	Semi-major axis of 90% ellipse or its estimate (km blank if fixed epicenter)
	62-66	f5.1	Semi-minor axis of 90% ellipse or its estimate (km, blank if fixed epicenter)
	68-70	i3	Strioke (0 <= x <= 360) of error ellipse clockwise from North (degrees)
	72-76	f5.1	Depth (km)
	77	a1	Fixed flag (f = fixed depth epicenter, d = fixed to depth phase depth, blank if not a fixed depth)
	79-82	f4.1	Depth error (km, blank if fixed depth)
	84-87	i4	Number of defining phases
	89-92	i4	Number of defining stations
	94-96	i3	Gap in azimuth coverage (degrees)

	98-103	f6.2	Distance to closest station (degrees)
	105-110	F6.2	Distance to furthest station (degrees)
	112	a1	Analysis type (a = automatic, m = manual, g = guess)
	114	a1	Location method (I = inversion, p = pattern recognition, g = ground truth, o = other)
	116-117	a2	Event type code
	119-127	a9	Author of the origin
	129-139	**a11**	Origin identification

Magnitude Sub-Block

Magnitude Types

Each ISF magnitude type consists of a magnitude type, optionally concatenated with a magnitude type modifier. The magnitude types and type modifiers are from lists maintained by the International Seismological Centre and reviewed by the IASPEI Commission on Seismological Observation and Interpretation.

Table: Magnitude Sub-Block

Record	Position	Format	Description
1 (header)	1-9	a9	`Magnitude`
	12-14	a3	`Err`
	16-19	a4	`Nsta`
	21-26	a6	`Author`
	33-38	a6	`OrigID`
2 (data)	1-5	a5	Magnitude type (mb, MS, ML etc ...)
	6	a1	Min max indicator (<, > or blank)
	7-10	f4.1	Magnitude value
	12-14	f3.1	Standard magnitude error
	16-19	i4	Number of stations used to calculate magnitude
	21-29	a9	Author of the origin
	31-41	**a11**	Origin identification

Example: ISF 2.1 Event, origin and magnitude blocks

```
Event  612845212 Santa Cruz Islands
   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az Depth   Err Ndef Nsta Gap  mdist  Mdist Qual   Author      OrigID
2018/09/30 02:35:38.70   4.36 0.660 -10.8769  166.1094  22.4  21.4 159 106.5  39.0   20      117  11.13 164.59     uk IDC         613321297
2018/09/30 02:35:41.40   1.31 0.650 -10.8398  166.0483  17.0 13.76 224 123.7   7.9   50      109   6.17            se NEIC        611705787
2018/09/30 02:36:28.20        0.420 -14.5300  166.5900                   0.0               6                          NOU         613225714
 (Vanuatu Islands)
2018/09/30 02:35:38.75   0.47 1.369 -10.8235  166.1479  11.6 9.306  69 100.0f        79   83 101   5.39 164.62 m i se ISC         614714278
 (#PRIME)
 (Depth fixed by ISC Analyst)

Magnitude  Err Nsta Author      OrigID
mb      3.8 0.1   11 IDC         613321297
mbtmp   4.2 0.1   13 IDC         613321297
mb      4.5 0.1   43 NEIC        611705787
MLv     4.4        6 NOU         613225714
mb      4.5 0.1   37 ISC         614714278
```

Stations Used Magnitude Comment

Stations used to compute individual magnitudes cannot be discovered by consulting defining/nondefining fields in the associated phase list. That mechanism would be unworkable, since magnitudes of several different types may have equal priority. Ambiguity may arise when trying to determine which stations contribute to each magnitude, especially when several types from several different agencies are given. This formatted comment provides a means of resolving the ambiguity. Each station is identified by an internationally registered code or by a network/code pair, joined by a forward slash, where the network code is internationally registered. Station identifications are separated by whitespace.

Table: Formatted Stations Used Magnitude Comment

Record	Position	Format	Description
1	3-11	a9	`#STATIONS`
(data)	13-92	a80	NET/CODE NET/CODE NET/CODE
2	3-11	a1	`+`
(data)	13-92	a80	NET/CODE NET/CODE NET/CODE

Basis Parameter Magnitude Comment

The basis for some magnitudes is another earthquake parameter (e.g., seismic moment, epicentral intensity, or seismic class) rather than ground motion amplitude averaged over a group of stations. It is sometimes useful to know both the type and value of parameter from which the magnitude was computed.

Table: Formatted Basis Parameter Origin Comment

Record	Position	Format	Description
1	3-11	a9	`#BASIS`
(data)	13-92	a80	PARAM=VALUE

Example: Formatted Magnitude Comments

```
Magnitude  Err Nsta Author      OrigID
mb      5.0       12 NEIC      2010565629
mb      4.8       16 ISC       2010569961
 (#STATIONS CTA RANI WARB RMQ FORT)
 (+         STKA BBOO WOOL BAL YOU NJ2 SIMI MJAR TOO XAN)
MS      4.5       15 ISC       2010569763
mL      5.5        1 DJA       2010568853
mb      5.2        3 DJA       2010568649
 (#STATIONS DJA/WAMI AEKI DJA/PANC)
MS      5.5          KRSC      2010564733
 (#BASIS ENERGY_KLASS=12.2)
Mw      5.2          HRV       2010565315
```

Prime Origin Comments

Agencies may report several origins for each event, but residuals in the arrival block are reported with respect to just one of them. This will not necessarily be the preferred origin for all purposes, but it is necessary to designate the prime origin in order for the residuals to be useful. In ISF this origin is explicitly designated by a prime origin comment.

Table: Formatted Prime Origin Comment

Record	Position	Format	Description
1 (header)	3-8	a6	`#PRIME`

Example: Formatted Prime Origin Comment

```
 (#PRIME)
```

Centroid Origin Comments

Centroids and hypocentres represent different physical properties of an earthquake's finite rupture zone. But the loctyp code on the origin line is intended to distinguish different methods for computing origins. Thus, loctyp cannot be used to distinguish centroids from hypocentres without overloading that attribute. Instead, centroids are distinguished with a special purpose formatted comment. The comment indicates only that the origin is a hypocentre without giving any further details, which are assumed to be given on the preceding origin line. Thus, the only required line is the header with the keyword CENTROID.

Table: Formatted Centroid Origin Comment

Record	Position	Format	Description
1 (header)	3-11	a9	`#CENTROID`

Example: Formatted Centroid Origin Comment

```
 (#CENTROID)
```

Moment Tensor Origin Comments

Each moment tensor report is comprised of two header lines and a variable number of pairs of data lines. All of the moment tensors in one report are for the same origin, which precedes the report. Several items are omitted:

- Centroid, since it is presumed to precede in an origin line.
- The best fitting double-couple, since it could follow as a FAULT_PLANE comment.
- Principal axes, since they could follow as a PRINAX comment.
- M_W , since it could be included in the magnitude sub-block associated with the event.

Several redundant items are included:

- All three diagonal elements of the moment tensor are included since non-isotropic moment tensors may be reported occasionally.
- Scalar moment, fraction CLVD and their uncertainties are included since these may be the most frequently used moment tensor parameters.

