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Old seismologic reports

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SEISMIC OBSERVATIONS
AT FABRA OBSERVATORY IN 1977

by JAVIER PAVIA SEGURA

The Observatory has now the following seismographs:

— One short period "Hiller-Stuttgart" seismograph, vertical component, with photographic recording.

— Two long period "Mainka" seismographs, horizontal components, with mechanic recording.

— One short period "Vicentini" seismograph, vertical component, with mechanic recording.

We symbolize by ZH the Z component of Hiller-Stuttgart set, by NM and EM the Mainka horizontal components and by ZV the Vicentini vertical component.

For the most outstanding earthquakes, we describe their epicentral characteristics, calculated by the Seismic Section of this Observatory (FBR), together with "Laboratori d'Estudis Geofisics Eduard Fontseré" of "Institut d'Estudis Catalans" (IEC) or provided by the United States Geological Survey (GS), by the Centre Seismologique Europeo-Mediterranean (CSEM), by the Laboratorio Central de la Sección de Sismología e Ingeniería sísmica (LC-SS), by the Laboratoire de Detection et de Geophysique (LDG) or by P. Stahl (PS).

The average instrumental constants have been:

1.º) Seismograph with photographic recording:

Type.	Component	Period (s)		Maximun Amplification V_m	Damping
		T_p	T_g		
Hiller-Stuttgart	Z(ZH)	1,61	1,3	7,326	Critical

2.º) Seismographs with mechanic recording:

Type	Component	Mass Kg.	Period (s) T_0	Damping ϵ	Friction $r/T \sigma^2$	Amplification V
Mainka	N-S (NM)	141	9,52	2,82	0,013	51,7
Mainka	E-W (EM)	144	8,4	2,86	0,02	39,5
Vicentini	Z (ZV)	56	0,9	—	—	125



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
1 Jan	ZH	iP	21	50	27		Ep.: 38,1 N; 91,0 E; H = 21 39 41,3 h = 27 Km; M = 5,9 (GS) Tsinghai Province, China.
3	ZH	iP	09	27	13		
17	ZH	iP	21	40	25	10100	Ep.: 24,8 S; 68,7 W; H = 21 27 12,6 h = 33 Km; M = 6,3 (GS) Chile-Argentina Border Region.
	ZH	ipP	21	41	06,5		
	EM	eSKS	21	50	52		
	EM	eS	21	51	26		
18	ZH	iPKP	06	01	54		Ep.: 41,7 S; 174,3 E; H = 05 41 49,6 h = 50 Km; M = 5,9 (GS) New Zealand.
19	ZH	iP	00	57	22		Ep.: 37,0 N; 95,7 E; H = 00 46 18,3 h = 33 Km; M = 5,9 (GS) Tsinghai Province, China.
19	ZH	iPg	20	48	33		Ep.: 36,6 N; 8,5 E; H = 20 46 53,3 h = 22 Km; M = 5,1 (GS) Tunisia.
	ZH	iPn	20	48	50		
	ZH	Sg	20	49	—		
22	ZH	ePg	07	47	07		See page 56.
23	74	iPKP	01	58	08,4		Ep.: 13,4 S; 166,5 E; H = 01 38 23,5 h = 39 Km; M = 5,5 (GS) New Hebrides Islands.
25	ZH	P	10	50	45,7		Ep.: 10,9 S; 164,7 E; H = 10 31 04,9 h = 25 Km; M = 5,7 (GS) Santa Cruz Islands Region.
31	ZH	iP	14	35	15,2		Ep.: 40,0 N; 70,9 E; H = 14 26 14,8 h = 20 Km; M = 6,1 (GS) Tadzhik SSR.
4 Feb	ZH	iP	07	57	32		Ep.: 24,7 S; 63,4 W; H = 07 46 33,8 h = 549 Km; M = 6,0 (GS) Salta Province, Argentina.
	ZH	iPP	08	00	36		
	ZH	ipPP	08	02	10		
5	ZH	iPKP	03	48	15,5	13750	Ep.: 66,4 S; 82,6 W; H = 03 29 18,9 h = 33 Km; M = 6,2 (GS) Southern Pacific Ocean.
	ZH	PP	03	49	52,5		
	ZH	SP	04	00	43,5		
	ZH	SPP	04	01	44,5		
6	ZH	ePKP	03	29	52,5		Ep.: 21,8 S; 175,3 W; H = 03 09 14 h = 33 KM; M = 5,6 (GS) Tonga Islands.
18	ZH	ePg	10	05	20,8	88	Ep.: Local.
		iSg	10	05	31,2		



