NRDC Information Product
Schema Reference Manual

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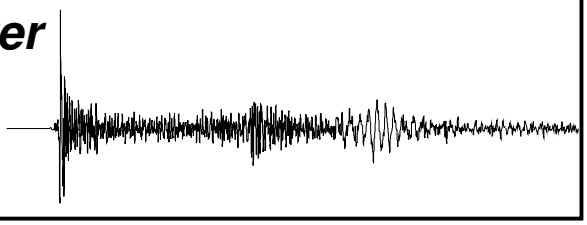
Prepared by

IRIS's *Joint Seismic Program Center*

Department of Physics
University of Colorado at Boulder
Campus Box 583
Boulder, CO 80309-0583



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Center for Seismic Studies
Version 3 Database:
Schema Reference Manual

J. Anderson, W.E. Farrell, K. Garcia, J. Given, H. Swanger

Center for Seismic Studies
1300 N. 17th Street, Suite 1450
Arlington, Virginia 22209-3871
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The original document is modified in the following ways:

- Tables and attributes not used in the JSPC NRDC data have been deleted.
- References to the ORACLE database representation are removed.
- The centryd and moment table, from the CSS Version 2.8 database have been added.
- The null values for belief and slores attributes in the assoc relation were changed since the original null value would not fit in the space reserved in the fixed format record.
- *Chanid* is used in the JSPC NRDC data to link the sitechan relation with the wfdisc and sensor tables. Because channels were changing frequently in this data, the dates in the sitechan relation are not adequate for linking sitechan with sensor and wfdisc. Consequently, while *chanid* is a deprecated key in the standard CSS 3.0 database, it is essential in the JSPC NRDC data.

DATABASE STRUCTURE

This chapter defines the physical structure of each table, as it exists as a flat file. The name of the relation appears in **bold** print at the top. Key attributes are shown first, convenience attributes next, followed by data fields. This hierarchy is described in the introduction to Chapter 3. Formats for "external" files specify fixed field widths and precisions in the style of FORTRAN. Exactly one blank separates fields in these files. This improves readability and makes it easier for C programs to scan the records. All numeric entries are right justified and all character strings are left justified. Having the field number quickly accessible is useful when dealing with flat files (e.g. *awk* and shell scripts).

Relation:	**affiliation**				
Description:	Network station affiliations				
attribute name	field no.	storage type	external format	character positions	attribute description
net	1	c8	a8	1-8	unique network identifier
sta	2	c6	a6	10-15	station identifier
lddate	3	date	a17	17-33	load date

Relation:	**arrival**				
Description:	Summary information on a seismic arrival				
attribute name	field no.	storage type	external format	character positions	attribute description
sta	1	c6	a6	1-6	station code
time	2	f8	f17.5	8-24	epoch time
arid	3	i4	i8	26-33	arrival id
jdate	4	i4	i8	35-42	julian date
stassid	5	i4	i8	44-51	stassoc id
chanid	6	i4	i8	53-60	instrument id
chan	7	c8	a8	62-69	channel code
iphase	8	c8	a8	71-78	reported phase
stype	9	c1	a1	80-80	signal type
deltim	10	f4	f6.3	82-87	delta time
azimuth	11	f4	f7.2	89-95	observed azimuth
delaz	12	f4	f7.2	97-103	delta azimuth
slow	13	f4	f7.2	105-111	observed slowness (s/deg)
delslo	14	f4	f7.2	113-119	delta slowness
ema	15	f4	f7.2	121-127	emergence angle
rect	16	f4	f7.3	129-135	rectilinearity
amp	17	f4	f10.1	137-146	amplitude, instrument corrected, nm
per	18	f4	f7.2	148-154	period
logat	19	f4	f7.2	156-162	log(amp/per)
clip	20	c1	a1	164-164	clipped flag
fm	21	c2	a2	166-167	first motion
snr	22	f4	f10.2	169-178	signal to noise ratio
qual	23	c1	a1	180-180	signal onset quality
auth	24	c15	a15	182-196	source/originator
commid	25	i4	i8	198-205	comment id
lddate	26	date	a17	207-223	load date

Relation:	**assoc**				
Description:	Data associating arrivals with origins				
attribute name	field no.	storage type	external format	character positions	attribute description
arid	1	i4	i8	1-8	arrival id
orid	2	i4	i8	10-17	origin id
sta	3	c6	a6	19-24	station code
phase	4	c8	a8	26-33	associated phase
belief	5	f4	f4.2	35-38	phase confidence
delta	6	f4	f8.3	40-47	station to event distance
seaz	7	f4	f7.2	49-55	station to event azimuth
esaz	8	f4	f7.2	57-63	event to station azimuth
timeres	9	f4	f8.3	65-72	time residual
timedef	10	c1	a1	74-74	time = defining, non-defining
azres	11	f4	f7.1	76-82	azimuth residual
azdef	12	c1	a1	84-84	azimuth = defining, non-defining
slores	13	f4	f7.2	86-92	slowness residual
slodef	14	c1	a1	94-94	slowness = defining, non-defining
emares	15	f4	f7.1	96-102	incidence angle residual
wgt	16	f4	f6.3	104-109	location weight
vmodel	17	c15	a15	111-125	velocity model
commid	18	i4	i8	127-134	comment id
lddate	19	date	a17	136-152	load date

Relation:	**centryd**				
Description:	Information on centroid location				
attribute name	field no.	storage type	external format	character positions	attribute description
orid	1	i4	i8	1-8	origin id
jdate	2	i4	i8	10-17	julian date
time	3	f8	f15.3	19-33	origin time
lat	4	f4	f9.4	35-43	latitude
lon	5	f4	f9.4	45-53	longitude
depth	6	f4	f9.4	55-63	emplacement depth
coterr	7	f4	f6.2	65-70	std err in origin time of centroid loc
claerr	8	f4	f6.2	72-77	std err in lat of centroid loc
cloerr	9	f4	f6.2	79-84	std err in lon of centroid loc
cdperr	10	f4	f6.2	86-91	std err in depth of centroid loc
durat	11	f4	f5.1	93-97	half-duration of source
nslpb	12	f4	i3	99-101	no of stns supplying long-per b-wave recs
nrlpb	13	f4	i3	103-105	no of long-per b-wave recs
tmnlpb	14	f4	f5.1	107-111	min period used in body wave inversion
nsmw	15	f4	i3	113-115	no of stns supplying mntl wave recs
nrmw	16	f4	i3	117-119	no of mntl wave recs
tmnmw	17	f4	f5.1	121-125	min period used in mntl wave inversion
dused	18	c10	a10	127-136	type of data used in inversion
auth	19	c15	a15	138-152	author
commid	20	i4	i8	154-161	comment id
lddate	21	date	a17	163-179	load date

Relation:		**instrument**			
Description:		Generic (default) calibration information about a station			
attribute name	field no.	storage type	external format	character positions	attribute description
inid	1	i4	i8	1-8	instrument id
insname	2	c50	a50	10-59	instrument name
instype	3	c6	a6	61-66	instrument type
band	4	c1	a1	68-68	frequency band
digital	5	c1	a1	70-70	(d,a) analog
samprate	6	f4	f11.7	72-82	sampling rate in samples/second
ncalib	7	f4	f16.6	84-99	nominal calibration
ncalper	8	f4	f16.6	101-116	nominal calibration period
dir	9	c64	a64	118-181	directory
dfile	10	c32	a32	183-214	data file
rsptype	11	c6	a6	216-221	response type
lddate	12	date	a17	223-239	load date

Relation:		**moment**			
Description:		Moment tensor description			
attribute name	field no.	storage type	external format	character positions	attribute description
orid	1	i4	i8	1-8	origin id
mexpon	2	i4	i3	10-12	exponent of moment scale factor
mrr	3	f4	f5.2	14-18	moment tensor component
mtt	4	f4	f5.2	20-24	moment tensor component
mff	5	f4	f5.2	26-30	moment tensor component
mrt	6	f4	f5.2	32-36	moment tensor component
mrf	7	f4	f5.2	38-42	moment tensor component
mtf	8	f4	f5.2	44-48	moment tensor component
mrrerr	9	f4	f5.2	50-54	standard error of moment tensor component
mtterr	10	f4	f5.2	56-60	standard error of moment tensor component
mfferr	11	f4	f5.2	62-66	standard error of moment tensor component
mrterr	12	f4	f5.2	68-72	standard error of moment tensor component
mrferr	13	f4	f5.2	74-78	standard error of moment tensor component
mtferr	14	f4	f5.2	80-84	standard error of moment tensor component
taxval	15	f4	f6.2	86-91	length of tension axis vector
taxplg	16	f4	f5.1	93-97	tension axis plunge
taxazm	17	f4	f5.1	99-103	tension axis azimuth
paxval	18	f4	f6.2	105-110	length of compressional axis vector
paxplg	19	f4	f5.1	112-116	compression axis plunge
paxazm	20	f4	f5.1	118-122	compression axis azimuth
naxval	21	f4	f6.2	124-129	length of null-axis vector
naxplg	22	f4	f5.1	131-135	null axis plunge
naxazm	23	f4	f5.1	137-141	null axis azimuth
bestdc	24	f4	f5.2	143-147	best double couple
str1	25	f4	f5.1	149-153	strike of first nodal plane
dip1	26	f4	f5.1	155-159	dip of first nodal plane
slip1	27	f4	f6.1	161-166	slip of first nodal plane
str2	28	f4	f5.1	168-172	strike of second nodal plane
dip2	29	f4	f5.1	174-178	dip of second nodal plane
slip2	30	f4	f6.1	180-185	slip of second nodal plane
nslpb	31	i4	i3	187-189	no of stns supplying long-per b-wave recs
nrlpb	32	i4	i3	191-193	no of long-per b-wave recs
tmnlpb	33	f4	f5.1	195-199	min period used in b-wave inversion
nsmw	34	i4	i3	201-203	no of stns supplying mntl wave recs
nrmw	35	i4	i3	205-207	no of mntl wave recs
tmnmw	36	f4	f5.1	209-213	min period used in mntl wave inversion
dused	37	c10	a10	215-224	type of data used in inversion
auth	38	c15	a15	226-240	source/originator
commid	39	i4	i8	242-249	comment id
lddate	40	date	a17	251-267	load date