Table: Formatted Moment Tensor Comment

Record	Position	Format	Description
1	3-10	a8	`#MOMTENS`
(header)	12-13	a2	`sc`
	18-19	a2	`M0`
	21-25	a5	`fCLVD`

	30-32	a3	MRR
	37-39	a3	MTT
	44-46	a3	MPP
	51-53	a3	MRT
	58-60	a3	MTP
	65-67	a3	MPR
	69-72	a4	NST1
	74-77	a4	NST2
	79-84	a6	Author
2	3	a1	#
(header)	17-19	a3	eM0
	21-25	a5	eCLVD
	30-32	a3	eRR
	37-39	a3	eTT
	44-46	a3	ePP
	51-53	a3	eRT
	58-60	a3	eTP
	65-67	a3	ePR
	69-72	a4	NCO1
	74-77	a4	NCO2
	79-86	a8	Duration
3	3	a1	#
(data)	12-13	i2	scale factor (log10 of number by which moment tensor components and their uncertainties must be multiplied to obtain Newton-meters)
	15-19	f5.3	scalar seismic moment
	21-25	f5.3	fraction of moment released as a compensated linear vector dipole
	27-32	f6.3	radial-radial element of moment tensor
	34-39	f6.3	theta-theta element of moment tensor
	41-46	f6.3	phi-phi element of moment tensor
	48-53	f6.3	radial-theta element of moment tensor
	55-60	f6.3	theta-phi element of moment tensor
	62-67	f6.3	phi-radial element of moment tensor
	69-72	i4	number of stations used, type 1
	74-77	i4	number of stations used, type 2
	79-87	a9	agency that computed the moment tensor
4	3	a1	#
(data)	15-19	f5.3	uncertainty of scalar seismic moment
	21-25	f5.3	uncertainty of fCLVD
	27-32	f6.3	uncertainty of radial-radial element
	34-39	f6.3	uncertainty of theta-theta element
	41-46	f6.3	uncertainty of phi-phi element
	48-53	f6.3	uncertainty of radial-theta element

	55-60	f6.3	uncertainty of theta-phi element
	62-67	f6.3	uncertainty of phi-radial element
	69-72	i4	number of components used, type 1
	74-77	i4	number of components used, type 2
	79-86	f8.2	presumed or computed source duration (seconds)

Example: Formatted Moment Tensor Comment

```
(#MOMTENS sc      M0 fCLVD    MRR    MTT    MPP    MRT    MTP    MPR NST1 NST2 Author  )
(#               eM0 eCLVD    eRR    eTT    ePP    eRT    eTP    ePR NCO1 NST2 Duration)
(#        27  2.109 0.345  1.601 -6.298  1.543 -3.456  8.901 -1.234   12  123 HRVD    )
(#              0.100 0.045  0.200  0.300  0.300  0.200  0.100  0.100   23  246    30.20)
```

Fault Plane Solution Origin Comments

Either one plane or two may be given.

Table: Fault Plane Solution Origin Comment

Record	Position	Format	Description
1	3-14	a12	`#FAULT_PLANE`
(header)	16-18	a3	`Typ`
	20-25	a6	`Strike`
	29-31	a3	`Dip`
	36-39	a4	`Rake`
	42-43	a2	`NP`
	46-47	a2	`NS`
	49-53	a5	`Plane`
	55-60	a6	`Author`
2	3	a1	`#` first plane, `+` second plane
(data)	16-18	a3	Fault plane solution computed from: `FM` = first motions `BB` = fit to broadband waveforms `BDC` = best double couple
	20-25	f6.2	Strike of either nodal plane (degrees, 0 to 360)
	27-31	f5.2	Dip of the same nodal plane (degrees, 0 to 90)
	33-39	f7.2	Rake of slip vector in the described plane (degrees, -180 to +180; required if only one plane is given)
	41-43	i3	For type = `FM`, number of P polarities For type = `BB`, number of stations For type = `BDC`, not used
	45-47	i3	For type = `FM`, number of S polarisations For type = `BB`, not used For type = `BDC`, not used
	49-53	a5	Plane identification `FAULT` = this is the preferred fault plane `AUXIL` = this is the auxiliary plane = neither plane is preferred as the fault
	55-63	a9	agency that computed the fault plane solution (neither required nor parsed for second plane)

Examples: Formatted Focal Mechanism Comment

```
(#FAULT_PLANE Typ Strike   Dip    Rake  NP  NS Plane Author   )
(#           BDC  25.00 80.00   90.00              GCMT     )
(+               203.00 10.00   88.00                       )
```

Principal Axes Origin Comments

Principal axes can be computed from either a moment tensor or a fault plane solution. A bulletin may include the principal axes alone, or as well as the moment tensor or fault plane solution from which they were computed. Principal values are optional since they may not be available if the principal axes are computed from a fault plane solution based on first motions.

The error header and error lines are each optional. ISF writers should write the error header if the error data line is written. ISF parsers should be able to parse the error line regardless of whether or not the error header line is present.

Table: Formatted Principal Axes Origin Comment

Record	Position	Format	Description
1	3-9	a7	`#PRINAX`
(header)	11-12	a2	`sc`
	15-19	a5	`T_val`
	21-26	a6	`T_azim`
	29-32	a4	`T_pl`
	35-39	a5	`B_val`
	41-46	a6	`B_azim`
	49-52	a4	`B_pl`
	55-59	a5	`P_val`
	61-66	a6	`P_azim`
	69-72	a4	`P_pl`
	74-79	a6	`Author`
2	3	a1	`+`
(header)	17-19	a3	`eTv`
	24-26	a3	`eTa`
	30-32	a3	`eTp`
	37-39	a3	`eBv`
	44-46	a3	`eBa`
	50-52	a3	`eBp`
	57-59	a3	`ePv`
	64-66	a3	`ePa`
	70-72	a3	`ePp`
	74-78	a5	`fCLVD`

(continued)

Table: Formatted Principal Axes Origin Comment (continued)

3	3	a1	#
(data)	11-12	i2	scale factor (log10 of number by which moment tensor components and their uncertainties must be multiplied to obtain Newton-meters; optional)
	14-19	f6.3	largest principal value (optional)
	21-26	f6.2	largest principal value axis azimuth
	28-32	f5.2	largest principal value axis plunge
	34-39	f6.3	middle principal value (optional)
	41-46	f6.2	middle principal value axis azimuth
	48-52	f5.2	middle principal value axis plunge
	54-59	f6.3	smallest principal value (optional)
	61-66	f6.2	smallest principal value axis azimuth
	68-72	f5.2	smallest principal value axis plunge
	74-82	a9	agency that computed the principal axes
4	3	a1	+
(data)	15-19	f5.3	uncertainty of T principal value (optional)
	21-26	f6.2	uncertainty of T axis azimuth
	28-32	f5.2	uncertainty of T axis plunge
	35-39	f5.3	uncertainty of B principal value (optional)
	41-46	f6.2	uncertainty of B axis azimuth
	48-52	f5.2	uncertainty of B axis plunge
	55-59	f5.3	uncertainty of P principal value (optional)
	61-66	f6.2	uncertainty of P axis azimuth
	68-72	f5.2	uncertainty of P axis plunge
	74-78	f5.3	fraction of the moment release as compensated linear vector dipole (optional)

Example: Formatted Principal Axes Origin Comment

```
(#PRINAX sc  T_val T_azim  T_pl  B_val B_azim  B_pl  P_val P_azim  P_pl Author)
(+             eTv    eTa   eTp    eBv    eBa   eBp    ePv    ePa   ePp fCLVD)
(#       27  1.123   0.00  0.00 -0.123 180.00 90.00 -1.000  90.00  0.00 ERI)
(+           0.100  10.00 10.00  0.100  10.00 10.00  0.100  10.00 10.00 0.403)
(+       computed from moment tensor; T axis very uncertain)
```

Additional Parameter Origin Comments

After the keyword PARAM, each origin parameter comment consists of name followed by an equal sign and a value. The name is from a list of earthquake parameters maintained by the International Seismological Centre and reviewed by the IASPEI Commission on Seismological Observation and Interpretation. Spaces are not allowed before or after the equal sign, but are instead reserved as a separator between measurements. Uncertainty is optionally given following a plus sign. Units are not given for the measurements, but specified for each standard measurement name (e.g., STRESS_DROP must be given in Pascals). Values must be stated as real numbers including a decimal point and may include an exponent, indicated by an upper-case "E", e.g., 1.0E27

Table: Formatted Additional Parameter Origin Comment

Record	Position	Format	Description
1	3-8	a6	`#PARAM`
(data)	10-89	a80	NAME=VALUE NAME=VALUE

Example: Formatted Additional Origin Measurement Comment

```
Event      934904 Irian Jaya region
   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az Depth
1997/08/03 19:09:06.60   2.20 1.230  -0.5910  135.7600 4.780   4.3  90  21.1
 (#PRIME)
 (#PARAM pP_DEPTH=20+1)
```

Effects Block

The Effects Block giving macroseismic observations is comprised of one header line, an optional summary data line, and any number of particular data lines. Each data line, including the summary, may be followed by comment lines giving further description of the effects. The descriptive comment lines provide further information about the immediately preceding data line; the author and location of the effects described are as given in the preceding data line.