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
19 Feb	ZH	iP	22	46	39	2110	Ep.: 53,6 N; 170,0 E; H = 22 34 04,1 h = 33 Km; M = 6,2 (GS) Near Islands, Aleutian Islands.
	NM	eS	22	57	13		
	EM	S	22	57	14		
2 Mar	ZH	iPKP	10	12	26,5		Ep.: 6,8 N; 123,7 E; H = 09 53 23,2 h = 52 Km; M = 6,1 (GS) Mindanao, Philippine Islands.
4	ZH	iP	19	26	04	2110	Ep.: 45,8 N; 26,8 E; H = 19 21 51,1 h = 94 Km; M = 7,2 (GS) Rumania.
	NM	iS	19	29	32		
7	ZH	eP	00	41	01		Ep.: 40,0 N; 118,7 E; H = 00 28 47,4 h = 33 Km; M = 5,3 (GS) Northeasten China.
9	ZH	iP	14	39	34	9590	Ep.: 41,6 N; 130,9 E; H = 14 27 53,6 h = 528 Km; M = 5,9 (GS) North Korea.
	ZH	ipP	14	41	39		
	ZH	iPP	14	43	04		
	ZH	ePPP	14	44	58		
	NM	eSKS	14	49	04		
	EM	eS	14	49	16		
	ZH	iSP	14	50	18		
18	ZH	eP	21	57	44		Ep.: 16,7 N; 122,6 E; H = 21 43 51,7 h = N; M 6,8 (GS) Luzon, Philippine Islands.
	EM	ePP	22	00	52		
	EM	eS	22	09	25		
19	ZH	iP	11	09	15,6		Ep.: 44,2 N; 148,2 E; H = 10 56 25,1 h = 70 Km; M = 6,0 (GS) Kuril Islands.
21	ZH	iP	21	27	17,6		Ep.: 27,7 N; 56,5 E; H = 21 18 54,6 h = 33 Km; M = 7,0 (GS) Southern Iran.
	NM	S	21	34	03		
21	ZH	iP	22	50	28,2		Ep.: 27,6 N; 56,5 E; H = 22 42 06,5 h = 33 Km; M = 5,8 (GS) Southern Iran.
22	ZH	iP	12	05	53		Ep.: 27,6 N; 56,5 E; H = 11 57 30,9 h = 39 Km; M = 5,7 (GS) Southern Iran.
	ZH	iPcP	12	06	42,5		
	ZH	iPP	12	07	31		
	ZH	iPPP	12	08	24		
23	ZH	iP	23	59	36		Ep.: 27,6 N, 56,6 E; H = 23 51 15,8 h = 35 Km; M = 5,8 (GS) Southern Iran.
26	ZH	iP	04	49	12		Ep.: 52,3 N; 168,3 W; H = 04 36 14,7 h = 38 Km; M = 5,7 (GS) Fox Islands, Aleutian Islands.



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
1 Apr	ZH	iP	13	44	47		Ep.: 28,1 N; 56,8 E; H = 13 36 28,7 h = 33 Km; M = 6,0 (GS) Southern Iran.
2	ZH	iP	07	35	12		Ep.: 16,5 S; 171,5 W; H = 07 15 25,0 h = 33 Km; M = 7,5 (GS) Samoa Islands Region.
	EM	eS	07	43	46		
4	ZH	eP	04	50	10		
4	ZH	iP	18	00	51	5106	Ep.: 7,3 N; 34,9 W; H = 17 52 19,7 h = 33 Km; M = 5,5 (GS) Central Mid-Atlantic Ridge.
	ZH	PP	18	02	40		
6	ZH	eP	13	44	11	4710	Ep.: 31,9 N; 50,6 E; H = 13 36 35,5 h = 33 Km; M = 6,0 (GS) Iran.
	ZH	iPcP	13	45	16		
	ZH	iPP	13	45	48		
13	ZH	iP	11	42	45,4	5883	Ep.: 36,5 N; 70,9 E; H = 11 33 51,8 h = 196 Km; M = 5,3 (GS) Hindu Kush Region.
	ZH	iPcP	11	43	56,5		
	ZH	iPP	11	45	44		
	ZH	iPPP	11	49	48		
14	ZH	iPn	07	18	34	580	Ep.: 36,3 N; 5,7 E; H = 07 17 9,0 h = 18 Km; M = 4,7; (GS) Algeria.
	ZH	iPg	07	18	53		
	ZH	iSn	07	19	41		
	ZH	iSg	07	20	07		
20	ZH	ePKP	23	32	40		Ep.: 9,8 S; 160,3 E; H = 23 13 10,4 h = 33 Km; M = 6,4 (GS) Solomon Islands.
	ZH	ePP	23	35	57		
20	ZH	ePKP	23	37	57		Ep.: 9,9 S; 160,6 E; H = 23 18 40,8 h = 33 Km; M = 5,9 (GS) Solomon Islands.
	ZH	iPKP2	23	38	46		
21	ZH	iPKP	00	02	34		Ep.: 9,9 S; 160, 3 E; H = 23 42 50,5 h = 19 Km; M = 6,3 (GS) Solomon Islands.
	ZH	iPP	00	05	55		
21	ZH	iPKP	00	08	47		Ep.: 9,8 S; 160,8 E; H = 23 49 13,1 h = 33 Km; M = 6,8 (GS) Solomon Islands.
	ZH	iPP	00	12	56		
21	ZH	ePKP	02	04	04		Ep.: 26,8 N; 142,4 E; H = 01 45 50,2 h = 33 Km; M = 5,8 (GS) Bonin Islands Region.
21	EM	ePKP	04	43	38		Ep.: 9,8 S; 160,7 E; H = 04 24 10,5 h = 33 Km; M = 7,7 (GS) Solomon Islands.
26	ZH	iPg	16	03	13		Ep.: Local.
26	ZH	iP	16	32	32		Ep.: 32,7 N; 48,9 E; H = 16 25 29,0 h = 47 Km; M = 5,4 (GS) Western Iran.
	ZH	e	16	34	00		