Relation:	**network**			
Description:	Network description and identification			
attribute name	field no.	storage type	external format	character positions	attribute description
net	1	c8	a8	1-8	unique network identifier
netname	2	c80	a80	10-89	network name
nettype	3	c4	a4	91-94	network type, array, local, world-wide, etc.
auth	4	c15	a15	96-110	source/originator
commid	5	i4	i8	112-119	comment id
lddate	6	date	a17	121-137	load date

Relation:	**origin**			
Description:	Data on event location and confidence bounds			
attribute name	field no.	storage type	external format	character positions	attribute description
lat	1	f4	f9.4	1-9	estimated latitude
lon	2	f4	f9.4	11-19	estimated longitude
depth	3	f4	f9.4	21-29	estimated depth
time	4	f8	f17.5	31-47	epoch time
orid	5	i4	i8	49-56	origin id
evid	6	i4	i8	58-65	event id
jdate	7	i4	i8	67-74	julian date
nass	8	i4	i4	76-79	number of associated phases
ndef	9	i4	i4	81-84	number of locating phases
ndp	10	i4	i4	86-89	number of depth phases
grn	11	i4	i8	91-98	geographic region number
srn	12	i4	i8	100-107	seismic region number
etype	13	c7	a7	109-115	event type
depdp	14	f4	f9.4	117-125	estimated depth from depth phases
dtype	15	c1	a1	127-127	depth method used
mb	16	f4	f7.2	129-135	body wave magnitude
mbid	17	i4	i8	137-144	mb magid
ms	18	f4	f7.2	146-152	surface wave magnitude
msid	19	i4	i8	154-161	ms magid
ml	20	f4	f7.2	163-169	local magnitude
mlid	21	i4	i8	171-178	ml magid
algorithm	22	c15	a15	180-194	location algorithm used
auth	23	c15	a15	196-210	source/originator
commid	24	i4	i8	212-219	comment id
lddate	25	date	a17	221-237	load date

Relation:	**remark**			
Description:	Comments			
attribute name	field no.	storage type	external format	character positions	attribute description
commid	1	i4	i8	1-8	comment id
lineno	2	i4	i8	10-17	comment line number
remark	3	c80	a80	19-98	free format comment
lddate	4	date	a17	100-116	load date

Relation: **sensor**
Description: Specific calibration information for physical channels

attribute name	field no.	storage type	external format	character positions	attribute description
sta	1	c6	a6	1-6	station code
chan	2	c8	a8	8-15	channel code
time	3	f8	f17.5	17-33	epoch time of start of recording period
endtime	4	f8	f17.5	35-51	epoch time of end of recording period
inid	5	i4	i8	53-60	instrument id
chanid	6	i4	i8	62-69	channel id
jdate	7	i4	i8	71-78	julian date
calratio	8	f4	f16.6	80-95	calibration
calper	9	f4	f16.6	97-112	calibration period
tshift	10	f4	f6.2	114-119	correction of data processing time
instant	11	c1	a1	121-121	(y,n) discrete/continuing snapshot
lddate	12	date	a17	123-139	load date

Relation: **site**
Description: Station location information

attribute name	field no.	storage type	external format	character positions	attribute description
sta	1	c6	a6	1-6	station identifier
ondate	2	i4	i8	8-15	Julian start date
offdate	3	i4	i8	17-24	Julian off date
lat	4	f4	f9.4	26-34	latitude
lon	5	f4	f9.4	36-44	longitude
elev	6	f4	f9.4	46-54	elevation
staname	7	c50	a50	56-105	station description
statype	8	c4	a4	107-110	station type: single station, virt. array, etc.
refsta	9	c6	a6	112-117	reference station for array members
dnorth	10	f4	f9.4	119-127	offset from array reference (km)
deast	11	f4	f9.4	129-137	offset from array reference (km)
lddate	12	date	a17	139-155	load date

Relation: **sitechan**
Description: Station-channel information

attribute name	field no.	storage type	external format	character positions	attribute description
sta	1	c6	a6	1-6	station identifier
chan	2	c8	a8	8-15	channel identifier
ondate	3	i4	i8	17-24	Julian start date
chanid	4	i4	i8	26-33	channel id
offdate	5	i4	i8	35-42	Julian off date
ctype	6	c4	a4	44-47	channel type
edepth	7	f4	f9.4	49-57	emplacement depth
hang	8	f4	f6.1	59-64	horizontal angle
vang	9	f4	f6.1	66-71	vertical angle
descrip	10	c50	a50	73-122	channel description
lddate	11	date	a17	124-140	load date

Relation:	**sregion**			
Description:	Seismic region			
attribute name	field no.	storage type	external format	character positions	attribute description
srn	1	i4	i8	1-8	seismic region number
srname	2	c40	a40	10-49	seismic region name
lddate	3	date	a17	51-67	load date

Relation:	**wfdisc**			
Description:	Waveform file header and descriptive information			
attribute name	field no.	storage type	external format	character positions	attribute description
sta	1	c6	a6	1-6	station
chan	2	c8	a8	8-15	channel
time	3	f8	f17.5	17-33	epoch time of first sample in file
wfid	4	i4	i8	35-42	waveform id
chanid	5	i4	i8	44-51	channel operation id
jdate	6	i4	i8	53-60	julian date
endtime	7	f8	f17.5	62-78	time+(nsamp-1)/samprate
nsamp	8	i4	i8	80-87	number of samples
samprate	9	f4	f11.7	89-99	sampling rate in samples/sec
calib	10	f4	f16.6	101-116	nominal calibration
calper	11	f4	f16.6	118-133	nominal calibration period
instype	12	c6	a6	135-140	instrument code
segtype	13	c1	a1	142-142	indexing method
datatype	14	c2	a2	144-145	numeric storage
clip	15	c1	a1	147-147	clipped flag
dir	16	c64	a64	149-212	directory
dfile	17	c32	a32	214-245	data file
foff	18	i4	i10	247-256	byte offset
commid	19	i4	i8	258-265	comment id
lddate	20	date	a17	267-283	load date

DATABASE RELATIONS

This chapter describes the relations that comprise the Version 3.0 Schema. The information given here, along with that in Chapter 4, *Database Attributes*, constitutes the data dictionary. There is an entry for each relation. Within the entry, the relation's name appears first, followed by a list of its attributes. A brief description completes the entry. The attributes of the relation are arranged in the following order: Keys, Convenience, Data. Key attributes link relations. Convenience attributes are redundant data whose real home is another relation, but are included in this table for the sake of convenience. Data attributes, the reason this table exists, are split into three categories: Descriptive, Measurement and Administrative. The following tableau explains the format used in the entries.

Name:	This is the name of the relation.	
Keys:	Primary.	These are the attributes which, taken together, uniquely identify a row in the table.
	Alternate.	These are other attributes which also uniquely identify a row and may be used as primary keys.
	Foreign.	These attributes are primary keys in another table.
Convenience:	Attributes in this class, if any, are data-attributes in another table.	
Data:	Descriptive.	Qualitative attributes are listed under this heading.
	Measurement.	This class contains a list of quantitative attributes.
	Administrative.	This class lists attributes used for database administration.
Description:	This paragraph describes the relation.	

Keys provide the links by which tables are joined. The following definitions explain the several types of keys.

A primary key (which often is the concatenation of several attributes) uniquely identifies a row in the table. For example, each **origin** record is unique by *lat, lon, depth*, and *time.*

An alternate key also uniquely identifies a row in the table and may be used as the primary key. For example, *orid* may also be used as the primary key for the **origin** table.