Apart from the optional summary line, each data line must include one quantitative statement of the location of the observer, which may be latitude and longitude, distance and azimuth from the origin, country and postal code, or seismic network and station code. The location is preceded by a location type code.

There may be at most one summary data line, which is recognised by a unique location type code. The effects in the summary data line show the maximum known effects at any location, and may include effects not attributed to particular locations in further data lines in the block. The summary line may be followed by comment lines describing effects that are not attributed to any particular location.

Table: Effects Block

Record	Position	Format	Description
1	1-7	a7	`Effects`
(header)	22-27	a6	`Loctyp`
	29-36	a8	`Location`
	48-56	a9	`Intensity`
	58-62	a5	`Scale`
	64-69	a6	`Author`
2	1	a1	heard flag (`H` or _)
(data)	2	a1	felt flag (`F` or _)
	3	a1	damage flag (`D` or _) (includes livestock casualties)
	4	a1	human casualties flag (`C` or _)

5	a1	uplift flag (U or _)
6	a1	subsidence flag (S or _)
7	a1	surface faulting flag (F or _)
8	a1	tsunami flag (T, _, or Q for wave action that may have been a tsunami)
9	a1	seiche flag (S, _, or Q for wave action that may have been a seiche)
10	a1	volcanism flag (V or _)
11	a1	acoustic waves flag (A or _)
12	a1	gravity waves flag (G or _)
13	a1	T-waves flag (T or _)
14	a1	liquefaction flag (L or _)
15	a1	geyser flag (G or _)
16	a1	landslides or avalanches flag (S or _)
17	a1	sandblows flag (B or _)
18	a1	ground cracks flag (C or _) (excludes cracks due to surface faulting)
19	a1	earthquake lights flag (V or _)
20	a1	odours flag (O or _)
22-27	a6	location type: one of Summar (allowed only on the first line) LatLon DistAz CoPost StaNet
		location of conforming type: one of blank
29-46	f8.4 f9.4	latitude(<0 for S) longitude(<0 for W)
29-41	f8.2 f4.0	distance (kilometres) azimuth (degrees)
29-42	a3 a10	country postal-code
29-43	a9 a5	network-code station-code
48-51	f4.1	first value of maximum intensity
52	a1	intensity modifier: (often blank, if second intensity is given must be -, only other allowed value is +)
53-56	f4.1	second value of maximum intensity (permitted only if modifier is -)
58-62	a5	intensity scale
64-72	a9	author of the intensity data

Example: Macroseismic Effects Block

```
Effects              LocTyp Latitude Longitude Intensity Scale Author)
_F_CU_FTQ______SBC__ Summar                     11.0      MMS   NEIS)
___CU_FTQ______SBC__ LatLon +60.1234 -000.1234 10.0-10.5 EMS   T_Blair)
 (Big Ben toppled, stopped showing 05:01)
```

Reference Block

The reference block is an ISF extension of IMS1.0. It is used to cite further of information about the event, other than seismic bulletins. Such sources are generally papers in journals.

Table: Reference Block

Record	Position	Format	Description
1	1-4	a4	`Year`
(header)	6-11	a6	`Volume`
	13-17	a5	`Page1`
	19-23	a5	`Page2`
	25-31	a7	`Journal`
2	1-4	i4	Year in which the paper was published
(data)	6-11	i6	Volume number of the journal in which the paper was published
	13-17	i5	Page in the journal on which the paper begins
	19-23	i5	Page in the journal on which the paper ends
	25-90	a66	Name or abbreviated name of the journal in which the paper was published

Table: Formatted Author Reference Comment

Record	Position	Format	Description
1	3-9	a7	`#AUTHOR`
(data)	11-90	a80	Surname,Initials, Surname,Initials, with white space only between authors.
2	3	a1	`+`
(data)	11-90	a80	further Surname, Initials, Surname, Initials, (, et al. is appended to partial a author list)

Table: Formatted Title Reference Comment

Record	Position	Format	Description
1	3-8	a6	`#TITLE`
(data)	11-90	a80	Title of the paper cited
2	3	a1	+
(data)	11-90	a80	Further words of the title of the paper

Example: Reference Block with Author and Title Comments

```
Year Volume Page1 Page2 Journal
1992     17    23     0 Nat. Haz. Observer
 (#TITLE Review of 'The Landers and Big Bear earthquakes of June 28, 1992)
 (+          by EQE International')
1992     73   417   418 EOS. Trans. Am. geophys. Un.
 (#AUTHOR Mori,J., Hudnut,K., Jones,L.M., et al.)
 (#TITLE Rapid scientific response to Landers quake)
```

Phase Block

Seismological agencies often wish to exchange information about phases further to that in the phase lines in a Bulletin. There is too much of this to include by extension of the phase lines; they would be far too long to be readily printed or viewed on-line. Some of the information is also required for a large fraction of all phases. Including comments after many of the phase lines would significantly interfere with scanning the phases to judge the quality of the solution. The alternative adopted for ISF is a new sub-block. Formatted comments of the phase information sub-block are also permitted in the phase block.

Phase Block

Table: Phase Block Format

Record	Position	Format	Description
1	1-3	a3	`Sta`
(header)	9-12	a4	`Dist`
	15-18	a4	`EvAz`
	20-24	a5	`Phase`
	33-36	a4	`Time`
	43-46	a4	`TRes`
	49-52	a4	`Azim`
	54-58	a5	`AzRes`
	62-65	a4	`Slow`
	69-72	a4	`SRes`
	74-76	a3	`Def`
	80-82	a3	`SNR`
	90-92	a3	`Amp`
	96-98	a3	`Per`
	100-103	a4	`Qual`
	105-113	a9	`Magnitude`
	118-122	a5	`ArrID`
	127-129	***a3***	***`Agy`***
	133-138	***a6***	***`Deploy`***
	142-143	***a2***	***`Ln`***
	145-148	***a4***	***`Auth`***
	151-153	***a3***	***`Rep`***
	157-159	***a3***	***`PCh`***
	161-163	***a3***	***`ACh`***
	165	***a1***	***`L`***
	169-171	***a3***	***`Lat`***
	179-181	***a3***	***`Lon`***
	187-190	***a4***	***`Elev`***
	195-199	***a5***	***`Depth`***

(continued)

Table: Phase Block Format (continued)

2-n	1-5	a5	station code
(data)	7-12	f6.2	station-to-event distance (degrees)
	14-18	f5.1	event-to-station azimuth (degrees)
	20-27	a8	phase code
	29-40	i2,a1,i2,a1,f6.3	arrival time (hh:mm:ss.sss)
	42-46	f5.1	time residual (seconds)
	48-52	f5.1	observed azimuth (degrees)
	54-58	f5.1	azimuth residual (degrees)
	60-65	f5.1	observed slowness (seconds/degree)
	67-72	f5.1	slowness residual (seconds/degree)
	74	a1	time defining flag (T or _)
	75	a1	azimuth defining flag (A or _)
	76	a1	slowness defining flag (S or _)
	78-82	f5.1	signal-to-noise ratio
	84-92	f9.1	amplitude (nanometers)
	94-98	f5.2	period (seconds)
	100	a1	type of pick (a = automatic, m = manual)
	101	a1	direction of short period motion (c = compression, d = dilatation, _= null)
	102	a1	onset quality (i = impulsive, e = emergent, q = questionable, _ = null)
	104-108	a5	magnitude type (mb, Ms, ML, mbmle, msmle)
	109	a1	min max indicator (<, >, or blank)
	110-113	f4.1	magnitude value
	115-122	a8	arrival identification
	123-125	***a3***	***optional extension of arrival identification***
	127-131	***a5***	***agency (ADSL)***
	133-140	***a8***	***deployment (ADSL)***
	142-143	***a2***	***location (ADSL)***
	145-149	***a5***	***author of data***
	151-155	***a5***	***reporter of data***
	157-159	***a3***	***phase channel***
	161-163	***a3***	***amplitude channel***
	165	***a1***	***direction of long period first motion***
	167-174	***f8.4***	***latitude of station***
	176-184	***f9.4***	***longitude of station***
	186-192	***f7.1***	***elevation of station at surface***
	194-199	***f6.1***	***instrument depth below surface***

Phase Information Sub-block

Each line in this sub-block is linked to a phase by sharing a common ArrID, just as each line in the magnitude sub-block is linked to an origin using by sharing a common OrigID.