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
12 May	ZH	iP	11	30	03		Ep.: 39,3 N; 117,7 E; H = 11 17 53,1 h = 22 Km; M = 5,8 (GS) Northeastern China.
12	ZH	iP	12	31	59		Ep.: 21,7 N; 93,0 E; H = 12 20 00,7 h = 40 Km; M = 5,4 (GS) Burma.
25	ZH	ePg	13	59	40,4		See page 56.
25	ZH	iP	15	08	41,5	10.000	Ep.: 4,2 N; 95,8 E; H = 14 55 45,0 h = 56 Km; M = 5,9 (GS) Northern Sumatra.
	ZH	epP	15	10	58		
	ZH	iPP	15	12	49		
29	ZH	iP	16	42	27,5		Ep.: 40,5 N; 29,5 W; H = 16 37 20,5 h = 12 Km; M = 4,7 (GS) Azores Islands Region.
30	ZH	iPn	14	36	51,5	245	Ep.: 42,4 N; 0,8 E; H = 14 36 25,5 h = 5 Km; (FBR - IEC) Pont de Suert, (Lerida) Spain. See page 56.
	ZH	eSn	14	37	21		
30	ZH	iP	15	28	40		Ep.: 52,4 N; 169,7 W; H = 15 16 01,6 h = 33 km; M = 5,6 (GS) Fox Islands, Aleutian Islands.
31	ZH	iPKP	15	07	25	17000	Ep.: 11,2 S; 166,6 E; 14 48 01,5 h = 135 Km; M = 5,6 (GS) Santa Cruz Islands.
	ZH	iPKP2	15	08	02		
31	ZH	iPg	18	34	32	80	Ep.: Local.
	ZH	Pn	18	34	35		
	ZH	iSg	18	34	42		
1 Jun	ZH	iP	12	59	52		Ep.: 36,2 N; 31,3 E; H = 12 54 49,2 h = 67 Km; M 5,7 (GS) Turkey.
5	ZH	iP	04	52	14		Ep.: 32,6 N; 48,1 E; H = 04 45 07,6 h = 40 km; M 5,5 (GS) Western Iran.
6	ZH	iPn	10	50	23		Ep.: 37,8 N; 1,8 W; H = 10 49 09,5 h = 33 Km; M = 4,2 (LCSS) Lorca (Murcia), Spain.
14	ZH	iP	21	49	16		Ep.: 14,1 S; 14,4 W; H = 21 39 35,2 h = 33 Km; M = 6,0 (GS) South Atlantic Ridge.
	ZH	ipP	21	49	28		
	ZH	iPcP	21	50	10		
	ZH	iPP	21	51	21		
17	ZH	iPKP	02	47	51		Ep.: 19,9 S; 179,1 W; H = 02 29 09,8 h = 690 Km; M = 5,7; (GS) Fiji Islands Region.
	ZH	ipPKP	02	48	31		
	ZH	iPP	02	52	18		
	ZH	ipPP	02	53	20		