A foreign key is another table's primary key. Thus, *evid* is a foreign key in the **origin** table, but is the primary key in the **event** table. (*The event table is not used in the JSPC NRDC data). Similarly, commid is a foreign key in many of the tables and the primary key in* **remark**.

Name:	**affiliation**	
Keys:	Primary.	*net, sta*
Data:	Administrative.	*lddate*
Description:	Network-Station affiliations. This is an intermediate relation by which seismic stations may be clustered into networks.	

Name:	**arrival**	
Keys:	Primary. Alternate. Foreign.	*sta, time* *arid* *stassid, chanid, commid*
Convenience:	*jdate*	
Data:	Descriptive. Measurement. Administrative.	*chan, iphase, stype* *deltim, azimuth, delaz, slow, delslo, ema, rect, amp, per, logat, clip, fm, qual* *auth, lddate*
Description:	Summary information on a seismic arrival. Information characterizing a "seismic phase" observed at a particular station is saved here. Many of the attributes conform to seismological convention and are listed in earthquake catalogs.	

Name:	**assoc**	
Keys:	Primary. Foreign.	*arid, orid* *commid*
Convenience:	*sta*	
Data:	Descriptive. Measurement. Administrative.	*phase, belief* *delta, seaz, esaz, timeres, timedef, azres, azdef, slores, slodef, emares, wgt* *vmodel, lddate*
Description:	Data associating arrivals with origins. This table has information that connects arrivals (i.e., entries in the **arrival** relation) to a particular origin. It has a composite key made of *arid* and *orid*. There are two kinds of measurement data: three attributes are related to the station (*delta, seaz, esaz*), and the remaining measurement attributes are jointly determined by the measurements made on the seismic wave (**arrival**), and the inferred event's origin (**origin**). The attribute *sta* is intentionally duplicated in this table to eliminate the need for a join with **arrival** when doing a lookup on station.	

Name: **centryd**

Keys:
- Primary. *orid*
- Alternate. *lat, lon, depth, time*
- Foreign. *commid*

Convenience: *jdate*

Data:
- Descriptive. *nslpb, nrlpb, tmnlpb, nsmw, nrmw, tmnmw*
- Measurement. *coterr, claerr, cloerr, cdperr, durat*
- Administrative. *dused, auth, lddate*

Description: Contains information on the 'centroid' location. This relation is designed mainly to accommodate such locations given in the USGS monthly summary and supplied to the USGS by Harvard. For more information see the USGS monthly listing for July, 1981 and "Determination of Earthquake Source Parameters from Waveform Data for Studies of Global and Regional Seismicity" by A. M. Dziewonski, T.A. Chou, and J. H. Woodhouse, J.Geophys.Res., 86, 2825-2852, 1981. The index attribute is *orid*.

Name: **instrument**

Keys:
- Primary. *inid*

Data:
- Descriptive. *insname, instype, band, digital, dir, dfile, rsptype*
- Measurement. *samprate, ncalib, ncalper*
- Administrative. *lddate*

Description: Ancillary calibration information. This table serves three purposes. It holds nominal one-frequency calibration factors for each instrument. It holds pointers to the nominal frequency-dependent calibration for an instrument. Finally, it holds pointers to the exact calibrations obtained by direct measurement on a particular instrument. See **sensor**.

Name: **moment**

Keys:
- Primary. *orid*
- Foreign. *commid*

Data:
- Descriptive. *mexpon, nslpb, nrlpb, tmnlpb, nsmw, nrmw, tmnmw*
- Measurement. *mrr, mtt, mff, mrt, mrf, mtf, mrrerr, mtterr, mfferr, mrterr, mrferr, mtferr, taxval, taxplg, taxazm, paxval, paxplg, paxazm, naxval, naxplg, naxazm, bestdc, str1, dip1, slip1, str2, dip2, slip2*
- Administrative. *dused, auth, lddate*

Description: Describes the moment tensor obtained for a given origin. Designed mainly to accommodate this in the form given in the USGS monthly summaries, described in more detail in the July, 1981 monthly summary and in "Determination of Earthquake Source Parameters from Waveform Data from Studies of Global and Regional Seismicity" by A. M. Dziewonski, T.A. Chou and J.H. Woodhouse, J.Geophys.Res., 86, 2825-2852, 1981. The index attribute is *orid*.

Name:	**network**	
Keys:	Primary.	*net*
	Foreign.	*commid*
Data:	Descriptive.	*netname, nettype*
	Administrative.	*auth, lddate*
Description:	Network description and identification. This relation gives general information about seismic networks. See **affiliation**.	

Name:	**origin**	
Keys:	Primary.	*lat, lon, depth, time*
	Alternate.	*orid*
	Foreign.	*evid, commid*
Convenience:	*jdate*	
Data:	Descriptive.	*nass, ndef, ndp, grn, srn, etype*
	Measurement.	*depdp, dtype, mb, mbid, ms, msid, ml, mlid*
	Administrative.	*algorithm, auth, lddate*
Description:	Summary of hypocentral parameters. Information describing a derived or reported origin for a particular event is stored in this table.	

Name:	**remark**	
Keys:	Primary.	*commid, lineno*
Data:	Descriptive.	*remark*
	Administrative.	*lddate*
Description:	Comments. This relation may be used to store free-form comments that embellish records of other relations. The *commid* field in many relations refers to a tuple in the **remark** table. If *commid* is null (-1) in a tuple of any other relation, there are no comments stored for that tuple.	

Name:	**sensor**	
Keys:	Primary.	*sta, chan, time, endtime*
	Foreign.	*inid*
Convenience:	*chanid, jdate*	
Data:	Descriptive.	*instant*
	Measurement.	*calratio, calper, tshift*
	Administrative.	*lddate*

Description: Calibration information for specific sensor channels. This table provides a record of updates in the calibration factor or clock error of each instrument, and links a *sta*/*chan*/*time* to a complete instrument response in the relation **instrument**.
Waveform data are converted into physical units through multiplication by the *calib* attribute located in **wfdisc**. It can happen that the correct value of *calib* is not accurately known when the **wfdisc** record is entered into the data base. The **sensor** relation provides the mechanism (*calratio* and *calper*) to "update" *calib*, without requiring that possibly hundreds of **wfdisc** records be updated.
Through the foreign key *inid* this table is linked to **instrument** which has fields pointing to flat files holding detailed calibration information in a variety of formats. See **instrument**.

Name:	**site**	
Keys:	Primary.	*sta, ondate*
Data:	Descriptive.	*staname, statype, refsta*
	Measurement.	*offdate, lat, lon, elev, dnorth, deast*
	Administrative.	*lddate*

Description: Station location information. **Site** names and describes a point on the earth where seismic measurements are made (e.g. the location of a seismic instrument or array). It contains information that normally changes infrequently, such as location. In addition, **site** contains fields to describe the offset of a station relative to an array reference location. Global data integrity implies that the *sta*/*ondate* in **site** be consistent with the *sta*/*chan*/*ondate* in **sitechan**.

Name:	**sitechan**	
Keys:	Primary.	*sta, chan, ondate*
	Alternate.	*chanid*
Data:	Descriptive.	*offdate, ctype*
	Measurement.	*edepth, hang, vang, descrip*
	Administrative.	*lddate*

Description: Station-Channel information. This relation describes the orientation of a recording channel at the site referenced by *sta*. This relation provides information about the various channels (e.g. sz, lz, iz) that are available at a station and maintains a record of the physical channel configuration at a site.

Name:	**sregion**	
Keys:	Primary.	*srn*
Data:	Descriptive.	*srname*
	Administrative.	*lddate*
Description:	Seismic regions. This is a static relation containing seismic region numbers and their equivalent English names. (See Flinn et al., BSSA, v64, p2, July, 1974.)	

Name:	**wfdisc**	
Keys:	Primary.	*sta, chan, time*
	Alternate.	*wfid*
	Foreign.	*chanid, commid*
Convenience:	*jdate, endtime*	
Data:	Descriptive.	*nsamp, samprate, calib, calper, instype, segtype, datatype, clip, dir, dfile, foff*
	Administrative.	*lddate*
Description:	Waveform header file and descriptive information. This relation provides a pointer (or index) to waveforms stored on disk. The waveforms themselves are stored in ordinary disk files, containing a continuous sequence of sample values (in binary representation).	

DATABASE ATTRIBUTES

This chapter describes each of the attributes used in the Version 3.0 Schema. Descriptions of the relations are found in Chapter 3, *Database Relations*. Attributes are presented as follows:

Name: *This is the name of the attribute.*

Relation: **These are the database relations which contain the attribute.**

Description: This paragraph describes the attribute.

NA Value: This is a value used to indicate that information is not available for this attribute. Many attributes in this schema are optional. The NA value is defined for these attributes and should be used when the actual value is not known. Essential attributes must always be given a value; they are documented as NA Value NOT ALLOWED.

Units: This lists the unit of measurement for the attribute, if applicable.

Range: This is the range of permissible or recommended values for this attribute, if such a range exists. For most strings, the range indicates the recommended values, but is not restricted to those values.

The following conventions are applied throughout.

