Project S4 – Italian strong motion data base

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ITACA

USER MANUAL

DRAFT VERSION

By

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1. INTRODUCTION

The Italian strong motion data base (Italian Strong Motion Data Base) is a joint product of the agreement between the *Dipartimento della Protezione Civile* and the *Istituto Nazionale di Geofisica e Vulcanologia* (National Institute of Geophysics and Volcanology), developed in the framework of the past Project S6 (2004-2006) and the ongoing Project S4 (2007-2009).
The data base is handled through two different relational data base management system: Ms Access® 2003, of major use among research institutions and public administrations, for CD-ROM release, and MySQL for the web distribution. The selection of the former product is driven by the simplicity of the software, the worldwide diffusion and the possibility of being linked to software's for the management of spatial data, such as ESRI ArcGis® and Arcview®, and software for the scientific calculation such as Matlab ®. The data base will store the information regarding the seismic events, the recording stations, the installed instruments, the main features of the recordings and the engineering parameters. The structure is based on a previous version of the Italian strong-motion data base created by ENEA in collaboration with Department of Civil Protection, which stores the information regarding the accelerometric recordings in the time span 1972-1993.
The draft version of this manual explains the format of data storaged in the ITACA 1.0 (beta version). Detail on the structure of the database and on which data and metadata are included, can be found in the web-site of the Project S6 (INGV-DPC, 2004-2006) - Deliverable D1 (http://esse6.mi.ingv.it/)

2. DATA FORMAT

2.1 RULES FOR FILES NAMING

The file name should make easier the data retrieval based on date, time, station name and component through simple OS commands. It should be therefore composed by:

YYYYYMMDD + _ + HHMMSS + NETWORK CODE + _ + STATION CODE + COMP ONENT+ PROCESSING FLAG . FORMAT

for a total length of 33 characters. The single segments are described in Table 1.

Example: the acceleration recorded by the *Department of Civil Protection network* (ITDPC) at *S. Giuliano di Puglia scuola* (SGIB), NS component, on 2002/11/12 at 09:27:00 GMT, unprocessed, ASCII format with header, will have the following name:

20021112_092700ITDPC_SGIB_NSX.DAT

Table 1: description of the segments forming the file name.

SEGMENT	DESCRIPTION	LENGTH	REQUIREMENTS
YYYYMMDD_HHMMSS	Origin time	15	The origin time of the selected localisation. When no events are listed in seismic catalogues, it is assumed the record start time
NETCODE	Network code	5	If the Network code has less than 5 characters, the rest is replaced by one or more underscores
STACODE	Station code	5	If the station code has less than 5 characters, the rest is replaced by one or more underscores
COMP	Component of the motion	2	*NS* = north-south *WE* = east-west *UP* = vertical
CORRECTION_FLAG	This flag specifies whether or not the record has been processed	1	*C* = processed *X* = unprocessed
FORMAT	Flag indicating the format type	4	*SAC* = acceleration (SAC format) *DAT* = acceleration (ASCII with header) *ASC* = acceleration (ASCII-XY) *VEL* = velocity (ASCII with header) *DIS* = displacement (ASCII with header) SPE = 5% damped acceleration response spectrum (ASCII-XY with header)

2.2 RECORD HEADER

The ASCII-with-header records (acceleration, velocity, displacement or acceleration response spectrum) will be characterised by a header of 43 rows, containing the following information, in order to make the record self-consistent:

EVENT_NAME:	Name of the seismic event
EVENT_DATE_YYYYMMDD:	GMT event date (YYYYMMDD)
EVENT_TIME_HHMMSS:	GMT event origin time (hhmmss)
EVENT_LATITUDE_DEGREE:	Event Latitude (decimal degrees)
EVENT_LONGITUDE_DEGREE:	Event Longitude (decimal degrees)
EVENT_DEPTH_KM:	Event depth (km)
MAGNITUDE_L:	Local magnitude Ml
MAGNITUDE_S:	Surface wave magnitude Ms
MAGNITUDE_W:	Moment magnitude Mw
FOCAL_MECHANISM:	Focal mechanism
STATION_CODE:	Station code
STATION_NAME:	Station name
STATION_LATITUDE_DEGREE:	Station Latitude (decimal degrees)
STATION_LONGITUDE_DEGREE:	Station Longitude (decimal degrees)
STATION_ELEVATION_M:	Station elevation (m.a.s.l.)
SITE_CLASSIFICATION_EC8:	Geotechnical classification (EC8,); * indicates that site classification is based on geophysical/geological information
MORPHOLOGIC_CLASSIFICATION:	Morphologic classification
EPICENTRAL_DISTANCE_KM:	Epicentral distance (km)
EARTHQUAKE_BACKAZIMUTH_DEGREE:	Earthquake backazimuth
TIME_FIRST_SAMPLE_S:	Time (GMT) of the first sample (hhmmss.dec)
SAMPLING_INTERVAL_S:	Sampling interval (s)
NDATA:	Number of points
DURATION_S:	Duration (s)
COMPONENT:	Component (NS, WE, UP, FC)
UNITS:	Units (cm/s^2, cm/s, cm, cm/s^2)
INSTRUMENT:	Instrument type
INSTRUMENTAL_FREQUENCY_HZ:	Instrument Frequency (Hz)

INSTRUMENTAL_DAMPING:	Instrument Damping
SENSITIVITY_V/G:	Sensitivity (cm/g, V/g)
FULL_SCALE_G:	Fullscale (g)
N_BIT_DIGITAL_CONVERTER:	Number of bits of the Analog to Digital Converter
PGX_CM/S^2:	Pga, Pgv, Pgd (cm/s^2, cm/s, cm)
TIME_PGX_S:	Time corresponding to the Pga, Pgv, Pgd
OWNER_RECORD:	Owner of the record
INSTRUMENT_ANALOG/DIGITAL:	A/D analog/digital
BASELINE_CORRECTION:	Baseline correction (REMOVED/NOT REMOVED)
FILTER_TYPE:	Filter type (Butterworth, ……)
FILTER_ORDER:	Filter order
LOW_CUT_FREQUENCY_HZ:	LP1 (low-cut frequency)
HIGH_CUT_FREQUENCY_HZ:	LP2 (roll-on frequency)
LATE/NORMAL_TRIGGERED:	LT/NT
DATA_VERSION:	Itaca 1.0 (the fist number indicates the Itaca version, the second one the processing version)
DATA_TYPE:	Data type (unprocessed acceleration, processed acceleration, velocity, displacement, acceleration response spectrum)

The SAC files are stored in binary format, with little-endian byte order, to be used with Linux OS.
The binary SAC format contains a fixed length header section followed by one or two data sections. The header contains floating point, integer, logical, and character fields. Details on the SAC header are defined at http://www.llnl.gov/sac/.
Some of the 43 row ASCII header metadata were stored in the unused spaces of the SAC header.

In particular the instrument characteristics were stored in the floating point part of the header (numbers refer to the position inside the header):

#22 instrument frequency
#23 instrument damping
#24 instrument sensitivity
#25 instrument full scale
#41 low pass frequency
#43 high pass frequency
#67 0 = LATE TRIGGERED, 1 = NORMAL TRIGGERED

#68 surface wave magnitude
#69 local magnitude
#70 moment magnitude

In the integer part of the header the following information has been stored (numbers refer to the position inside the header):

#26 number of bit of ADC
#27 1 = BASELINE REMOVED, 0 = BASELINE NOT REMOVED
#28 1 = BUTTERWORTH, 0 = COSINE filter
#29 1 = PROCESSED ACCELERATION, 0 = UN PROCESSED ACCELERATION

The instrument type information, contained in the character header KINST, is stored as DIGITAL or ANALOG, due to the limitation to 8 characters.