Table: Phase Information Sub-block

Record	Position	Format	Description
1	1-3	a3	`Net`
(header)	10-13	a4	`Chan`
	15	a1	`F`
	17-21	a5	`Low_F`
	23-27	a5	`HighF`
	29-36	a8	`AuthPhas`
	41-44	a4	`Date`
	50-54	a5	`eTime`
	56-60	a5	`wTime`
	62-66	a5	`eAzim`
	68-72	a5	`wAzim`
	75-79	a5	`eSlow`
	81-85	a5	`wSlow`
	92-95	a4	`eAmp`
	98-101	a4	`ePer`
	103-106	a4	`eMag`
	108-113	a6	`Author`
	119-123	a5	`ArrID`

(continued)

Table: Phase Information Sub-block (continued)

2	1-9	a9	WDC/ISC network code (station codes may be unique only within networks)
(data)	11-13	a3	FDSN channel code
	15	a1	Filter type: C = causal 0 = zero phase
	17-21	f5.*	Minimum frequency of the filter pass band
	23-27	f5.*	Maximum frequency of the filter pass band
	29-36	a8	phase identification by the author, i.e., the agency that read the waveform
	38-47	i4,a1,i2,a1,i2	arrival date (yyyy/mm/dd)
	49-54	f6.3	uncertainty of the phase arrival time
	56-60	f5.3	posterior weight of the time in computing the prime hypocenter (a dimensionless real number normally in the range 0.0 - 1.0; not a subjective description of relative quality)
	62-66	f5.1	uncertainty of the measured azimuth
	68-72	f5.3	posterior weight of the azimuth
	74-79	f6.1	uncertainty of the measured slowness
	81-85	f5.3	posterior weight of the slowness
	87-95	f9.1	Uncertainty of the measured amplitude
	97-101	f5.2	Uncertainty of the measured period
	103-105	f3.1	Uncertainty of the station magnitude
	107-114	a8	Author, i.e., ISC/WDC code of the agency reading the waveform.
	116-123	a8	ArrID of the phase to which these uncertainties apply
	124-126	***a3***	***optional extension of arrival identification***

Example: Phase Block , Phase Information Sub - block, and Phase Information Sub-block Formatted Comments

```
Sta      Dist  EvAz Phase         Time      TRes  Azim AzRes   Slow   SRes Def   SNR       Amp   Per Qual Magnitude    ArrID Agy  Deploy   Ln Auth  Rep   PCh ACh L   Lat       Lon      Elev    Depth
OJC      0.55  82.4 Pg       00:09:09.3     1.1                            ___                       _e              752078604 FDSN PL       -- WAR   WAR   ??Z ??? _  50.2195   19.7984   391.0   30.0
OJC      0.55  82.4 Sg       00:09:16.58                                   ___                       _e              752078604 FDSN PL       -- WAR   WAR   ??N ??? _  50.2195   19.7984   391.0   30.0
MORC     0.98 248.2 Pg       00:09:19.7          63.7                      ___                       _e              790040167 FDSN M1       -- IPEC  IPEC  ??? ??? _  49.7768   17.5425   742.0    0.0
MORC     0.98 248.2 Sg       00:09:32.0          63.7                      ___            9.5  0.19  _e              790040167 FDSN M1       -- IPEC  IPEC  ??? ??? _  49.7768   17.5425   742.0    0.0
MORC     0.98 248.2 Pb       00:09:19.7     0.1                            ___                       _e              790074754 FDSN M1       -- IPEC  IPEC  ??? ??? _  49.7768   17.5425   742.0    0.0
MORC     0.98 248.2 SG       00:09:32.0                                    ___                       _e              790074754 FDSN M1       -- IPEC  IPEC  ??? ??? _  49.7768   17.5425   742.0    0.0
NIE      1.14 129.4 Pn       00:09:22.86    0.3                            ___                       _e              752078605 FDSN PL       -- WAR   WAR   ??Z ??? _  49.4182   20.2996   645.0    0.0
NIE      1.14 129.4 Sg       00:09:40.88                                   ___                       _e              752078605 FDSN PL       -- WAR   WAR   ??E ??? _  49.4182   20.2996   645.0    0.0
KRLC     1.40 267.8 PG       00:09:25.4                                    ___                       _e              815518292 ISC  IR       -- PRU   PRU   ??? ??? _  50.0753   16.7817   754.0    0.0
KRLC     1.40 267.8 SG       00:09:43.9                                    ___            8.0  0.40  _e ML      1.2  815518292 ISC  IR       -- PRU   PRU   ??Z ??? _  50.0753   16.7817   754.0    0.0
JAVC     1.54 213.3 Pn       00:09:29.1          31.7                      ___                       _e              790040165 FDSN OE       -- IPEC  IPEC  ??? ??? _  48.8591   17.6707   827.6    0.0
JAVC     1.54 213.3 Pb       00:09:29.2     0.1                            ___                       _e              790073666 FDSN OE       -- IPEC  IPEC  ??? ??? _  48.8591   17.6707   827.6    0.0
STHS     1.66 115.4 Pn       00:09:30.4     0.1                            ___                       _e              832657624 FDSN SK       -- BRA   BRA   ??? ??? _  49.4167   21.2437   534.0    0.0
STHS     1.66 115.4 SN       00:09:55.1                                    ___                       _e              832657624 FDSN SK       -- BRA   BRA   ??? ??? _  49.4167   21.2437   534.0    0.0
STHS     1.66 115.4 LG       00:10:02.7                                    ___                       _e              832657624 FDSN SK       -- BRA   BRA   ??? ??? _  49.4167   21.2437   534.0    0.0
VYHS     1.66 182.6 Pn       00:09:30.4     0.1                            ___                       _e              832656662 FDSN SK       -- BRA   BRA   ??? ??? _  48.4940   18.8361   480.0    0.0
VYHS     1.66 182.6 SN       00:09:53.6                                    ___                       _e              832656662 FDSN SK       -- BRA   BRA   ??? ??? _  48.4940   18.8361   480.0    0.0
DPC      1.70 277.8 PG       00:09:29.9                                    ___                       _e              815518289 FDSN CZ       -- PRU   PRU   ??? ??? _  50.3502   16.3222   748.0    0.0
DPC      1.70 277.8 SG       00:09:53.7                                    ___            5.8  0.50  _e ML      1.2  815518289 FDSN CZ       -- PRU   PRU   ??Z ??? _  50.3502   16.3222   748.0    0.0

Net       Chan F Low_F HighF AuthPhas    Date     eTime wTime eAzim wAzim  eSlow wSlow      eAmp  ePer eMag Author     ArrID
 (#OrigID 12345678)
IMS        BZH C  1.00  10.0 Pg       1997/01/01  0.200 0.000  10.0 0.400    2.5 0.400       0.1  0.05 1.0 EIDC       25636151
IMS        BZH C  1.00  10.0 pPKKPPKP 1997/01/01 99.200 0.000  10.0 0.400    2.5 0.400       0.1  0.05     EIDC       25616240
IMS        BZH C  1.00  10.0 P        1997/01/01  0.200 0.000  10.0 0.400    2.5 0.400       0.1  0.05     EIDC       25616246
IMS        BZH C  1.00  10.0 P        1997/01/01  0.200 0.000  10.0 0.400    2.5 0.400       0.1  0.05     EIDC       25616266
 (#MEASURE RECTILINEARITY=0.8)
IMS        BZH C  1.00  10.0 LR       1997/01/01        0.000  10.0 0.400    2.5 0.400 1234567.9  1.00     EIDC       25636151
 (#ORIG   PZH NRA0                    1997/01/01 01:27:05.123 359.9       1234.5          123.4       1.3)
 (#MIN                                          -99.999      -100.0      -1000.0       -1234567.9     -10.23)
 (#MAX                                          +99.999      +100.0      +1000.0       +1234567.9     +10.23)
 (#COREC                                         +0.500      -100.0      -1234.5                        0.12)
```

OrigID Phase and Phase Information Comments

Some data in the phase block and phase information sub-block connect an arrival with an origin, e.g., residuals. In IMS1.0 it is implicit that origin-specific data in the phase block refer to a primary or preferred origin. In ISF, a formatted comment may be used immediately after the phase block header or phase information sub-block header to state the OrigID explicitly. ISF also allows multiple phase blocks and phase information sub-blocks, but only if an OrigID comment is given for each one.