Dates and Times

The *time* attribute throughout the database is stored as epochal time, the number of seconds since January 1, 1970. Epochal time has a precision of 1 millisecond. Often *time* is matched by the more readable attribute, *jdate*. This so called "Julian date" represents a day in the form, for example, 1981231 where 1981 is the year (YYYY) and 231 is the day of year (DOY).

Units of Measurement

Attribute descriptions also include the unit of measurement, if applicable. Here are some quantities with their corresponding measurement units:

period, time	seconds	*calper*, *time*, *endtime*, etc.
julian date	YYYYDOY	*jdate*
amplitude	nanometers	Note that long-period measurements are frequently reported in microns so conversion is required.
angular measurements	degrees	*delta*, *azimuth*, etc.
depth, errors in location	kilometers	*deast*, *depdp*, *depth*, etc.

NA Values

Whenever possible, explicit ranges are defined for each attribute. This is important for data integrity and prepares us for future database management systems which will perform range checking automatically. When the range consists of some element in a finite set, we use the notation {e1 | e2 | ... | en } where "|" denotes the logical OR operation. No range is documented for attributes whose value may be any floating point number.

Sometimes no information is available for an attribute. In that case, an NA (NOT AVAILABLE) value is assigned. An NA value is outside the range of permissible or recommended values for the attribute. This special NA value alerts users and applications that the desired attribute was not available when the record was created. For example, in the **origin** relation, the attribute *ms*, surface wave magnitude, may be unknown for a given record, since it often can't be measured. Then the NA value for magnitudes (–999.0) should be assigned to *ms* and *msid* should be set to –1, the NA value for *msid*. Some attributes are essential to defining a meaningful record and they must be specified; the NA value is not allowed. For example, the attribute *time* in **arrival** must be given a value in the valid range, not an NA value.

Some general guidelines and specific examples of NA values are given in the following table.

Representative NA Values:

character fields	- (a dash)
non-negative integer numbers	–1
non-negative real numbers	–1.0
negative real numbers	–999.0
conf	0.0
deast, dnorth	0.0
endtime	+9999999999.999
time	–9999999999.999

In Versions 2.7 and 2.8 of the schema, the underscore "_" was used to denote an unavailable character string. Since the underscore "_" represents the ANSI SQL "match any single character" wildcard, Version 3.0 uses the dash "-" to denote an unknown character string.

Format of Character Data

Most character fields are lowercase. The following two lists of attributes define the exceptions:

Uppercase:	*auth, dused, instype, srname, sta, staname, volname*
Mixed Case:	*phase, iphase, remark*

Name: *algorithm*

Relation: **origin**

Description: Location algorithm used. This is a brief textual description of the algorithm used for computing a seismic origin.

NA Value: - (a dash)

Range: Any string up to 15 characters long.

Name: *amp*

Relation: **arrival**

Description: Signal amplitude. This is the zero-to-peak amplitude of the earth's displacement for a seismic phase. *Amp* is assumed to be corrected for the response of the instrument.

NA Value: –1.0

Units: Nanometers

Range: *amp* > 0.0

Name: *arid*

Relations: **arrival, assoc**

Description: Arrival identifier. Each arrival is assigned a unique positive integer identifying it with a unique *sta*, *chan* and *time*. This number is used in the **assoc** relation along with the origin identifier to link **arrival** and **origin**.

NA Value: A valid entry is required for **arrival** and **assoc**.

Range: *arid* > 0

Name: *auth*

Relations: **arrival, network, origin**

Description: Author. This records the originator of an arrival (in **arrival** relation) or origin (in **origin** relation). Possibilities include externally supplied arrivals identified according to their original source, such as WMO, NEIS, CAN(adian), UK(array), etc. This may also be an identifier of an application generating the attribute, such as an automated interpretation or signal processing program.

NA Value: - (a dash)

Range: Any string with no more than 15 upper case characters.

Name: *azdef*

Relation: **assoc**

Description: Azimuth defining code. This is a one character flag that indicates whether or not the azimuth of a phase was used to determine the event's origin. It is defining (*azdef* = d) if used to help locate the event or non-defining (*azdef* = n) if it is not used.

NA Value: - (a dash)

Range: {d | n}, lower case

Name:	*azimuth*
Relations:	**arrival**
Description:	Observed azimuth. This is the estimated station-to-event azimuth measured clockwise from north. Azimuth is estimated from f-k or polarization analysis.
NA Value:	–1.0
Units:	Degrees
Range:	$0.0 \leq azimuth < 360.0$

Name:	*azres*
Relation:	**assoc**
Description:	Azimuth residual. This is the difference between the measured station-to-event azimuth for an arrival and the true azimuth. The "true" azimuth is the bearing to the inferred event origin.
NA Value:	–999.0
Units:	Degrees
Range:	$-180.0 \leq azres \leq 180.0$

Name:	*band*
Relation:	**instrument**
Description:	Frequency band. This is a qualitative indicator of frequency pass-band for an instrument. Values should reflect the response curve rather than just the sample rate. Recommended values are s (short-period), m (mid-period), i (intermediate-period), l (long-period), b (broad-band), h (high frequency, very short-period), and v (very long-period). For a better notion of the instrument characteristics, see the instrument response curve.
NA Value:	- (a dash)
Range:	{s | m | i | l | b | h | v}, lower case.

Name:	*belief*
Relation:	**assoc**
Description:	Phase identification confidence level. This is a qualitative estimate of the confidence that a seismic phase is correctly identified.
NA Value:	9.99 *Note: This differs from the CSS 3.0 published standard, which specifies -1.0. That value will not fit in the allocated space, however.*
Range:	$0.0 \leq belief \leq 1.0$

Name: *bestdc*

Relation: **moment**

Description: Best double couple. If the moment tensor T and P eigenvalues ar s1 and s2 respectively, then the scalar seismic moment is defined as bestdc = (s1+s2)/2.

NA Value: –999.0

Units: Given in units of *mexpon*.

Range: Any floating point number.

Name: *calib*

Relations: **wfdisc**

Description: Calibration factor. This is the conversion factor that maps digital data to earth displacement. The factor holds true at the oscillation period specified by the attribute *calper*. A positive value means ground motion increasing in component direction (up, north, east) is indicated by increasing counts. A negative value means the opposite. *Calib* generally reflects the best calibration information available at the time of recording, but refinement may be given in **sensor** reflecting a subsequent recalibration of the instrument. See *calratio*.

NA Value: NOT ALLOWED. A valid entry is required.

Units: Nanometers/digital count

Range: Any non-zero floating point number.

Name: *calper*

Relations: **sensor, wfdisc**

Description: Calibration period. This gives the period for which *calib*, *ncalib* and *calratio* are valid.

NA Value: NOT ALLOWED. A valid entry is required.

Units: Seconds

Range: *calper* > 0.0

Name: *calratio*

Relation: **sensor**

Description: Calibration conversion ratio. This is a dimensionless calibration correction factor which permits small refinements to the calibration correction made using *calib* and *calper* from the **wfdisc** relation. Often, the **wfdisc** *calib* contains the nominal calibration assumed at the time of data recording. If the instrument is recalibrated, *calratio* provides a mechanism to update calibrations from **wfdisc** with the new information without modifying the **wfdisc** relation. A positive value means ground motion increasing in component direction (up, north, east) is indicated by increasing counts. A negative value means the opposite. *Calratio* is meant to reflect the most accurate calibration information for the time period for which the **sensor** record is appropriate, but the nominal value may appear until other information is available.

NA Value: NOT ALLOWED. A valid entry is required.

Range: Any non-zero floating quantity.

Name: *cdperr*
Relation: **centryd**
Description: Standard error in depth of centroid location.
NA Value: –1.0
Units: Kilometers
Range: *cdperr* > 0.0

Name: *chan*
Relations: **arrival, sensor, sitechan, wfdisc**
Description: Channel identifier. This is an eight-character code, which, taken together with *sta*, *jdate* and *time*, uniquely identifies the source of the seismic data, including the geographic location, spatial orientation, sensor and subsequent data processing.
NA Value: "-" (a dash) Al1owed only in **arrival**. A valid entry is required in **sensor, sitechan,** and **wfdisc**.
Range: Any sequence of up to 8 lower case characters.

