The IGEX Data Center at the CDDIS

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Abstract

The Crustal Dynamics Data Information System (CDDIS) serves as a global data center for the IGEX-98. This paper will present information about the archive and data holdings. Complete listings of data holdings, latency figures, as well as problems encountered during the campaign will also be presented.

Introduction

The Crustal Dynamics Data Information System (CDDIS) was established in 1982 as a dedicated data bank to archive and distribute all Crustal Dynamics Project-acquired data and information about these data. Today, the CDDIS continues to serve as the NASA archive and distribution center for space geodesy data, particularly GPS, GLONASS, laser, DORIS and VLBI data. The CDDIS has served as a global data center for the International GPS Service (IGS) since its start in June 1992, providing on-line access to GPS data from nearly 160 sites on a daily basis as well as the products derived by the IGS Analysis Centers from these data. The CDDIS also serves as a data center for GPS and DORIS in support of the International Earth Rotation Service (IERS). Furthermore, the CDDIS provides an on-line archive of TOPEX/Poseidon (SLR and DORIS) and ERS-1 and -2 (SLR) data for near real-time access by precision orbit determination (POD) analysis centers. Selected data sets are accessible to scientists through ftp and the World Wide Web (WWW); general information about all data is accessible via the WWW. The CDDIS staff issues a bimonthly bulletin to apprise the user community of new data sets and changes to the archive.

In 1998, the CDDIS was selected to serve as a global data center for the International GLONASS Experiment (IGEX-98), as well as a data center for the International Laser Ranging Service (ILRS) and the International VLBI Service for Geodesy and Astrometry (IVS). In its capacity as an IGEX data center, the CDDIS established an on-line archive of GLONASS data and products; all data and products since August 1998 are available through the CDDIS.

Computer System

A new computer system for the CDDIS, a DEC AlphaServer 4000 running the UNIX operating system, host name *cddisa.gsfc.nasa.gov*, was recently installed. The system is currently equipped over 210 Gbytes of on-line magnetic disk storage; approximately 100

Gbytes of storage are devoted to the storage of GPS and GLONASS data and products. A 600-platter CD-ROM jukebox, primarily for GPS data, is also part of this computer facility.

The on-line archive of the CDDIS consists of an ORACLE data base and GPS, GLONASS, laser, DORIS, and VLBI data sets (over 100 Gbytes on-line, many Gbytes near-line). The off-line archive consists of GPS, laser, DORIS and VLBI data on CD-ROM, magneto-optical disks, and magnetic tapes. The CDDIS utilizes the ORACLE data base management system to provide flexibility for storing and accessing these diverse data sets, particularly meta-data, or information about these data.

Support of IGEX-98

The GLONASS data available through the CDDIS consists of daily files (from 00:00:00 through 23:59:30 GPS time) of observation data sampled at 30 seconds. These data are stored in compressed, compact RINEX format using UNIX compression on Hatanaka-compacted files. In addition, GPS and GLONASS navigation and meteorological data (also in RINEX format) are available. Ideally, data are transmitted from the GLONASS station to the global data center within 48 hours after then end of the UTC day. The directory structure for the CDDIS GLONASS data archive is shown in Figure 1.