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
18 Jun	ZH	i	02	08	36		Ep.: 15,3 S; 166,1 E; H = 01 48 48,0 h = 37 Km; M = 5,4 (GS) New Hebrides.
18	ZH	Pg	20	48	31		Ep.: Local.
18	ZH	iPKP	22	30	24		Ep.: 9,8 S; 159,7 E; H = 22 10 49,6 h = 11 Km; M = 5,6 (GS) Solomon Islands.
19	ZH	iP	11	32	27,5		
19	ZH	iP	11	59	55,5		Ep.: 47,2 N; 151,1 E; H = 11 47 23,4 h = 149 Km; M = 5,6 (GS) Kuril Islands.
19	ZH	i	18	26	28		Ep.: 15,5 N; 46,7 W; H = 18 17 39,2 h = 33 Km; M = 5,3 (GS) North Atlantic Ridge.
19	ZH	e	19	59	29		
22	ZH	iPKP	12	28	27	17500	Ep.: 22,9 S; 175,9 W; H = 12 08 33,4 h = 65 Km; M = 6,8 (GS) Tonga Islands Region.
	ZH	ipPKP	12	28	37		
	NM	iSKS	12	35	56		
	EM	eSKKKS	12	40	30		
	EM	ePPS	12	47	49		
	EM	SS	12	53	21		
	EM	SSS	12	59	17		
28	ZH	iP	07	15	07		Ep.: 38,6 N; 14,7 E; H = 07 12 49,3 h = 261 Km; M = 5,3 (GS) Sicily.
28	ZH	iP	15	46	38,5		Ep.: 22,6 N; 45,1 W; H = 15 38 37,0 h = 33 Km; M = 5,3 (GS) North Atlantic Ridge.
	ZH	PP	15	48	20,5		
28	ZH	iP	16	26	08,5		Ep.: 22,7 N; 45,1 W; H = 16 18 15,2 h = 33 Km; M = 5,5 (GS) North Atlantic Ridge.
	ZH	PcP	16	28	06,5		
28	ZH	iP	19	26	37,5		Ep.: 47,7 N; 6,4 E; H = 19 25 16,7 h = 24 Km; (GS) France.
	ZH	PcP	19	28	29,5		
28	ZH	iP	19	43	03,5		Ep.: 22,6 N; 45,1 W; H = 19 35 01,9 h = 33 Km; M = 4,9 (GS) North Atlantic Ridge.
29	ZH	iPKP	07	43	13,5		Ep.: 7,6 S; 127,7 E; H = 07 24 24,8 h = 58 Km; M = 6,0 (GS) Banda Sea.
3 Jul	ZH	eP	12	14	32		Ep.: 44,7 N, 6,6 E; H = 12 13 26,9 h = 10 Km (CSEM); M = 4,0 (LDG) France.
3	ZH	iP	14	58	32		Ep.: 1,4 N; 126,4 E; H = 14 39 14,1 h = 51 Km; M = 5,9 (GS) Molucca Passage.



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
6 Jul	ZH	iPKP	11	47	23,5	40	Ep.: 21,1 S; 178,6 W; H = 11 28 31,5 h = 594 Km; M = 5,8 (GS) Fiji Islands Region.
	ZH	i	11	48	06,5		
	ZH	iPP	11	49	40,5		
10	ZH	iP	00	29	01		Ep.: 37,9 S; 49,7 E; H = 00 15 58,8 h = 33 Km; M = 6,1 (GS) Atlantic - Indian Rise.
10	ZH	e	02	01	14		Ep.: 16,7 N; 122,6 E; H = 01 47 53,7 h = 33 Km; M = 4,6 (GS) Luzón, Philippine Islands.
11	ZH	e	09	51	20		
11	ZH	iPg	17	51	48,5	40	Ep.: Local.
	ZH	Sg	17	51	53,5		
13	ZH	eP	08	18	36,5		Ep.: 29,9 N; 67,5 E; H = 08 09 15,7 h = 10 Km; M = 5,1 (GS) Pakistan.
24	ZH	iPKP	06	42	49		Ep.: 15,3 S; 173,2 W; H = 06 22 51,3 h = 33 Km; M = 6,0 (GS) Tonga Islands.
	ZH	iPP	06	46	36		
28	ZH	eP	01	55	49		Ep.: 1,1 S; 14,0 W; H = 01 47 32,7 h = 33 Km; M = 5,3 (GS) North of Ascension Island.
	ZH	ePcP	01	57	36		
29	ZH	ePKP	11	35	07		Ep.: 8,0 S; 155,5 E; H = 11 15 45,3 h = 33 Km; M = 6,4 (GS) Solomon Islands.
7 Aug	ZH	iPKP	02	04	54		Ep.: 12,4 S; 166,3 E; H = 01 45 09,3 h = 36 Km; M = 5,2 (GS) Santa Cruz Islands.
7	ZH	eP	02	14	38		Ep.: 12,4 S; 166,1 E; H = 01 54 56,3 h = 47 Km; M = 5,2 (GS) Santa Cruz Islands.
8	ZH	ePKP	13	18	24		Ep.: 10,6 S; 161,3 E; H = 12 58 45,0 h = 32 Km; M = 5,8 (GS) Solomon Islands.
10	ZH	iP	09	48	20		Ep.: 7,1 N; 123,6 E; H = 09 33 29,2 h = 54 Km; M = 5,3 (GS) Mindanao, Philippine Islands.
10	ZH	iPKP	18	46	59		Ep.: 20,75 S; 178,5 W; H = 18 27 09,6 h = 585 Km; M = 5,4 (GS) Fisi Islands Region.
11	ZH	PKP	02	03	—		Ep.: 17,6 S; 174,4 W; H = 01 42 47,5 h = 57 Km; M = 6,3 (GS) Tonga Islands.
	ZH	SKS	02	15	57		
14	ZH	iP	19	15	00		Ep.: 22,7 S; 12,7 W; H = 19 04 20,3 h = 33 Km; M = 5,6 (GS) South Atlantic Ridge.