Name: *chanid*
Relations: **arrival, sensor, sitechan, wfdisc**
Description: Channel recording identifier. This is a surrogate key used to uniquely identify a specific recording. *Chanid* duplicates the information of the compound key *sta, chan, time. Chanid* is used in the JSPC NRDC data to link the sitechan relation with the wfdisc and sensor tables. Because channels were changing frequently in this data, the dates in the sitechan relation are not adequate for linking sitechan with sensor and wfdisc. Consequently, while *chanid* is a deprecated key in the standard CSS 3.0 database, it is essential in the JSPC NRDC data.
NA Value: –1
Range: *chanid* > 0

Name: *claerr*
Relation: **centryd**
Description: Standard error in latitude of centroid location.
NA Value: –1.0
Units: Kilometers
Range: *claerr* > 0.0

Name: *clip*
Relations: **arrival, wfdisc**
Description: Clipped data flag. This is a single-character flag to indicate whether (c) or not (n) the data were clipped. Typically, this flag is derived from status bits supplied with GDSN or RSTN data, but could also be supplied as a result of analyst review.
NA Value: - (a dash)
Range: {c | n}, lower case

Name: *cloerr*
Relation: **centryd**
Description: Standard error in longitude of centroid location.
NA Value: –1.0
Units: Kilometers
Range: *cloerr* > 0.0

Name: *commid*
Relations: **arrival, assoc, centryd, moment, network, origin, remark, wfdisc**
Description: Comment identification. This is a key used to point to free-form comments entered in the **remark** relation. These comments store additional information about a tuple in another relation. Within the **remark** relation, there may be many tuples with the same *commid* and different *lineno*, but the same *commid* will appear in only one other tuple among the rest of the relations in the database. See *lineno*. This table is not currently used in the JSPC NRDC data.
NA Value: –1 NOT ALLOWED in **remark** where a valid entry is required.
Range: *commid* > 0

Name: *coterr*
Relation: **centryd**
Description: Standard error in origin time of centroid location.
NA Value: –1.0
Units: Kilometers
Range: *coterr* > 0.0

Name: *ctype*
Relation: **sitechan**
Description: Channel type. This attribute specifies the type of data channel: n (normal, a normal instrument response), b (beam, a coherent beam formed with array data), or i (an incoherent beam or energy stack).
NA Value: - (a dash)
Range: {n | b | i}, lower case

Name: *datatype*

Relations: **wfdisc**

Description: Numeric data storage. This attribute specifies the format of a data series in the file system. Datatypes i4, f4 and s4 are typical values. Datatype i4 denotes a 4-byte integer and f4 denotes a 32-bit real number in DEC/VAX format. s4 is an integer where the most significant byte is in the low address position in memory (used by Motorola and Sun chipsets) and is opposite to the order used on DEC and Intel chipsets. Machine dependent formats are supported for common hardwares to allow data transfer in native machine binary formats. ASCII formats have also been defined to retain full precision of any binary data type. ASCII may be used when exchanging data between computer systems with incompatible binary types. See the ‘‘wfport’’ command manual page for information about converting formats. *Datatype* can only describe single values or arrays of one data type.

NA Value: - (a dash)

Range: The currently recognized types (lower case is mandatory) are:

legal datatype values

datatype value	size (bytes)	description
a0	15	ASCII single precision
b0	24	ASCII double precision
c0	12	ASCII integer
a#	15	ASCII single precision
b#	24	ASCII double precision
c#	12	ASCII integer
t4	4	SUN IEEE single precision real
t8	8	SUN IEEE double precision real
s4	4	SUN IEEE integer
s2	2	SUN IEEE short integer
f4	4	VAX IEEE single precision real
f8	8	VAX IEEE double precision real
i4	4	VAX IEEE integer
i2	2	VAX IEEE short integer
g2	2	NORESS gain-ranged

The JSPC software supports **only** *the t4, s4 and s2 datatype values.*

Name: *deast*

Relation: **site**

Description: Distance east. This attribute gives the "easting" or relative position of an array element, east of the location of the array center specified by the value of *refsta*. See *dnorth*.

NA Value: 0.0

Units: Kilometers

Range: –20,000.0 ≤ *deast* ≤ 20,000.0

Name: *delaz*
Relation: **arrival**
Description: Delta azimuth. This attribute gives the standard deviation of the azimuth of a signal.
NA Value: –1.0
Units: Degrees
Range: *delaz* > 0.0

Name: *delslo*
Relation: **arrival**
Description: Delta slowness. This attribute gives the standard deviation of the slowness of a signal.
NA Value: –1.0
Units: Seconds (of time)/degree
Range: *delslo* > 0.0

Name: *delta*
Relation: **assoc**
Description: Source-receiver distance. This attribute is the arc length, over the earth's surface, of the path the seismic phase follows from source to receiver. The location of the origin is specified in the **origin** record referenced by the attribute *orid*. The attribute *arid* points to the record in the **arrival** relation that identifies the receiver. The value of the attribute can exceed 180 degrees, it can even exceed 360 degrees. The geographic distance between source and receiver is *delta* mod(180).
NA Value: –1.0
Units: Degrees
Range: *delta* ≥ 0.0

Name: *deltim*
Relation: **arrival**
Description: Delta time. This attribute gives the standard deviation of a detection time.
NA Value: –1.0
Units: Seconds
Range: *deltim* > 0.0

Name: *depdp*
Relation: **origin**
Description: Depth as estimated from depth phases. This is a measure of event depth estimated from a depth phase or an average of several depth phases. Depth is measured positive in a downwards direction starting from the earth's surface. See *ndp*.
NA Value: –999.0
Units: Kilometers
Range: 0.0 ≤ *depdp* < 1000.0

Name:	*depth*
Relations:	**origin, centryd**
Description:	Source depth. This attribute gives the depth of the event origin.
NA Value:	–999.0 **origin, centryd**
Units:	Kilometers
Range:	$0.0 \leq depth < 1000.0$

Name:	*descrip*
Relation:	**sitechan**
Description:	Channel description. This is a description of the data channel. For non-instrument channels (e.g. beams) this can be the only quantitative description of channel operations in the core tables.
NA Value:	- (a dash)
Range:	Any free-format string up to 50 characters

Name:	*dfile*
Relations:	**instrument, wfdisc**
Description:	Data file. In **wfdisc**, this is the file name of a disk-based waveform file. In **instrument**, this points to an instrument response file. See *dir*.
NA Value:	NOT ALLOWED. A valid entry is required.
Range:	Any free-format string up to 32 characters long

Name:	*digital*
Relation:	**instrument**
Description:	Digital/Analog. This attribute is a single character flag denoting whether this instrument record describes an analog or digital recording system.
NA Value:	- (a dash)
Range:	{d | a}, lower case

Name:	*dip1,dip2*
Relation:	**moment**
Description:	Dip of first and second nodal planes; for sign conventions see Aki and Richards, 1980, p. 106. Refers to best-fitting double couple (see *bestdc). See also slip1, slip2, str1, str2, paxazm, paxplg, paxval, taxazm, taxplg, taxval, naxazm, naxplg, naxval.*
NA Value:	–1.0
Units:	Degrees
Range:	$0.0 \leq dip1 \leq 90.0$, $0.0 \leq dip2 \leq 90.0$

Name: *dir*

Relations: **instrument, wfdisc**

Description: Directory. This attribute is the directory-part of a path name. Relative path names or "." (dot), the notation for the current directory, may be used.

NA Value: NOT ALLOWED. A valid entry is required.

Range: Any string up to 64 characters long

Name: *dnorth*

Relation: **site**

Description: Distance north. This attribute gives the "northing" or relative position of array element north of the array center specified by the value of *refsta*. See *deast*.

NA Value: 0.0

Units: Kilometers

Range: –20,000.0 ≤ *dnorth* ≤ 20,000.0

Name: *dtype*

Relation: **origin**

Description: Depth determination flag. This single-character flag indicates the method by which the depth was determined or constrained during the location process. The recommended values are f (free), d (from depth phases), r (restrained by location program) or g (restrained by geophysicist). In cases r or g, either the *auth* field should indicate the agency or person responsible for this action, or the *commid* field should point to an explanation in the **remark** relation.

NA Value: - (a dash)

Range: {f | d | r | g}, lower case

Name: *durat*

Relation: **centryd**

Description: Half-duration of source.

NA Value: –999.0

Units: Seconds

Range: Any non-zero floating point number.

Name: *dused*

Relations: **centryd, moment**

Description: Type of data used in inversion; a character string giving the type(s) of data used to determine centroid location or moment tensor (e.g., "GDSN," "GDSN+IDA,"etc.).

NA Value: -(a dash)

Range: Any free-format string up to 10 characters long.

Name: *edepth*

Relation: **sitechan**

Description: Emplacement depth. This attribute gives the depth at which the instrument is positioned, relative to the value of *elev* in the **site** relation.

NA Value: NOT ALLOWED. A valid entry is required.

Units: Kilometers

Range: *edepth* ≥ 0.0

Name: *elev*

Relations: **site**

Description: Elevation. This attribute is the elevation of a seismic station relative to mean sea level.

NA Value: –999.0

Units: Kilometers

Range: –10.0 ≤ *elev* ≤ 10.0

Name: *ema*

Relation: **arrival**

Description: Emergence angle. This attribute is the emergence angle of an arrival, as observed at a three-component station or array. The value increases from the vertical direction towards the horizontal.

NA Value: –1.0

Units: Degrees

Range: 0.0 ≤ *ema* ≤ 90.0

Name: *emares*

Relation: **assoc**

Description: Emergence angle residual. This attribute is the difference between an observed emergence angle and the theoretical prediction for the same phase, assuming an event location as specified by the accompanying *orid*.