Table: Formatted OrigID Phase and Phase Information Comments

Record	Position	Format	Description
1	3-9	a7	`#OrigID`
(data)	11-21	**a11**	origin identification

Measurement Range Phase Information Comments

Asymmetrical phase measurement uncertainties are stated as pairs of formatted comment lines in the phase information sub-block. The offsets from the preferred values to the minima and maxima are signed values, aligned under the uncertainties so that they are easy to read and so that the sub-block header identifies which uncertainties are being stated. There are no required fields; offsets to minimum and maximum arrival time, for example, could be stated without stating a range for any other parameters. All offsets are arithmetic (plus or minus) rather than geometric (times or divided by).

The basis for and use of ranges is not part of the format standard. For example, some agencies might compute minimum and maximum magnitudes based on the minimum and maximum amplitudes while others use the range of distances allowed by the minimum and maximum slownesses.

Table: Formatted Measurement Range Phase Information Comments

Record	Position	Format	Description
1	3-6	a4	`#MIN`
(data)	48-54	f7.3	offset to minimum arrival time (seconds)
	61-66	f6.1	offset to minimum azimuth (degrees)
	73-79	f7.1	offset to minimum slowness (seconds/degree)
	86-95	f10.1	offset to minimum amplitude (nanometers)
	96-101	f6.1	offset to minimum period (seconds)
	102-105	f4.1	offset to minimum magnitude value
2	3-6	a4	`#MAX`
(data)	48-54	f7.3	offset to maximum arrival time (seconds)
	61-66	f6.1	offset to maximum azimuth (degrees)
	73-79	f7.1	offset to maximum slowness (seconds/degree)
	86-95	f10.1	offset to maximum amplitude (nanometers)
	96-101	f6.1	offset to maximum period (seconds)
	102-105	f4.1	offset to maximum magnitude value

Additional Phase Measurement Comments

Measurements additional to those in the phase information lines may be placed in comments. After the keyword MEASURE, a phase measurement comment consists of standard measurement names, each followed by an equal sign and a value then, optionally, a plus sign and an uncertainty. The names are from a list maintained by the International Seismological Centre and reviewed by the IASPEI Commission on Seismological Observation and Interpretation, (http://www.isc.ac.uk/standards/phases/). Spaces are not allowed before or after the equal sign or the plus sign, but reserved as a separator between measurements. Units are not given for the measurements, but specified for each standard measurement name.

Example: Additional Phase Measurement Comment

```
(#MEASURE CODA_DURATION=5.4+0.2)
```

Measurement Correction Phase Information Comments

Corrections are model-based changes applied to phase measurements to remove bias from computed origin parameters. The basis for and use of corrections is not part of the format standard, e.g. some agencies might use static station corrections for time and slowness while others use source-dependent corrections. A bulletin might include both amplitude and magnitude corrections, one from focal mechanisms and the other on near-station attenuation.

Phase measurement corrections are stated as a single formatted comment line in the phase information sub-block. The corrections are aligned under the measured values so that they are easy to read and so that the sub-block header identifies which corrections are being stated. There are no required fields; amplitude correction, for example, could be stated without stating uncertainty in any other parameters. The values stated are arithmetic corrections, rather than corrected values. That is, the corrections were added to or subtracted from the measurements before being used to compute hypocentral parameters.

Table: Formatted Phase Measurement Correction Comment

Record	Position	Format	Description
1	3-8	a6	`#COREC`
(data)	48-54	f7.3	arrival time correction (seconds)
	61-66	f6.1	observed azimuth correction (degrees)
	73-79	f7.1	observed slowness correction (seconds/degree)
	86-95	f10.1	amplitude correction (nanometers)
	96-101	f6.1	period correction (seconds)
	102-106	f5.2	magnitude value correction

Original Value Phase Information Comments

Agencies compiling bulletins may correct apparent blunders (e.g., minute errors or non-standard units) or standardise presentation (e.g., increment minute and subtract 60 from seconds). Some agencies translate local station codes or phase identifications to international standards. Original values can be useful for judging the reliability of “corrected” values. Since original values include blunders and local usage, they do not necessarily comply with conventions for dates and times, phase names, channels, station codes, etc. The originally reported slowness, amplitude and period are not necessarily in the standard units.

Table: Formatted Original Phase Values

Record	Position	Format	Description
1	3-7	a5	`#ORIG`
(data)	11-13	a3	originally reported channel code
	15-22	a8	originally reported station code
	38-47	i4,a1,i2,a1,i2	originally reported date (yyyy/mm/dd)
	49-60	i2,a1,i2,a1,f6.3	originally reported arrival time (hh:mm:ss.sss)
	62-66	f5.1	originally reported observed azimuth (degrees)
	74-79	f6.1	originally reported observed slowness (seconds/degree)
	87-95	f9.1	originally reported amplitude (nanometers)
	97-101	f5.2	originally reported period (seconds)
	103-105	f3.1	originally reported station magnitude

Arrival Data Type

The ARRIVAL data type is divided into five subtypes (automatic, reviewed, grouped, associated, and unassociated) to reflect the different processing stages.

Automatic Arrival / Unassociated Arrival

The automatic subtype provides the result of a detection process run on waveforms. The format for the automatic data subtype is given in the table below and an example follows.

The unassociated subtype is used for arrivals that have been detected and reviewed, but have not been associated with a seismic origin. The format of the unassociated subtype line is the same as the format for the automatic subtype.

Table: Automatic Arrival Format

Record	Position	Format	Description
1	1-3	a3	Net
(header)	11-13	a3	Sta
	17-22	a6	BeamID
	33-36	a4	Date
	44-47	a4	Time
	54-58	a5	Phase
	64-67	a4	Azim
	70-73	a4	Slow
	77-79	a3	SNR
	87-89	a3	Amp
	93-95	a3	Per
	99-101	a3	STA
	105-107	a3	Dur
	109-114	a6	Author
	122-126	a5	DetID
	131-133	***a3***	***Agy***
	137-142	***a6***	***Deploy***
	146-147	***a2***	***Ln***
	149-152	***a4***	***Auth***
	155-157	***a3***	***Rep***
	161-163	***a3***	***PCh***
	165-167	***a3***	***ACh***
	169	***a1***	***L***
	173-175	***a3***	***Lat***
	183-185	***a3***	***Lon***
	191-194	***a4***	***Elev***
	199-203	***a5***	***Depth***

(continued)

Table: Automatic Arrival Format (continued)

2-n	1-9	a9	network code
(data)	11-15	a5	station code
	17-28	a12	beam identifier
	30-39	i4,a1,i2,a1,i2	detection date (yyyy/mm/dd)
	41-52	i2,a1,i2,a1,f6.3	detection time (hh:mm:ss.sss)
	54-61	a8	preliminary phase code
	63-67	f5.1	observed azimuth (degrees)
	69-73	f5.1	observed slowness (seconds/degree)
	75-79	f5.1	signal-to-noise ratio
	81-89	f9.1	amplitude (nanometers)
	91-95	f5.2	period (seconds)
	97-101	f5.1	short-term average
	103-107	f5.1	detection duration (seconds)
	109-117	a9	author of the detection
	119-126	a8	detection identifier
	127-129	***a3***	***optional extension of detection identification***
	131-135	***a5***	***agency (ADSL)***
	137-144	***a8***	***deployment (ADSL)***
	146-147	***a2***	***location (ADSL)***
	149-153	***a5***	***author of data***
	155-159	***a5***	***reporter of data***
	161-163	***a3***	***phase channel***
	165-167	***a3***	***amplitude channel***
	169	***a1***	***direction of long period first motion***
	171-178	***f8.4***	***latitude of station***
	180-188	***f9.4***	***longitude of station***
	190-196	***f7.1***	***elevation of station at surface***
	198-203	***f6.1***	***instrument depth below surface***