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
14 Aug	ZH	e	21	57	—		
15	ZH	eP	20	36	19	Ep.: 2,9 N; 84,3 W; H = 20 23 44,1 h = 23 Km; M = 5,2 (GS) Off Coast of Central America.	
15	ZH	iP	21	13	18	Ep.: 38,8 N; 17,0 E; H = 21 10 32,5 h = 54 Km; M = 5,0 (GS) Southern Italy.	
16	ZH	eP	06	35	12	Ep.: 19,3 S; 167,7 E; H = 06 15 16,7 h = 12 Km; M = 5,5 (GS) New Hebrides Islands Region.	
19	ZH	eP	06	27	31	Ep.: 11,1 S; 118,5 E; H = 06 08 55,2 h = 33 Km; M = 7,0 (GS) South of Sumbawa Islands.	
	NM	SKS	06	38	42		
	NM	SSS	06	49	40		
20	ZH	iP	02	58	13	Ep.: 16,6 N; 86,9 W; H = 02 46 11,8 h = 14 Km; M = 5,3 (GS) Caribbean Sea.	
20	ZH	iP	04	03	52	Ep.: 16,7 N; 86,6 W; H = 03 51 54,7 h = 36 Km; M = 5,6 (GS) Caribbean Sea.	
	ZH	i	04	04	03		
20	ZH	ePKP	19	36	25	Ep.: 11,0 S; 119,1 E; H = 19 16 32,7 h = 33 km; M = 6,0 (GS) South of Sumba Island.	
26	ZH	e	20	08	10	Ep.: 59,4 S; 20,5 W; H = 19 50 01,4 (GS) Southwestern Atlantic Ocean.	
27	ZH	PKP	07	31	18	Ep.: 8,1 S; 125,3 E; H = 07 12 22,5 h = 25 Km; M = 6,4 (GS) Timor.	
	ZH	PKP2	07	32	37		
	ZH	PKPPKP	07	45	15		
	ZH	SS	07	49	52		
28	ZH	iPn	09	46	08,5	500 Ep.: 38,1 S; 8,1 E; H = 09 45 16,1 h = 10 Km; M = 5,6 (CSEM) Western Mediterranean Sea.	
	ZH	iPg	09	46	26		
	ZH	eSn	09	47	09		
	NM	eS	09	47	14		
29	ZH	ePP	14	41	23	Ep.: 17,4 N; 119,9 E; H = 14 23 40,5 h = 12 Km; M = 6,0 (GS) Philippine Islands Region.	
31	ZH	iP	00	53	53	Ep.: 7,3 N; 76,3 W; H = 00 42 05,4 h = 33 Km; M = 5,7 (GS) Northern Colombia.	
2 Sep	ZH	eP	10	55	12	Ep.: 11,0 S; 119,1 E; H = 10 36 28,3 h = 33 Km; M = 6,0 (GS) South of Sumba Island.	
	ZH	e	10	56	20		
	ZH	ePP	10	59	55		