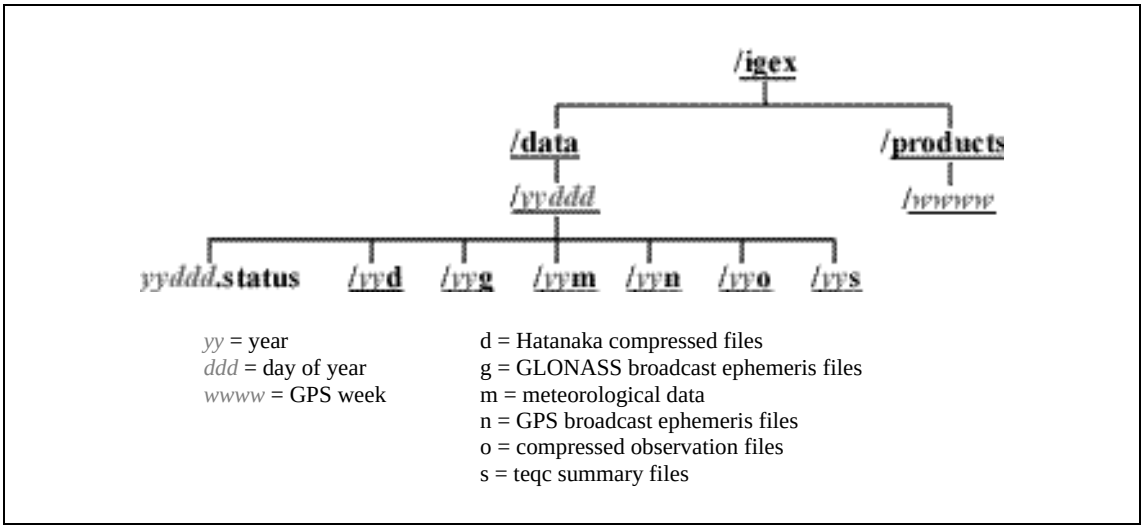

Figure 1. Directory Structure of CDDIS GLONASS Data Holdings

Table 1 lists the data holdings for the IGEX campaign (19-Oct-1998 through 19-Apr-1999). Over 8300 station days of data were archived from 74 receivers located at 62 globally distributed sites.

Table 1. IGEX-98 GLONASS Data Holdings of the CDDIS
(19-Oct-98 through 19-Apr-99)