NA Value: –999.0

Units: Degrees

Range: –90.0 ≤ *emares* ≤ 90.0

Name: *endtime*

Relations: **sensor, wfdisc**

Description: Time of last datum. In **wfdisc**, this attribute is the time of the last sample in the waveform file. *Endtime* is equivalent to *time* + (*nsamp* – 1)/*samprate*. In **sensor**, this is the last time the data in the record are valid.

NA Value: +9999999999.999

Units: Epochal seconds

Range: *endtime* > *time*

Name: *esaz*

Relation: **assoc**

Description: Event to station azimuth. This attribute is the calculated event-to-station azimuth, measured in degrees clockwise from North.

NA Value: –999.0

Units: Degrees

Range: $0.0 \leq esaz \leq 360.0$

Name: *etype*

Relations: **origin**

Description: Event type. This attribute is used to identify the type of seismic event, when known. For *etypes* l, r, t the value in **origin** will be the value determined by the station closest to the event.

NA Value: - (a dash)

Range: The recommended codes (all lower case) are:

etype values

etype code	meaning of code
qb	Quarry blast or mining explosion
eq	Earthquake
me	Marine explosion
ex	Other explosion
o	Other source of known origin
l	Local event of unknown origin
r	Regional event of unknown origin
t	Teleseismic event of unknown origin

Name: *evid*

Relations: **origin**

Description: Event identifier. Each event is assigned a unique positive integer which identifies it in a database. It is possible for several records in the **origin** relation to have the same *evid*. This indicates there are several opinions about the location of the event.

NA Value: –1 Allowed in **origin**.

Range: $evid > 0$

Name: *fm*

Relation: **arrival**

Description: First motion. This is a two-character indication of first motion. The first character describes first motion seen on short-period channels and the second holds for long-period instruments. Compression (dilation) on a short-period sensor is denoted by c(d) and compression (dilation) on a long-period sensor is denoted by u(r). Empty character positions will be indicated by dots (e.g., ".r").

NA Value: - (a dash)

Range: All two-letter permutations of {c | d | . }, {u | r | . }, lower case

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Name: *foff*

Relation: **wfdisc**

Description: File offset. This is the byte offset of a waveform segment within a data file. It is used when data are multiplexed. See *dir* and *dfile.*

NA Value: NOT ALLOWED. A valid entry is required.

Range: *foff* ≥ 0

Name: *grn*

Relations: **origin**

Description: Geographic region number. This is a geographic region number, as defined by Flinn, Engdahl and Hill (Bull. Seism. Soc. Amer. vol 64, pp. 771-992, 1974). See *grname*.

NA Value: –1 Allowed only in **origin**.

Range: *grn* > 0

Name: *hang*

Relation: **sitechan**

Description: Horizontal orientation of seismometer. This attribute specifies the orientation of the seismometer in the horizontal plane, measured clockwise from North. For a North-South orientation with the seismometer pointing toward the north, *hang*=0.; for East-West orientation with the seismometer pointing toward the west, *hang*=270. See *vang*.

NA Value: NOT ALLOWED. A valid entry is required.

Units: Degrees

Range: 0.0 ≤ *hang* ≤ 360.0

Name: *inid*

Relations: **instrument, sensor**

Description: Instrument identifier. This is a unique key to the **instrument** relation. *Inid* provides the only link between **sensor** and **instrument**.

NA Value: –1 Allowed only in **sensor**. A valid entry is required for **instrument**.

Range: *inid* > 0

Name: *insname*

Relation: **instrument**

Description: Instrument name. This is a character string containing the name of the instrument.

NA Value: - (a dash)

Range: Any free-format string up to 50 characters long.

Name: *instant*

Relation: **sensor**

Description: Snapshot indicator. When this attribute has the value *instant* = "y", it means that the snapshot was taken at the time of a discrete procedural change, such as an adjustment of the instrument gain; n means the snapshot is of a continuously changing process, such as calibration drift. This is important for tracking time corrections and calibrations.

NA Value: NOT ALLOWED. If the value is unknown, default to "y".

Range: {y | n}

Name: *instype*

Relations: **instrument, wfdisc**

Description: Instrument type. This character string is used to indicate the instrument type. Some examples are: SRO, ASRO, DWWSSN, LRSM, and S-750.

NA Value: - (a dash)

Range: Upper case and too numerous to mention, but see "Directory of World Digital Seismic Station", Ganse & Hutt, World Data Center A, Report SE-32, August, 1982.

Name: *iphase*

Relation: **arrival**

Description: Reported phase. This eight-character field holds the name initially given to a seismic phase. Standard seismological labels for the types of signals (or phases) are used (e.g., P, PKP, PcP, pP). Both upper and lower case letters are available and should be used when appropriate, for example, pP or PcP. See *phase*.

NA Value: - (a dash)

Range: Any string up to 8 characters long which conforms to seismological practice.

Name: *jdate*

Relations: **arrival, centryd, origin, sensor, wfdisc**

Description: Julian date. This attribute is the date of an arrival, origin, seismic recording, etc. The same information is available in epoch time, but the Julian date format is more convenient for many types of searches. Dates B.C. are negative. Note: there is no year = 0000 or day = 000. Where only the year is known, day of year = 001; where only year and month are known, day of year = first day of month. Note: only the year is negated for BC, so Jan 1 of 10 BC is –0010001. See *time*.

NA Value: –1

Range: Julian dates of the form yyyyddd. Must be consistent with the accompanying *time* attribute.

Name: *lat*

Relations: **origin, centryd, site**

Description: Latitude. This attribute is the geographic latitude. Locations north of the equator have positive latitudes.

NA Value: A valid entry is required in **origin** and **site**.

Units: Degrees

Range: –90.0 ≤ *lat* ≤ +90.0

Name: *lddate*

Relations: **all**

Description: Load date. This is the date and time the record was inserted into the database.

Range: Any valid date.

Name: *lineno*

Relation: **remark**

Description: Comment line number. This integer attribute is assigned as a sequence number for multiple line comments. The combination of *commid* and *lineno* is unique.

NA Value: NOT ALLOWED. A valid entry is required.

Range: *lineno* > 0

Name: *logat*

Relation: **arrival**

Description: Log of amplitude divided by period. This measurement of signal size is often reported instead of the amplitude and period separately. This attribute is only filled if the separate measurements are not available.

NA Value: –999.0

Units: Log (Nanometers/seconds)

Name: *lon*

Relations: **origin, centryd, site**

Description: Longitude. This attribute is the geographic longitude in degrees. Longitudes are measured positive east of the Greenwich meridian.

NA Value: –999.0 Allowed only in **centryd**. *A valid entry is required in* **origin** *and* **site**.

Units: Degrees

Range: –180.0 ≤ *lon* ≤ +180.0

Name: *mb*

Relation: **origin**

Description: Body wave magnitude. This is the body wave magnitude of an event. Associated with this attribute is the identifier *mbid* which points to *magid* in the **netmag** relation, which is not used in the JSPC data. See *ml* and *ms*.

NA Value: –999.0

Name: *mbid*

Relation: **origin**

Description: Magnitude identifier for *mb*. This stores the *magid* for a record in **netmag**, which is not currently filled in. See *magid*, *mlid* and *msid*.

NA Value: –1

Range: *mbid* > 0

Name: *mexpon*

Relation: **moment**

Description: Exponent of moment scale factor; the power of 10 by which scalar moment (*bestdc*) or moment tensor components (*mrr*, *mtt*, etc.) and their corresponding errors are to be multiplied to give their actual values. As an example, if *mexpon*=17 and *bestdc*=1.3, then the scalar moment is given by 1.3x10**17 N.-m. (Note units.)

NA Value: –1

Range: *mexpon* ≥ 0

Name: *mff,mrf,mrr,mrt,mtf,mtt*

Relation: **moment**

Description: Moment tensor components; given in a spherical coordinate system - for conventions and conversion to a Cartesian (x,y,z) system, see Aki & Richards, 1980, p. 118.

NA Value: –999.0 (Only if *mexpon* = -1.)

Units: Given by *mexpon*.

Range: Any floating point number.

Name: *mfferr,mrferr,mrrerr,mrterr,mtferr,mtterr*

Relation: **moment**

Description: Standard errors of moment tensor components; calculated under the usual assumption of uncorrelated errors in the data.

NA Value: –999.0 (Only if mexpon = -1.)

Units: Same as *mff*, *mrf*, etc.

Range: Any floating point number.

Name: *ml*

Relation: **origin**

Description: Local magnitude. This is the local magnitude of an event. See *mb* and *ms*.

NA Value: –999.0

Name: *mlid*

Relation: **origin**

Description: Magnitude identifier for *ml*. *Mlid* is a foreign key joining **origin** to the **netmag** relation; netmag is not used in the JSPC NRDC data. See sid **and** *mbid***.**

NA Value: –1

Range: *mlid* > 0

Name: *ms*

Relation: **origin**

Description: Surface wave magnitude. This is the surface wave magnitude for an event. Associated with this attribute is the identifier *msid*, which points to *magid* in the **netmag** relation, which is not used in the JSPC data. See *mb* and *ml*.