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
4 Sep	ZH	iPKP	09	08	17		Ep.: 13,7 S; 166,7 E; H = 08 48 39,2 h = 33 Km; M = 6,0 (GS) New Hebrides Islands.
	ZH	iPKKP	09	09	04		
	ZH	iPP	09	11	58		
4	ZH	eP	15	53	39		Ep.: 51,2 N; 178,4 E; H = 15 40 57,3 h = 34 Km; M = 5,6 (GS) Rat Islands, Aleutian Islands.
4	ZH	iP	17	23	14		Ep.: 51,1 N; 178,3 E; H = 17 10 30,6 h = 31 Km; M = 5,5 (GS) Rat Islands, Aleutian Islands.
	ZH	iPP	17	26	38		
4	ZH	iP	17	37	29		Ep.: 51,1 N; 178,0 E; H = 17 24 42,8 h = 8 Km; M = 5,8 (GS) Rat Islands, Aleutian Islands.
	ZH	i	17	40	33		
	ZH	i	17	43	36		
5	ZH	iP	03	12	11		Ep.: 50,1 N; 79,0 E; H = 03 02 57,8 h = 0 Km; M = 5,9 (GS) Eastern Kazakh SSR.
		iS	03	14	08		
6	ZH	iP	04	52	55		Ep.: 10,4 S; 161,1 E; H = 04 33 27,9 h = 61 Km; M = 5,5 (GS) Solomon Islands.
7	ZH	ePg	11	49	22,6		Ep.: Local.
7	ZH	iPg	16	49	50,7		Ep.: Local.
7	ZH	iPn	22	51	15	310	Ep.: 43,2 N; 0,2 W; H = 22 50 35,0 h = 33 Km; M = 3,7 (LCSS) Pyrenees.
	ZH	iSn	22	51	43,5		
11	ZH	iP	23	23	23		Ep.: 35,0 N; 23,0 E; H = 23 19 23,7 h = 33 Km; M = 5,8 (GS) Crete.
	ZH	iS	23	27	53		
12	ZH	P	09	54	40		Ep.: 11,5 S; 118,0 E; H = 09 45 34,6 h = 33 Km; M = 5,2 (GS) South of Sumbawa Island.
12	ZH	iP	14	27	47,2		Ep.: 12,8 S; 14,7 W; H = 14 18 06,6 h = 21 Km; M = 5,3 (GS) South Atlantic Ridge.
12	ZH	iPn	22	21	12,4	315	Ep.: 43,0 N; 0,9 W; H = 22 20 27,0 h = 33 Km; (LCSS) Pyrenees.
13	ZH	iPKP	00	41	42,5		Ep.: 15,5 S; 173,3 W; H = 00 21 52,6 h = 33 Km; M = 5,7 (GS) Tonga Islands.
13	ZH	Pg	10	54	50,5		Ep.: Local.
13	ZH	iPg	10	55	31	15	Ep.: Local.
	ZH	iSg	10	55	33		
13	ZH	iPg	11	31	07	13	Ep.: Local.
	ZH	iSg	11	31	08,2		
15	ZH	iPg	17	16	16,9	20	Ep.: Local.
	ZH	iSg	17	16	19,7		



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
16 Sep	ZH	iPn	23	50	20,9	955	Ep.: 46,3 N; 13,0 E; H = 23 48 08,4 h = 25 Km; M = 5,1 (GS) Austria.
	ZH	iSn	23	52	04,9		
17	ZH	iP	05	43	04,4		
17	ZH	iPg	10	55	05,8		Ep.: Local.
21	ZH	iPg	15	43	13	11	Artificial.
	ZH	iSg	15	43	14,5		
22	ZH	iPg	17	15	08,4	38	See page.
	ZH	i	17	15	09,9		
	ZH	iSg	17	15	13,3		
27	ZH	ePg	17	58	30,8	37	See page.
	ZH	eSg	17	58	35,8		
28	ZH	iP	11	45	10		
28	ZH	iPg	12	33	27	18	Ep.: Local.
	ZH	iSg	12	33	29,5		
28	ZH	iPg	13	12	25,5		See page 56.
	ZH	i	13	12	28		
	ZH	i	13	12	36		
30	ZH	iPg	12	47	10,3	13	Ep.: Local.
	ZH	iSg	12	47	12,1		
3 Oct	ZH	ePg	13	18	50		Ep.: Local.
4	ZH	ePg	11	54	28		Ep.: Local.
4	ZH	iPg	11	58	32		Artificial.
4	ZH	iP	13	55	27		Ep.: 10,4 N; 62,3 W; H = 13 44 52,0 h = 21 Km; M = 5,1 (GS) Near Coast of Venezuela.
5	ZH	iP	05	39	56,2	2900	EP.: 41,0 N; 33,4 E; H = 05 34 46,8 h = 33 Km; M = 5,3 (GS) Turkey.
	ZH	iPP	05	40	40,2		
	ZH	eS	05	44	22,2		
	ZH	i	05	45	05,2		