Example: Arrival:Automatic
(Please note that data has been edited to create this example)

```
DATA TYPE   ARRIVAL:AUTOMATIC ISF2.1
Net       Sta   BeamID          Date       Time      Phase     Azim  Slow  SNR        Amp   Per   STA   Dur Author       DetID    Agy   Deploy   Ln Auth  Rep   PCh ACh L   Lat       Lon     Elev    Depth
IDC_SEIS  BBB   BP0.5_4.0    1996/08/16 03:41:40.523 P        256.3  16.2  13.4     228.6  0.33   4.5   0.2 IDC_REB   11618391411 ISC   IR       -- TAP   TAP   ???        24.4453  121.7783    37.0    0.0
IDC_SEIS  BBB   BP0.2_1.0    1996/08/16 03:42:04.531 S        334.7  18.6   8.2     338.6  0.33   9.1   1.2 IDC_REB   11618393412 ISC   IR       -- TAP   TAP   ???        24.4453  121.7783    37.0    0.0
IDC_SEIS  DLBC  BP0.2_2.0    1996/08/16 03:42:58.584 P        166.7  16.5  16.5       1.5  0.33   2.0   0.4 IDC_REB   11618396413 ISC   IR       -- TAP   TAP   ???        24.4280  121.7410   113.0    0.0
IDC_SEIS  DLBC  BP0.4_6.0    1996/08/16 03:44:59.808                                                        IDC_REB   11621022414 ISC   IR       -- TAP   TAP   ???        24.4280  121.7410   113.0    0.0
```

Reviewed Arrivals

The reviewed subtype is used for arrivals that have been reviewed and assigned phase names. Phase names are not expected to have been verified by location. The table below gives the format for the reviewed data subtype, and an example is provided following the table.

Table: Reviewed Arrival Format

Record	Position	Format	Description
1	1-3	a3	Net
(header)	11-13	a3	Sta
	16-19	a4	Chan
	22-24	a3	Aux
	30-33	a4	Date
	40-43	a4	Time
	50-54	a5	Phase
	60-63	a4	Azim
	66-69	a4	Slow
	73-75	a3	SNR
	83-85	a3	Amp
	89-91	a3	Per
	93-96	a4	Qual
	98-103	a6	Author
	110-114	a5	ArrID
	119-121	***a3***	***Agy***
	125-130	***a6***	***Deploy***
	134-135	***a2***	***Ln***
	137-140	***a4***	***Auth***
	143-145	***a3***	***Rep***
	149-151	***a3***	***PCh***
	153-155	***a3***	***ACh***
	157	***a1***	***L***
	161-163	***a3***	***Lat***
	171-173	***a3***	***Lon***
	179-182	***a4***	***Elev***
	187-191	***a5***	***Depth***

(continued)

Table: Reviewed Arrival Format (continued)

2-n	1-9	a9	network code
(data)	11-15	a5	station code
	17-19	a3	FDSN channel code
	21-24	a4	auxiliary identification code
	26-35	i4,a1,i2,a1,i2	arrival date (yyyy/mm/dd)
	37-48	i2,a1,i2,a1,f6.3	arrival time (hh:mm:ss.sss)
	50-57	a8	phase code
	59-63	f5.1	observed azimuth (degrees)
	65-69	f5.1	observed slowness (seconds/degree)
	71-75	f5.1	signal-to-noise ratio
	77-85	f9.1	amplitude (nanometers)
	87-91	f5.2	period (seconds)
	93	a1	type of pick (a = automatic, m = manual)
	94	a1	direction of short period motion (c = compression, d = dilatation, _ = null)
	95	a1	detection character (i =impulsive, e = emergent, q = questionable, _ = null [see Table 9])
	97-105	a9	author of the arrival
	107-114	a8	arrival identification
	115-117	***a3***	***optional extension of arrival identification***
	119-123	***a5***	***agency (ADSL)***
	125-132	***a8***	***deployment (ADSL)***
	134-135	***a2***	***location (ADSL)***
	137-141	***a5***	***author of data***
	143-147	***a5***	***reporter of data***
	149-151	***a3***	***phase channel***
	153-155	***a3***	***amplitude channel***
	157	***a1***	***direction of long period first motion***
	159-166	***f8.4***	***latitude of station***
	168-176	***f9.4***	***longitude of station***
	178-184	***f7.1***	***elevation of station at surface***
	186-191	***f6.1***	***instrument depth below surface***

Example: Reviewed Arrival Format

```
DATA_TYPE ARRIVAL:REVIEWED ISF2.1
Net        Sta  Chan  Aux      Date       Time       Phase     Azim  Slow   SNR       Amp   Per Qual Author       ArrID  Agy   Deploy   Ln Auth  Rep   PCh ACh L   Lat       Lon      Elev     Depth
           EWUT  ???       2018/09/30 00:00:22.69  P        326.0                          _i TAP         1023308411 ISC   IR       -- TAP   TAP   ???        24.4453  121.7783    37.0     0.0
           EWUT  ???       2018/09/30 00:00:26.0   S        326.0                          _i TAP         1023308412 ISC   IR       -- TAP   TAP   ???        24.4453  121.7783    37.0     0.0
           ENA   ???       2018/09/30 00:00:22.97  P        282.0                          di TAP         1023308413 ISC   IR       -- TAP   TAP   ???        24.4280  121.7410   113.0     0.0
           ENA   ???       2018/09/30 00:00:26.21  S        282.0                          _i TAP         1023308414 ISC   IR       -- TAP   TAP   ???        24.4280  121.7410   113.0     0.0
           EAHA  ???       2018/09/30 00:00:23.13  P        212.0                          __ TAP         1023308415 ISC   IR       -- TAP   TAP   ???        24.3293  121.7393    51.0     0.0
           EAHA  ???       2018/09/30 00:00:26.95  S        212.0                          __ TAP         1023308416 ISC   IR       -- TAP   TAP   ???        24.3293  121.7393    51.0     0.0
           ESAO  ???       2018/09/30 00:00:23.71  P         14.0                          _i TAP         1023308417 ISC   IR       -- TAP   TAP   ???        24.5757  121.8439    33.0     0.0
           NNS   ???       2018/09/30 00:00:33.85  S        273.0                          __ TAP         1023308435 ISC   IR       -- TAP   TAP   ???        24.4400  121.3730  1140.0     0.0
           EOS3  ???       2018/09/30 00:00:36.93  S        105.0                          __ TAP         1023308446 ISC   IR       -- TAP   TAP   ???        24.2864  122.3174 -1114.0     0.0
           CMAR  ???       2018/09/30 00:01:09.398 Pn        42.9  16.0   7.3       0.2  0.33  __              996408923 ISC   IR       --             ??? ???    18.4575   98.9429   307.0     0.0
           CMAR  ???                                                                1.1  0.66  __              996408924 ISC   IR       --             ??? ???    18.4575   98.9429   307.0     0.0
           VRAC  ??Z       2018/09/30 00:01:46.566 LR       305.5  34.7            48.0 18.02  __              996408904 ISC   IR       --             ??Z ???    49.3083   16.5935   475.0     0.0
           IZZE  HHZ       2018/09/30 00:02:35.56  P                                       __ AFAD         917613577 ISC   IR       -- AFAD  AFAD  HHZ        36.4368   29.2256   305.0     0.0
           IZZE  HHN       2018/09/30 00:02:43.15  S                                       __ AFAD         917613578 ISC   IR       -- AFAD  AFAD  HHN        36.4368   29.2256   305.0     0.0
           IZZE  HHN       2018/09/30 00:02:47.0   AML                             64.8  0.30  _i AFAD         917613579 ISC   IR       -- AFAD  AFAD  HHN ???    36.4368   29.2256   305.0     0.0
           IZZE  HHE       2018/09/30 00:02:47.0   AML                             38.4  0.20  _i AFAD         917613580 ISC   IR       -- AFAD  AFAD  HHE ???    36.4368   29.2256   305.0     0.0
```

Grouped Arrivals

Many agencies using a geographically restricted network are able to locate local events, but not teleseisms. These can be reported in IMS1.0 using the data type “grouped arrivals”, which is separate from the data type “bulletin”.