NA Value: –999.0

Name: *msid*

Relation: **origin**

Description: Magnitude identifier for *ms*. This is a foreign key into the netmag relation, which is not used in the JSPC NRDC data. See *mlid* and *mbid*.

NA Value: –1

Range: *msid* > 0

Name: *nass*

Relation: **origin**

Description: Number of associated arrivals. This attribute gives the number of arrivals associated with the origin.

NA Value: –1

Range: *nass* > 0

Name: *naxazm,naxplg*

Relation: **moment**

Description: Null-axis azimuth and plunge; obtained by rotation of the moment tensor into the principal axes system. Associated with the largest positive eigenvalue. For conventions see Aki & Richards (1980).

NA Value: –1.0

Units: Degrees

Range: $0 \leq naxazm \leq 360.0$, $0 \leq naxplg \leq 90.0$

Name: *naxval*

Relation: **moment**

Description: Length of null-axis vector; obtained by rotation of the moment tensor into the principal axes system. See also *naxazm*, *naxplg*.

NA Value: –1.0

Units: Units given by *mexpon*.

Range: Any positive floating point number

Name: *ncalib*

Relation: **instrument**

Description: Nominal calibration factor. This is the conversion factor that maps digital data to earth displacement. The factor holds true at the oscillation period specified by *ncalper*. A positive value means ground motion increasing in component direction (up, north, east) is indicated by increasing counts. A negative value means the opposite. Actual calibration for a particular recording is determined using the **wfdisc** and **sensor** relations. See *calratio*.

NA Value: NOT ALLOWED. A valid entry is required.

Units: Nanometers/digital count

Range: Any non-zero floating point number.

Name: *ncalper*

Relation: **instrument**

Description: Calibration period. This attribute is the period for which *ncalib* is valid.

NA Value: NOT ALLOWED. A valid entry is required.

Units: seconds

Range: $ncalper > 0.0$

Name: *ndef*

Relation: **origin**

Description: Number of time-defining phases. This attribute is the number of arrivals used to locate an event. See *timedef*.

NA Value: –1

Range: $0 < ndef \leq nass$

Name: *ndp*

Relation: **origin**

Description: Number of depth phases. This attribute gives the number of depth phases used in calculating *depth* and/or *depdp*. See *depdp*.

NA Value: –1

Range: $ndp \geq 0$

Name: *net*
Relations: **affiliation, network**
Description: Unique network identifier. This character string is the name of a seismic network. One example is WWSSN.
NA Value: A valid entry is required in **affiliation** and **network**.
Range: Any free-format string up to 8 characters

Name: *netname*
Relation: **network**
Description: Network Name. String containing the name of a network.
NA Value: - (a dash)
Range: Any string up to 80 characters

Name: *nettype*
Relation: **network**
Description: Network type. This 4 character string specifies what type of network (ar = array), (lo = local area), (ww = world-wide) for the given value of *net*.
NA Value: - (a dash)
Range: Any lower case string up to 4 characters

Name: *nrlpb*
Relations: **centryd, moment**
Description: Number of long-period body wave records; the number of records used in inversion. See also *nslpb*.
NA Value: –1
Range: *nrlpb* > 0

Name: *nrmw*
Relation: **centryd, moment**
Description: Number of mantle wave records; the number of records used in inversion. See also *nsmw*.
NA Value: –1
Range: *nrmw* > 0

Name: *nsamp*
Relations: **wfdisc**
Description: Number of samples. This quantity is the number of samples in a waveform segment.
NA Value: NOT ALLOWED. A valid entry is required.
Range: *nsamp* > 0

Name: *nslpb*

Relation: **centryd, moment**

Description: Number of stations supplying long-period body wave records; refers to number of stations used in inversion. (There may be several records per station - see *nrlpb*.)

NA Value: –1

Range: *nslpb* > 0

Name: *nsmw*

Relation: **centryd, moment**

Description: Number of stations supplying mantle wave records; refers to number of stations used in inversion. (There may be several records per station - see *nrmw*.)

NA Value: –1

Range: *nsmw* > 0

Name: *offdate*

Relations: **site, sitechan**

Description: Turn off date. This attribute is the Julian Date on which the station or sensor indicated was turned off, dismantled, or moved. See *ondate*.

NA Value: –1

Range: Julian date of the form yyyyddd

Name: *ondate*

Relations: **site, sitechan**

Description: Turn on date. This attribute is the Julian Date on which the station or sensor indicated began operating. *Offdate* and *ondate* are not intended to accommodate temporary downtimes, but rather to indicate the time period for which the attributes of the station (*lat, lon, elev*) are valid for the given station code. Stations are often moved, but with the station code remaining unchanged.

NA Value: NOT ALLOWED. A valid entry is required.

Range: Julian date of the form yyyyddd

Name: *orid*

Relations: **assoc, centryd, moment, origin**

Description: Origin identification. Each origin is assigned a unique positive integer which identifies it in a data base. The *orid* is used to identify one of the many hypotheses of the actual location of the event.

NA Value: NOT ALLOWED. A valid entry is required for all relations.

Range: *orid* > 0

Name: *paxazm,paxplg*

Relation: **moment**

Description: Compression axis azimuth and plunge; obtained by rotation of the moment tensor into the principal axes system. Associated with the largest positive eigenvalue. For conventions see Aki & Richards (1980).

NA Value: –1.0

Units: Degrees

Range: $0 \leq paxazm \leq 360.0$, $0 \leq paxplg \leq 90.0$

Name: *paxval*

Relation: **moment**

Description: Length of compressional axis vector; obtained by rotation of the moment tensor into the principal axes system. See also *paxazm*, *paxplg*.

NA Value: –1.0

Units: Units given by *mexpon*.

Range: Any positive floating point number.

Name: *per*

Relation: **arrival**

Description: Signal period. This attribute is the period of the signal described by the **arrival** record.

NA Value: –1.0

Units: Seconds

Range: $per > 0.0$

Name: *phase*

Relations: **assoc**

Description: Associated phase. This field holds the identity of a seismic phase which has been associated to an event. Standard seismological labels for phases are used (e.g., P, PKP, PcP, pP, etc.). Both upper and lower case letters are available and should be used when appropriate, for example, pP or PcP. See *iphase*.

NA Value: - (a dash)

Range: Any string up to 8 characters long which conforms to seismological practice.

Name: *qual*

Relation: **arrival**

Description: Onset quality. This single-character flag is used to denote the sharpness of the onset of a seismic phase. This relates to the timing accuracy as follows:

i (impulsive) - accurate to +/– 0.2 seconds
e (emergent) - accuracy between +/–(0.2 to 1.0 seconds)
w (weak) - timing uncertain to > 1 second.

NA Value: - (a dash)

Range: {i | e | w}, lower case

Name: *rect*

Relation: **arrival**

Description: Rectilinearity. This attribute is a measure of signal rectilinearity. The value is obtained from polarization analysis of 3-component data.

NA Value: –1.0

Range: $0.0 \leq rect \leq 1.0$

Name: *refsta*

Relation: **site**

Description: Reference station. This string specifies the reference station with respect to which array members are located. See *deast, dnorth*.

NA Value: - (a dash)

Range: Any *sta* from **site**.

Name: *remark*

Relation: **remark**

Description: Descriptive text. This single line of text is an arbitrary comment about a record in the database. The comment is linked to its ‘‘parent’’ relation only by forward reference from *commid* in the tuple of the relation of interest. See *commid* and *lineno*.

NA Value: - (a dash)

Range: Any free-format string up to 80 characters long.

Name: *rsptype*

Relation: **instrument**

Description: Instrument response type. This denotes the style in which detailed calibration data are stored. The neighboring attribute *dfile* tells where the calibration data are saved. When *rsptype* = paz, it indicates the data are the poles and zeroes of the Laplace transform. *rsptype* = fap indicates they are amplitude/phase values at a range of frequencies. *rsptype* = fir indicates it is a finite impulse response table. *rsptype* = pazfir indicates a combination of poles, zeros and finite impulse response. Other codes may be defined.

NA Value: NOT ALLOWED. A valid entry is required.

Range: Any lower case string up to 6 characters long.

Name: *samprate*

Relations: **instrument, wfdisc**

Description: Sampling rate. This attribute is the sample rate in samples/second. In the **instrument** relation this is specifically the nominal sample rate, not accounting for clock drift. In **wfdisc**, the value may vary slightly from the nominal to reflect clock drift.

NA Value: NOT ALLOWED. A valid entry is required.

Units: 1/seconds

Range: $samprate > 0.0$

Name: *seaz*

Relation: **assoc**

Description: Station to event azimuth. This attribute is calculated from the station and event locations. It is measured clockwise from North.