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
10 Oct	ZH	ePKP	12	13	59		Ep.: 25,9 S; 175,4 W; H = 11 53 53,6 h = 33 Km; M = 6,6 (GS) South of Tonga Islands.
	ZH	ePP	12	18	40		
	EM	e	13	01	27		
13	ZH	ePg	15	23	43,2	11	Ep.: Local.
	ZH	eSg	15	23	44,7		
14	ZH	ePKP	05	15	24		Ep.: 15,7 S; 173,0 W; H = 04 55 34,8 h = 33 Km; M = 5,9 (GS) Tonga Islands.
14	ZH	eP	12	48	45		
15	ZH	iPg	11	25	23	22	Ep.: Local.
	ZH	iSg	11	25	26		
17	ZH	ePKP	17	46	41,2	17800	Ep.: 27,9 S; 173,0 E; H = 17 26 40,4 h = 33 Km; M = 6,3 (GS) North of New Zealand.
	ZH	iPKKP	17	47	39,2		
	ZH	iPP	17	51	22,2		
22	ZH	iP	18	09	20		Ep.: 28,0 S; 63,0 W; H = 17 57 17,4 h = 614 Km; M = 6,1 (GS) Santiago del Estero Prov., Argentina.
	ZH	ipP	18	11	34,7		
27	ZH	eP	07	04	03,8		Ep.: 33,5 N; 27,6 E; H = 06 59 27,3 h = 52 Km; M = 4,9 (GS) Dodecanese Islands.
27	ZH	ePg	12	21	16,8	27	Ep.: Local.
	ZH	i	12	21	18,1		
	ZH	iSg	12	21	20,1		
27	ZH	eP	22	48	03,7		Ep.: 38,0 N; 27,9 E; H = 22 43 32,5 h = 24 Km; M = 4,7 (GS) Turkey.
	ZH	iPP	22	49	28,7		
28	ZH	iPg	12	35	40,6		Ep.: Local.
28	ZH	iPg	15	23	59,6		Artificial.
29	ZH	iPKP	10	34	42,8		Ep.: 14,4 S; 167,3 E; H = 10 15 12,1 h = 184 Km; M = 5,1 (GS) New Hebrides Islands.
	ZH	e	10	34	48		
30	ZH	iPKP	13	13	04		EP.: 14,9 S; 167,0 E; H = 12 53 22,8 h = 103 Km; M = 5,6 (GS) New Hebrides Islands.
31	ZH	iPg	11	49	12,4	15	Artificial.
	ZH	iSg	11	49	14,4		
2 Nov	ZH	iPg	12	51	03,2	8	Artificial.
	ZH	iSg	12	51	04,3		
2	ZH	iPg	16	36	15,1	11	Artificial.
	ZH	iSg	16	36	16,6		



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
3 Nov	ZH	iP	02	26	44,5		Ep.: 42,1 N; 24,0 E; H = 02 22 54,9 h = 6 Km; M = 5,2 (GS) Bulgaria.
4	ZH	iP	10	05	47,4		Ep.: 51,7 N; 176,0 W; H = 09 52 55,7 h = 33 Km; M = 5,7 (GS) Andreanof Islands, Aleutian Islands.
4	ZH	iPg	13	48	33,9	12	Artificial.
	ZH	iSg	13	48	35,5		
5	ZH	iSg	10	26	54,3		Artificial.
6	ZH	iP	02	52	14,6		Ep.: 53,6 N; 159,8 E; H = 02 39 35,4 (GS) Coast of Kamchatka.
8	ZH	ePg	08	30	08,6		See page 56.
8	ZH	e	14	25	52,2		
8	ZH	iPg	16	40	10,9		Artificial.
8	ZH	i	22	01	57,6		
9	ZH	iP	09	04	34,5		
9	ZH	iP	22	12	29,7		Ep.: 37,1 N; 116,1 W; H = 22 00 00,1 h = 0 Km; M = 5,7 (GS) Southern Nevada.
11	ZH	iPg	14	56	54,9	15	Ep.: Local.
	ZH	iSg	14	56	56,9		
11	ZH	iPg	17	36	10,4	27	Artificial.
	ZH	iSg	17	36	13,8		
12	ZH	iPg	09	34	48	24	Artificial.
	ZH	iSg	09	34	51		
22	ZH	iPKP	16	16	08,2		Ep.: 10,2 S; 161,1 E; H = 15 56 44,1 h = 92 Km; M = 5,9 (GS) Solomon Islands.
	ZH	iPKKP	16	16	36,2		
	ZH	i	16	16	42,7		
22	ZH	iPg	17	02	23,7	24	Artificial.
	ZH	iSg	17	02	26,7		
23	ZH	iP	09	39	56,4		Ep.: 31,0 S; 67,8 W; H = 09 26 24,7 h = 13 Km; M = 6,3 (GS) San Juan Province, Argentina.
	ZH	i	09	41	28,4		
	EM	eS	09	50	41,4		
24	ZH	iPg	16	37	35,8		Ep.: Local.
28	ZH	iP	03	03	43,2		Ep.: 36,1 N; 27,8 E; H = 02 59 10,8 h = 85 Km; M = 5,6 (GS) Dodecanese Islands.