Mon. Name	Site Name	Country	Receiver Type	Start Date	End Date	No. Days	
BELR	Bellevue	Australia	Ashtech GG24C	23-Nov-98	19-Jan-99	27	
BETR	Bellevue	Australia	Ashtech Z-12 (GPS only)	09-Nov-98	19-Jan-99	15	
BISZ	Bishkek	Kyrgyzstan	MAN NR-R124	16-Nov-98	19-Apr-99	147	
BORG	Borowiec	Poland	3S Navigation R100/30T	19-Oct-98	19-Apr-99	167	*
BRST/G	Brest	France	Ashtech GG24 (Martec)	19-Oct-98	16-Apr-99	156	
SUNM	Brisbane	Australia	Javad Legacy GGD	24-Dec-98	03-Apr-99	90	*
BRUG	Brussels	Belgium	3S Navigation R100/30T	19-Oct-98	19-Apr-99	154	*
DLFT	Delft	The Netherlands	Ashtech GG24C	19-Oct-98	16-Feb-99	120	
			Javad Legacy GGD	23-Feb-99	19-Apr-99	53	*
VSLD	Delft	The Netherlands	3S Navigation R100/40T	21-Oct-98	15-Apr-99	165	*
EKAT	Ekaterinburg	Russia	Javad Legacy	13-Jan-99	04-Feb-99	8	
GATR	Gainesville	USA	Javad Legacy GGD	19-Oct-98	03-Apr-99	120	*
GRAC	Grasse	France	Ashtech GG24C	29-Nov-98	19-Apr-99	119	
GRAB	Graz	Austria	Ashtech Z-18	23-Nov-98	19-Apr-99	115	
GTY1	Great Yarmouth	United Kingdom	Trimble 4000SSI (GPS only)	19-Oct-98	30-Jan-99	97	
GTY2	Great Yarmouth	United Kingdom	Ashtech GG24	19-Oct-98	28-Jan-99	74	
GODZ	Greenbelt	USA	Ashtech Z-18	19-Oct-98	19-Apr-99	170	*
HERP	Herstmonceux	United Kingdom	3S Navigation R100/40	03-Nov-98	19-Apr-99	151	*
HOBR	Hobart	Australia	Ashtech GG24C	18-Nov-98	30-Nov-98	3	
HKPU	Hong Kong	China	Ashtech GG24C	20-Oct-98	29-Oct-98	4	
IBK1	Innsbruck	Austria	Ashtech GG24	19-Oct-98	19-Apr-99	120	
IRKG	Irkutsk	Russia	Trimble 4000SGL	19-Oct-98	10-Apr-99	169	*
IRKZ	Irkutsk	Russia	Ashtech Z-18	19-Oct-98	19-Apr-99	174	*
3SNA	Irvine	USA	3S Navigation R100/40T	19-Oct-98	19-Apr-99	139	
KHAB	Khabarovsk	Russia	Ashtech Z-18	19-Oct-98	20-Mar-99	150	*
KR0G	Kiruna	Sweden	Ashtech Z-18	19-Oct-98	19-Apr-99	170	*
CSN1	Korolev	Russia	Ashtech Z-12 (GPS only)	25-Oct-98	25-Oct-98	1	
REUN	La Reunion	La Reunion	Ashtech Z-18	15-Dec-98	19-Apr-99	64	
LDS1	Leeds	United Kingdom	ESA/ISN GNSS	19-Oct-98	19-Apr-99	181	
LDS2	Leeds	United Kingdom	Trimble 4000SSE (GPS only)	20-Oct-98	19-Apr-99	178	
LDS3	Leeds	United Kingdom	Ashtech GG24EC	19-Oct-98	19-Apr-99	180	
SL1X	Lexington	USA	Ashtech Z-18	19-Oct-98	18-Apr-99	172	
LINR	Lindfield	Australia	3S Navigation R100/30T	19-Oct-98	19-Apr-99	90	*
MR6G	Maartsbo	Sweden	Ashtech GG24C	19-Oct-98	19-Apr-99	177	*
MAGD	Magadan	Russia	Javad Legacy	13-Jan-99	10-Mar-99	54	
MTBG	Mattersburg	Austria	Ashtech GG24C	05-Nov-98	17-Apr-99	137	*
MDOA	McDonald	USA	Javad Legacy	20-Nov-98	19-Apr-99	138	
CRAR	McMurdo	Antarctica	Javad Legacy GGD	26-Dec-98	06-Feb-99	43	
MDVG	Mendeleevo	Russia	Trimble 4000SGL	19-Oct-98	14-Feb-99	118	
MDVZ	Mendeleevo	Russia	Ashtech Z-18	19-Oct-98	19-Apr-99	181	*
METZ	Metsahovi	Finland	Ashtech Z-18	19-Oct-98	19-Apr-99	137	*
MTKA	Mitaka	Japan	Ashtech Z-18	27-Oct-98	19-Apr-99	127	*
STRR	Mt. Stromlo	Australia	Ashtech Z-18	07-Nov-98	19-Apr-99	123	*
NKLG	N'Koltang	Gabon	Ashtech Z-18	13-Feb-99	19-Apr-99	37	
BLVA	Neubiberg	Germany	3S Navigation R100/R101	19-Oct-98	21-Dec-98	10	
NTZ1	Neustrelitz	Germany	3S Navigation R101	19-Oct-98	19-Apr-99	183	*
NTZ3	Neustrelitz	Germany	Rogue SNR-8100 (GPS only)	19-Oct-98	19-Apr-99	183	*
NPLI	New Delhi	India	3S Navigation GNSS-300T	16-Nov-98	26-Nov-98	2	
DLRA	Oberpfaffenhofen	Germany	3S Navigation R100/40T	19-Oct-98	19-Apr-99	132	
OS0G	Onsala	Sweden	Ashtech Z-18	22-Oct-98	18-Apr-99	163	*
PKST	Petropavlovsk-Kamchatskiy	Russia	Javad Legacy	16-Jan-99	14-Feb-99	28	
CSIR	Pretoria	South Africa	3S Navigation R100/30T	19-Oct-98	19-Apr-99	165	*
REYZ	Reykjavik	Iceland	Ashtech Z-18	19-Oct-98	18-Apr-99	85	*
RIOZ	Rio Grande	Argentina	MAN NR-R124	11-Nov-98	19-Apr-99	141	
SANG	Santiago	Chile	3S Navigation R100/40	05-Nov-98	19-Apr-99	156	
BIPD	Sèvres	France	3S Navigation R100/30T	25-Oct-98	18-Apr-99	144	*
SUTG	Sutherland	South Africa	MAN NR-R124	03-Dec-98	19-Apr-99	136	
SVT3	Svetloe	Russia	Javad Legacy GGD	05-Jan-99	07-Feb-99	34	
CK02	Taiwan	Taiwan	Ashtech Z-12 (GPS only)	20-Oct-98	19-Apr-99	125	
NCKU	Taiwan	Taiwan	Ashtech GG24	20-Oct-98	17-Apr-99	117	
NPLB	Teddington	United Kingdom	Ashtech Z-12	27-Nov-98	30-Nov-98	4	
NPLC	Teddington	United Kingdom	3S Navigation R100/40T	21-Oct-98	19-Apr-99	131	
THU2	Thule	Greenland	Ashtech Z-18	10-Nov-98	19-Apr-99	112	*
TSKA	Tsukuba	Japan	Ashtech Z-18	19-Nov-98	19-Apr-99	136	
LRBA	Vernon	France	Ashtech Z-18	21-Oct-98	19-Apr-99	138	
VS0G	Visby	Sweden	Ashtech GG24C	19-Oct-98	19-Apr-99	169	*
USNX	Washington, DC	USA	3S Navigation R100/30T	22-Oct-98	19-Apr-99	166	*
WTZG	Wettzell	Germany	3S Navigation R100/R101	19-Oct-98	19-Apr-99	123	*
WTZZ	Wettzell	Germany	Ashtech Z-18	07-Feb-99	19-Apr-99	68	*
YAKT	Yakutsk	Russia	Javad Legacy	12-Jan-99	07-Mar-99	52	
YARR	Yaragadee	Australia	Ashtech Z-18	20-Oct-98	19-Apr-99	137	*
ZIMJ	Zimmerwald	Switzerland	Javad Legacy GGD	14-Feb-99	19-Apr-99	48	*
ZIMZ	Zimmerwald	Switzerland	Ashtech Z-18	19-Oct-98	19-Apr-99	172	*
ZWEG	Zvenigorod	Russia	Ashtech GG24	28-Oct-98	02-Feb-99	79	
Totals:	74 receivers at 62 sites				station days:	8,354	

Notes: * denotes site that continues in operation
47 dual frequency, 20 single frequency, and 7 GPS-only receivers

Figure 2 shows the average latency of data transmitted from the stations to the CDDIS; nearly 30 percent of the data were received in 24 hours.