Chronological Interpolation

The recipient of a message benefits from seeing how sets of arrivals that are related but not associated with a locatable event fit among local events. This can be accomplished within IMS1.0 by chronologically interpolating data sections of different types within an IMS1.0 message. In ISF, the interpolated position is based on primary origin times in the bulletin events and first arrival times in grouped arrivals.

IMS1.0 requires a stop line at the end of the last data section. Other data sections can omit the stop line and be ended implicitly by the start of a new data section, indicated by a data_type line.

Example: Use of Chronologically Interpolated data_types

```
DATA_TYPE BULLETIN IMS1.0:short

Event    934906 Kuril Islands, Russia
   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az ...
1997/08/03 19:40:19.60   0.50        43.7300  147.4900   6.7   4.4

Sta     Dist  EvAz Phase        Time      TRes  Azim AzRes   Slow   SNR ...
JNK     2.02 267.0          19:41:16.2
JAK     2.17 251.0          19:41:21.5
JAR     2.74 262.0 P        19:41:03.0     0.8
JAR     2.74                19:41:35.5
JOB     2.79 254.0 P        19:41:03.4     0.5
JCH     3.22 251.0 P        19:41:09.4     0.4
JCH     3.22                19:41:47.0
JEM     3.62 243.0 P        19:41:15.1     0.5
URA3    3.82 249.0 P        19:41:18.6     1.1

DATA_TYPE ARRIVAL:grouped IMS1.0:short

Net      Sta   Chan Aux    Date      Time      Phase      Azim  Slow ...
JMA      JOD2           1997/08/03 20:00:53.3  P
JMA      JHU            1997/08/03 20:00:54.3  P
JMA      JHU            1997/08/03 20:01:05.5
JMA      KTJJ           1997/08/03 20:00:55.2  P

Net      Sta   Chan Aux    Date      Time      Phase      Azim  Slow ...
IMS      WRA            1997/08/03 20:10:50.1  P         343.0  10.0
AGSO     QIS            1997/08/03 20:11:11.2  P
CSN      BJT            1997/08/03 20:12:09.1  P         157.8   5.8

STOP
```

Grouped Arrival Format

The grouped subtype is used for arrivals that have phase names and have been grouped together, with the implication that they were generated by the same seismic event. The table below gives the format for the grouped data subtype and an example follows.

Table: Grouped Arrival Format

Record	Position	Format	Description
1	1-3	a3	`Net`
(header)	11-13	a3	`Sta`
	16-19	a4	`Chan`
	21-23	a3	`Aux`
	29-32	a4	`Date`
	39-42	a4	`Time`
	50-54	a5	`Phase`
	60-63	a4	`Azim`
	66-69	a4	`Slow`
	73-75	a3	`SNR`
	83-85	a3	`Amp`
	89-91	a3	`Per`
	93-96	a4	`Qual`
	100-104	a5	`Group`
	106	a1	`C`
	108-113	a6	`Author`
	121-125	a5	`ArrID`
	130-132	***a3***	***`Agy`***
	136-141	***a6***	***`Deploy`***
	145-146	***a2***	***`Ln`***
	148-151	***a4***	***`Auth`***
	154-156	***a3***	***`Rep`***
	160-162	***a3***	***`PCh`***
	164-166	***a3***	***`ACh`***
	168	***a1***	***`L`***
	172-174	***a3***	***`Lat`***
	182-184	***a3***	***`Lon`***
	190-193	***a4***	***`Elev`***
	198-202	***a5***	***`Depth`***

(continued)

Table: Grouped Arrival Format (continued)

2-n (data)	1-9	a9	network code
	11-15	a5	station code
	17-19	a3	FDSN channel code
	21-24	a4	auxiliary identification code
	26-35	i4,a1,i2,a1,i2	arrival date (yyyy/mm/dd)
	37-48	i2,a1,i2,a1,f6.3	arrival time (hh:mm:ss.sss)
	50-57	a8	phase code
	59-63	f5.1	observed azimuth (degrees)
	65-69	f5.1	observed slowness (seconds/degree)
	71-75	f5.1	signal-to-noise ratio
	77-85	f9.1	amplitude (nanometers)
	87-91	f5.2	period (seconds)
	93	a1	type of pick (a = automatic, m = manual)
	94	a1	direction of short period motion (c = compression, d = dilatation, _ = null)
	95	a1	detection quality (i = impulsive, e = emergent, q = questionable, _ = null)
	97-104	a8	group identification
	106	i1	conflict flag (number of times an arrival belongs to more than one group; leave blank if arrival only belongs to one group)
	108-116	a9	author of the arrival
	118-125	a8	arrival identification
	126-128	***a3***	***optional extension of arrival identification***
	130-134	***a5***	***agency (ADSL)***
	136-143	***a8***	***deployment (ADSL)***
	145-146	***a2***	***location (ADSL)***
	148-152	***a5***	***author of data***
	154-158	***a5***	***reporter of data***
	160-162	***a3***	***phase channel***
	164-166	***a3***	***amplitude channel***
	168	***a1***	***direction of long period first motion***

Grouped Arrival Information Sub-block

Each line in this sub-block is linked to an arrival by sharing a common ArrID. The grouped arrival information sub-block differs from the phase information sub-block to avoid duplicating fields in the grouped arrival block and since phase information are inapplicable without an origin.

Table : Grouped Arrival Information Sub-Block

Record	Position	Format	Description
1 (header)	1	a1	`F`
	3-7	a5	`Low_F`
	9-13	a5	`HighF`
	16-21	a5	`eTime`
	24-28	a5	`eAzim`
	32-36	a5	`eSlow`
	44-47	a4	`eAmp`
	51-54	a4	`ePer`
	59-63	a5	`ArrID`
2 (data)	1	a1	Filter type: C = causal 0 = zero phase
	3-7	f5.*	Minimum frequency of the filter pass band
	9-13	f5.*	Maximum frequency of the filter pass band
	16-21	f6.3	uncertainty of the phase arrival time (seconds)
	24-28	f5.1	uncertainty of the measured azimuth (degrees)
	30-36	f7.1	uncertainty of the measured slowness (seconds/degree)
	39-47	f9.1	uncertainty of the measured amplitude (nanometers)
	50-54	f5.2	uncertainty of the measured period (seconds)
	56-66	**a11**	arrival identification

Grouped Arrival Comments

ISF allows all of the formatted comment types from the phase information block of the bulletin data type also to be included in the grouped arrivals data type. Original values formatted comments are in the grouped arrival block, while minimum, maximum and correction comments are in the grouped arrival information sub-block. The field in these comments are shifted from their positions in the phase information block comments to align them with the analogous fields in the arrival block and arrival sub-block.

Distance Range Grouped Arrival Comment

Often, an agency reporting grouped arrivals will be confident of identifying the arrivals as local, regional or teleseismic from the character of the waveforms that they have read. Nevertheless, they may not be able to identify particular phases without an origin estimate. ISF messages indicate this type of information using a comment immediately after the header line.

Note that within one grouped arrivals data section, arrivals may be grouped with several different events, which would be indicated by a new header line for event. By putting the distance range comment after the header, ISF allows each event to be given a separate distance range.