NA Value: –999.0

Units: Degrees

Range: $0.0 \leq seaz \leq 360.0$

Name: *segtype*

Relations: **wfdisc**

Description: Segment type. This attribute indicates if a waveform is o (original), v (virtual), s (segmented) or d (duplicate).

NA Value: - (a dash)

Range: {o | v | s | d}, lower case

Name: *slip1,slip2*

Relation: **moment**

Description: Slip of the first and second nodal planes; for sign conventions see Aki and Richards, 1980, p. 106. Refers to best-fitting double couple (see *bestdc*). See also *dip1, dip2, str1, str2, paxazm, paxplg, paxval, taxazm, taxplg, taxval, naxazm, naxplg, naxval.*

NA Value: –1.0

Units: Degrees

Range: $-180.0 \leq slip1 \leq +180.0$, $-180.0 \leq slip2 \leq +180.0$

Name: *slodef*

Relation: **assoc**

Description: Slowness defining code. This one-character flag indicates whether or not the slowness of a phase is d (defining), or n (non-defining) for this arrival. See *azdef* and *timedef.*

NA Value: - (a dash)

Range: {d | n}

Name: *slores*

Relation: **assoc**

Description: Slowness residual. This attribute gives the difference between an observed slowness and a theoretical prediction. The prediction is calculated for the related phase and event origin described in the record.

NA Value: –999.0
Note: This differs from the CSS 3.0 published standard, which specifies -99999.0. That value will not fit in the allocated space, however.

Units: Seconds/degree

Name: *slow*

Relation: **arrival**

Description: Observed slowness. This is the observed slowness of a wave as it sweeps across an array.

NA Value: –1.0

Units: Seconds/degree

Range: *slow* ≥ 0.0

Name: *snr*

Relation: **arrival**

Description: Signal-to-noise ratio. This is an estimate of the size of the signal relative to that of the noise immediately preceding it.

NA Value: –1.0

Range: *snr* > 0.0

Name: *srn*

Relations: **origin, sregion**

Description: Region number. This is a seismic region number, as given by Flinn, Engdahl and Hill (Bull. Seism. Soc. Amer. vol 64, pp 791-992, 1974). See *grn, grname* and *srname*.

NA Value: –1 Allowed only in **origin**. A valid entry is required in **sregion**.

Range: *srn* > 0

Name: *srname*

Relation: **sregion**

Description: Seismic region name. This attribute is the common name of a seismic region, as given in Flinn, Engdahl and Hill (Bull. Seism. Soc. Amer., vol 64, pp 771-992, 1974). Names may have changed due to changing political circumstances (e.g., old RHODESIA = new ZIMBABWE). See *srn* and *grname*.

NA Value: NOT ALLOWED. A valid entry is required.

Range: Any upper-case string up to 40 characters long.

Name: *sta*

Relations: **affiliation, arrival, assoc, sensor, site, sitechan, wfdisc**

Description: Station code. This is the common code-name of a seismic observatory. Generally only three or four characters are used.

NA Value: A valid entry is required.

Range: Any upper case string up to 6 characters long.

Name: *staname*

Relation: **site**

Description: Station name/description. This is the full name of the station whose code-name is in *sta*. As an example, one record in the **site** relation connects *sta* = ANMO to *staname* = ALBUQUERQUE, NEW MEXICO (SRO).

NA Value: - (a dash)

Range: Any upper-case string up to 50 characters long.

Name: *stassid*

Relations: **arrival**

Description: Station association identification. The wavetrain from a single event may be made up of a number of arrivals. A unique *stassid* joins those arrivals believed to have come from a common event as measured at a single station.

NA Value: –1 Allowed only in **arrival**.

Range: *stassid* > 0

Name: *statype*

Relation: **site**

Description: Station type. This character string specifies the station type. Recommended entries are ss (single station) or ar (array).

NA Value: - (a dash)

Range: {ss | ar}, lower case

Name: *str1,str2*

Relation: **moment**

Description: Strike of first and second nodal planes; for sign conventions see Aki and Richards, 1980, p. 106. Refers to best-fitting double couple (see *bestdc). See also dip1, dip2, slip1, slip2, paxazm, paxplg, paxval, taxazm, taxplg, taxval, naxazm, naxplg, naxval.*

NA Value: –1.0

Units: Degrees

Range: $0.0 \leq str1 \leq 360.0$, $0.0 \leq str2 \leq 360.0$

Name: *stype*

Relation: **arrival**

Description: Signal type. This single-character flag indicates the event or signal type. The following definitions hold:

l = local event
r = regional event
t = teleseismic event
m = mixed or multiple event
g = glitch (i.e., non-seismic detection)
c = calibration activity upsets the date

l, r, and t are supplied by the reporting station, or as an output of post-detection processing. g and c come from analyst comment or from status bits from GDSN and RSTN data.

NA Value: - (a dash)

Range: {l | r | t | m | g | c}, lower case

Name: *taxazm,taxplg*

Relation: **moment**

Description: Tension axis azimuth and plunge; obtained by rotation of the moment tensor into the principal axes system. Associated with the largest (in the absolute sense) negative eigenvalue. For conventions see Aki & Richards (1980).

NA Value: –1.0

Units: Degrees

Range: $0 \leq taxazm \leq 360.0$, $0 \leq taxplg \leq 90.0$

Name: *taxval*

Relation: **moment**

Description: Length of tension axis vector; obtained by rotation of the moment tensor into the principal axes system. See also *taxazm*, *taxplg*.

NA Value: –1.0

Units: Units given by *mexpon*.

Range: Any negative floating point number.

Name: *time*

Relations: **arrival, centryd, origin, sensor, wfdisc**

Description: Epoch time. Epochal time given as seconds and fractions of a second since hour 0 January 1, 1970, and stored in a double precision floating number. Refers to the relation data object with which it is found. E.g., in **arrival** - arrival time; in **origin** - origin time; in **wfdisc**, - start time of data. Where date of historical events is known, time is set to the start time of that date; where the date of contemporary arrival measurements is known but no time is given, then the time attribute is set to the NA value. The double-precision floating point number allows 15 decimal digits. At 1 millisecond accuracy this is a range of $3 * 10^4$ years. Where time is unknown, or prior to Feb. 10, 1653, set to the NA value.

NA Value: All relations require a valid time.

Units: Seconds

Name: *timedef*

Relation: **assoc**

Description: Time-defining code. This one character flag indicates whether the time of a phase is d (defining), or n (non-defining) for this arrival. See *azdef* and *slodef*.

NA Value: - (a dash)

Range: {d | n}

Name: *timeres*

Relation: **assoc**

Description: Time residual. This attribute is a travel time residual, measured in seconds. The residual is found by taking the observed arrival time (saved in the **arrival** relation) of a seismic phase and subtracting the expected arrival time. The expected arrival time is calculated by a formula based on earth velocity model (attribute *vmodel*), an event location and origin time (saved in table **origin**), the distance to the station (attribute *dist* in table **assoc**), and the particular seismic phase (attribute *phase* in table **assoc**).

NA Value: –999.0

Units: Seconds

Name: *tmnlpb*

Relations: **centryd, moment**

Description: Minimum period used in body-wave inversion; the cut-off period of the low pass filter applied before inversion.

NA Value: –1.0

Units: Seconds

Range: *tmnlpb* ≥ 0.0

Name: *tmnmw*

Relations: **centryd, moment**

Description: Minimum period used in mantle wave inversion; the cut-off period of the low pass filter applied before inversion.

NA Value: –1.0

Units: Seconds

Range: *tmnmw* ≥ 0.0

Name: *tshift*

Relation: **sensor**

Description: Correction for clock errors. This attribute is designed to accommodate discrepancies between actual time and the numerical time written by data recording systems. Actual time is the sum of the reported time plus *tshift*.

NA Value: NOT ALLOWED. An entry is required to define a valid record.

Units: Seconds

Name: *vang*

Relation: **sitechan**

Description: Vertical orientation of seismometer. This attribute measures the angle between the sensitive axis of a seismometer and the outward-pointing vertical direction. For a vertically oriented seismometer, *vang* = 0. For a horizontally oriented seismometer, *vang*=90. See *hang*.

NA Value: NOT ALLOWED. A valid entry is required.

Units: Degrees

Range: 0.0 ≤ *vang* ≤ 90.0

Name: *vmodel*

Relation: **assoc**

Description: Velocity model. This character string identifies the velocity model of the earth used to compute the travel times of seismic phases. These are required for event location (if phase is defining) or for computing travel-time residuals.

NA Value: - (a dash)

Range: Any free-format string up to 15 characters

Name: *wfid*

Relations: **wfdisc**

Description: Waveform identifier. The key field is a unique identifier for a segment of digital waveform data.

NA Value: NOT ALLOWED. A valid entry is required.

Range: *wfid* > 0

Name:	*wgt*
Relation:	**assoc**
Description:	Location weight. This attribute gives the final weight assigned to the allied arrival by the location program. It is used primarily for location programs that adaptively weight data by their residuals.
NA Value:	–1.0
Range:	$0.0 \leq wgt < 1.0$