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
3 Dec	ZH	iPg	10	31	04,6		Ep.: 42,5 N; 1,4 E; H = 10 30 37,1 h = 16 Km; (FBR-IEC) Seu de Urgel (Lerida) Spain. See page. 56.
3	ZH	iP	13	54	20,3		Ep.: 3,5 N; 95,9 E; H = 13 41 20,9 h = 41 Km; M = 5,8 (GS) Off W. Coast of Northern Sumatra.
11	ZH	iP	16	33	21,4		Ep.: 9,5 N; 69,6 W; H = 16 22 08,6 h = 18 Km; M = 5,6 (GS) Venezuela.
13	ZH	iP	01	23	41,7		Ep.: 17,4 N; 54,8 W; H = 01 14 18,6 h = 33 Km; M = 5,7 (GS) North Atlantic Ocean.
13	ZH	iPg	16	07	38,4		Artificial.
	ZH	iSg	16	07	39,4		
13	ZH	iPg	16	08	35,9		Artificial.
	ZH	iSg	16	08	38,4		
13	ZH	iPg	16	11	33,4		Artificial.
17	ZH	iPg	10	08	41,3	15	Artificial.
	ZH	iSg	10	08	43,3		
17	ZH	iPg	12	39	35,2	22	Artificial.
	ZH	iSg	12	39	38,2		
18	ZH	ePg	06	29	01,5	40	Ep.: Local.
	ZH	Sg	06	29	06,5		
18	ZH	eP	07	09	41,5		Ep.: 55,3 N; 160,6 E; H = 06 57 33,3 h = 118 Km; M = 5,1 (GS) Kamchatka.
18	ZH	iPg	10	33	19,8	20	Ep.: Local.
	ZH	eSg	10	33	22,5		
18	ZH	eP	16	56	50,9		Ep.: 39,9 N; 77,3 E; H = 16 47 17,1 h = 33 Km; M = 5,3 (GS) Southern Sinkiang Prov., China.
19	ZH	ePg	17	01	51		Ep.: Local.
19	ZH	iP	23	42	42,1		Ep.: 31,0 N; 56,5 E; H = 23 34 34,2 h = 31 Km; M = 5,4 (GS) Iran.
	ZH	i	23	42	59,6		
	ZH	iPP	23	44	26,1		
20	ZH	iP	09	03	05,5		Ep.: 48,6 N; 153,0 E; H = 08 50 38,2 h = 140 Km; M = 5,8 (GS) Kuril Islands.
20	ZH	iPg	14	09	25,2	10	Ep.: Local.
	ZH	iSg	14	09	26,5		



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Date	Comp.	Phase	Time TU			Δ Km	Remarks
			h	m	s		
21 Dec	ZH	P	01	14	35,5		Ep.: 25,5 N; 143,1 E; H = 01 00 32,8 h = 33 Km; M = 6,2 (GS) Volcano Islands Region.
	ZH	ePP	01	18	55		
21	ZH	iPg	16	40	53,1	44	See page 57.
	ZH	iSg	16	40	58,6		
22	ZH	ePg	16	35	157	42	Ep.: 41,2 N; 1,9 E; H = 16 35 12 h = 0,2 Km (FBR-IEC) Garraf (Barcelona) Spain. See page 57.
	ZH	iSg	16	35	20,9		
	ZH	e	16	35	24,5		
23	ZH	iPg	11	56	15,6	26	Ep.: Local.
	ZH	iSg	11	56	18,8		
23	ZH	iPg	11	58	53,6		Artificial.
23	ZH	iPg	12	21	16,6		Artificial.
23	ZH	eP	21	15	18		Ep.: 39,1 N; 143,2 E; H = 21 02 02,5 h = 19 km; M = 5,6 (GS) Off East Coast of Honshu, Japan.
28	ZH	iP	02	53	23		Ep.: 16,7 N; 40,3 E; H = 02 45 36,7 h = 33 Km; M = 5,9 (GS) Red Sea.
	ZH	iPP	02	54	59		
	EM	eS	02	59	32		
28	ZM	iPg	12	08	39,9	24	Ep.: Local.
	ZH	iSg	12	08	42,9		
28	ZH	iPg	15	48	49,9		Ep.: Local.
	ZH	iSg	15	48	52,4		
30	ZH	iP	17	37	29,5		Ep.: 40,0 N; 15,4 E; H = 17 35 08,9 h = 283 Km; M = 5,6 (GS) Southern Italy.
	EM	S	17	39	—		
31	ZH	iP	08	05	51,8		Ep.: 15,3 S; 71,7 W; H = 07 53 18,0 h = 158 Km; M = 5,9; (GS) Southern Peru.
	ZH	ipP	08	06	30,8		