Table: Formatted Distance Range Grouped Arrival Comment

Record	Position	Format	Description
1	3-13	a11	`#DIST_RANGE`
(data)	15-25	a11	Distance Range: `LOCAL` = 0 to 10 degrees from network `REGIONAL` = 10 to 30 degrees from network `TELESEISMIC` = >30 degrees from network

Example: Grouped Arrival Block, Arrival Information Sub-block and Formatted Comments
(Please note that data has been edited to created this example)

```
DATA_TYPE   ARRIVAL:GROUPED IMS1.0
Net        Sta  Chan Aux     Date       Time       Phase     Azim  Slow   SNR       Amp   Per Qual   Group C Author       ArrID    Agy    Deploy    Ln Auth  Rep    PCh ACh L   Lat       Lon      Elev     Depth
IDC_SEIS   BBB   bhz      1996/08/16 03:41:40.523 P         256.3 16.2  13.4     228.6  0.33 a__     5636   IDC_REB   11618395411 ISC    IR        -- TAP   TAP    ???         24.4453  121.7783    37.0     0.0
IDC_SEIS   BBB   bhz      1996/08/16 03:42:04.531 S         334.7 18.6   8.2     338.6  0.33 a__     5636   IDC_REB   11618393412 ISC    IR        -- TAP   TAP    ???         24.4453  121.7783    37.0     0.0
 (#DIST_RANGE        LOCAL)
IDC_SEIS   DLBC  bhz      1996/08/16 03:42:58.584 P         166.7 16.5  16.5       1.5  0.33 a__     5636   IDC_REB   11618396414 ISC    IR        -- TAP   TAP    ???         24.4280  121.7410   113.0     0.0
IDC_SEIS   DLBC  bhz      1996/08/16 03:44:59.808 S                                         m__     5636   IDC_REB   11621022415 ISC    IR        -- TAP   TAP    ???         24.3293  121.7393    51.0     0.0
IDC_SEIS   NEW   bhz      1996/08/16 03:43:23.394 P         308.2  6.6   4.2       0.3  0.33 a__     5636   IDC_REB   11614783416 ISC    IR        -- TAP   TAP    ???         24.3293  121.7393    51.0     0.0
IDC_SEIS   NEW   bhz      1996/08/16 03:46:03.321 S         337.6 12.2   4.1       0.2  0.33 a__     5636   IDC_REB   11614787417 ISC    IR        -- TAP   TAP    ???         24.5757  121.8439    33.0     0.0

F Low_F HighF  eTime    eAzim    eSlow       eAmp    ePer  ArrID    Agy    Deploy    Ln Auth  Rep    PCh ACh L   Lat       Lon      Elev    Depth
C  1.00  10.0  0.200     10.0      2.5        0.1    0.05  36151923 ISC    IR        --              ??? ???     18.4575   98.9429   307.0    0.0
 (#MIN       -99.999  -100.0 -1000.0 -1234567.9 -10.23)
 (#MAX       +99.999  +100.0 +1000.0 +1234567.9 +10.23)
 (#COREC      +0.500  -100.0 -1234.5 +1234567.9 +12.45)
```

Associated Arrivals

The associated subtype is used for arrivals that have been run through a location program and have formed a seismic event. If multiple magnitude measurements have been made on an arrival, the subsequent magnitudes will appear on lines immediately after the arrival. The table below gives the format for the associated data subtype and an example follows.

Table: Associated Arrival Format

Record	Position	Format	Description
1	1-3	a3	Net
(header)	11-13	a3	Sta
	19-22	a4	Dist
	25-28	a4	EvAz
	30-34	a5	Phase
	41-44	a4	Date
	53-56	a4	Time
	64-67	a4	TRes
	70-73	a4	Azim
	75-79	a5	AzRes
	82-85	a4	Slow
	88-91	a4	SRes
	93-95	a3	Def
	99-101	a3	SNR
	109-111	a3	Amp
	115-117	a3	Per
	119-122	a4	Qual
	124-132	a9	Magnitude
	136-141	a6	OrigID
	146-151	**a6**	**Author**
	159-163	**a5**	**ArrID**
	168-170	***a3***	***Agy***
	174-179	***a6***	***Deploy***
	183-184	***a2***	***Ln***
	186-189	***a4***	***Auth***
	192-194	***a3***	***Rep***
	198-200	***a3***	***PCh***
	202-204	***a3***	***ACh***
	206	***a1***	***L***
	210-212	***a3***	***Lat***
	220-222	***a3***	***Lon***
	228-231	***a4***	***Elev***
	236-240	***a5***	***Depth***

(continued)

Table: Associated Arrival Format (continued)

2-n	1-9	a9	network code
(data)	11-15	a5	station code
	17-22	f6.2	station to event distance (degrees)
	24-28	f5.1	event to station azimuth (degrees)
	30-37	a8	phase code
	39-48	i4,a1,i2,a1,i2	arrival date (yyyy/mm/dd)
	50-61	i2,a1,i2,a1,f6.3	arrival time (hh:mm:ss.sss)
	63-67	f5.1	time residual (seconds)
	69-73	f5.1	observed backazimuth (degrees)
	75-79	f5.1	azimuth residual (degrees)
	81-85	f5.1	observed slowness (seconds/degree)
	87-91	f5.1	slowness residual (seconds/degree)
	93	a1	time defining flag (T or _)
	94	a1	azimuth defining flag (A or _)
	95	a1	slowness defining flag (S or _)
	97-101	f5.1	signal-to-noise ratio
	103-111	f9.1	amplitude (nanometers)
	113-117	f5.2	period (seconds)
	119	a1	type of pick (a = automatic, m = manual)
	120	a1	direction of short period motion (c = compression, d = dilatation, _ = null)
	121	a1	onset quality (i = impulsive, e = emergent, q = questionable, _ = null)
	123-127	a5	magnitude type (mb, Ms, ML, mbmle, msmle)
	128	a1	min max indicator (<, >, or blank)
	129-132	f4.1	magnitude value
	134-144	**a11**	**origin identification**
	146-154	**a9**	**author of the arrival**
	156-166	**a11**	**arrival identification**
	161-163	***a3***	***optional extension of arrival identification***
	168-172	***a5***	***agency (ADSL)***
	174-181	***a8***	***deployment (ADSL)***
	183-184	***a2***	***location (ADSL)***
	186-190	***a5***	***author of data***
	192-196	***a5***	***reporter of data***
	198-200	***a3***	***phase channel***
	202-204	***a3***	***amplitude channel***
	206	***a1***	***direction of long period first motion***
	208-215	***f8.4***	***latitude of station***
	217-225	***f9.4***	***longitude of station***
	227-233	***f7.1***	***elevation of station at surface***
	235-240	***f6.1***	***instrument depth below surface***

Example: Associated Arrival
(Please note that data has been edited to create this example)

```
DATA_TYPE ARRIVAL:ASSOCIATED ISF2.0
Net        Sta      Dist  EvAz Phase       Date         Time       TRes  Azim AzRes  Slow  SRes Def   SNR       Amp   Per Qual Magnitude   OrigID   Author       ArrID     Agy   Deploy   Ln Auth  Rep   PCh ACh L   Lat       Lon      Elev     Depth
           MORF     0.12 252.9 P         2011/01/01 00:57:31.49                               ___                        _e                   817984 IGIL        230642411 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
           MORF     0.12 252.9 S         2011/01/01 00:57:33.66                               ___                        _e                   817984 IGIL        230642412 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
           MORF     0.12 252.9 AML       2011/01/01 00:57:34.2                                ___             69.8  0.15 __                   817984 IGIL        230642411 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
           MORF     0.12 252.9 Pg        2011/01/01 00:57:31.5                                ___                        ce                   817984 INMG        233442412 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
           MORF     0.12 252.9 Sg        2011/01/01 00:57:33.7                                ___                        _e                   817984 INMG        233442411 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
           MORF     0.12 252.9 A         2011/01/01 00:57:34.1                                ___             60.4  0.20 __                   817984 INMG        233442412 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
           MORF     0.12 252.9 Pg        2011/01/01 00:57:31.5                                ___                        __                   817984             615630411 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
           MORF     0.12 252.9 Lg        2011/01/01 00:57:33.7                                ___             60.4  0.20 __                   817984             615630412 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
           MORF     0.12 252.9 Pg        2011/01/01 00:57:31.5                                ___                        ce                   817984 CSEM        633881411 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
           MORF     0.12 252.9 Sg        2011/01/01 00:57:33.7                                ___             60.4  0.20 ce                   817984 CSEM        633881412 ISC   IR       -- TAP   TAP   ???         24.4453  121.7783    37.0     0.0
```