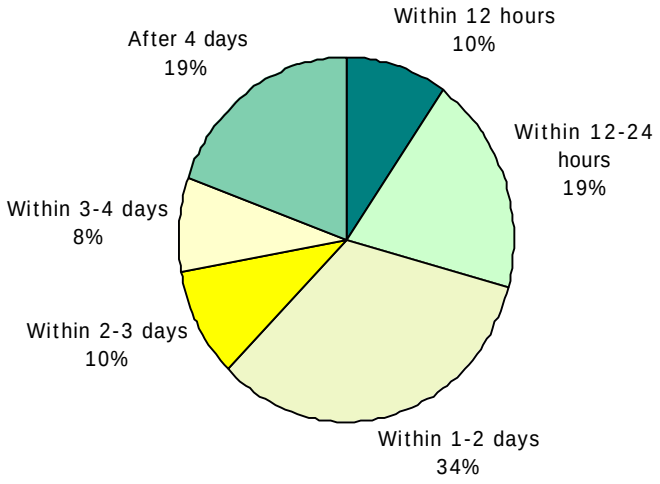

Figure 2. Average Latency of Data Transmitted from IGEX-98 Stations to the CDDIS

The CDDIS also archived the satellite laser ranging (SLR) data from the ILRS stations tracking the retro-reflector equipped GLONASS satellites. These data holdings are shown in Table 2. A total of thirty SLR stations tracked eighteen GLONASS satellites during the official campaign, generating over 6600 passes containing over 36K normal points.

Table 2. IGEX-98 SLR Data Holdings of the CDDIS (19-Oct-98 through 19-Apr-99)

Site Name	Country	Sta.	Number of Passes																	
			GL-62*	GL-64	GL-65*	GL-66*	GL-67	GL-68	GL-69*	GL-70*	GL-71*	GL-72*	GL-74	GL-75	GL-76	GL-77	GL-79*	GL-80*	GL-81*	GL-82*	Totals
Beijing	China	7249	7	0	0	3	0	6	6	7	6	4	0	0	0	0	0	0	0	0	39
Borowiec	Poland	7811	2	0	0	3	0	1	4	5	5	3	0	0	0	0	3	0	0	0	26
Changchun	China	7237	45	23	8	15	11	37	40	34	36	35	14	20	22	18	27	0	0	1	386
Grasse	France	7835	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Grasse (LLR)	France	7845	66	0	8	77	0	47	60	65	127	82	0	0	0	0	76	0	0	0	608
Graz	Austria	7839	70	8	8	50	0	56	54	64	65	68	4	30	37	43	44	0	0	0	601
Greenbelt	USA	7105	34	0	10	37	0	56	47	49	39	38	0	0	0	0	31	2	13	4	360
Haleakala	USA	7210	29	0	3	44	0	43	18	26	43	18	0	0	0	0	1	0	0	0	225
Herstmonceux	United Kingdom	7840	45	5	5	37	39	50	48	53	48	42	0	0	0	0	41	0	0	0	413
Kashima	Japan	7335	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	4
Koganei	Japan	7328	2	0	0	0	0	2	1	4	6	1	0	0	0	0	1	0	0	0	17
Komsomolsk-na-Amure	Russia	1868	0	0	0	14	0	0	0	0	19	0	0	0	0	0	0	0	0	0	33
Kunming	China	7820	2	1	0	2	0	1	7	5	6	9	0	0	0	1	1	0	0	0	35
Maidanak	Uzbekistan	1864	1	0	0	8	0	8	8	8	12	1	0	1	0	0	5	0	0	0	52
McDonald	USA	7080	27	0	6	39	1	25	27	28	39	22	0	0	0	0	28	0	3	0	245
Metsahovi	Finland	7806	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Miura	Japan	7337	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Monument Peak	USA	7110	112	0	12	88	0	108	123	117	119	110	0	0	0	0	77	4	15	11	896
Mount Stromlo	Australia	7849	68	0	8	72	0	65	63	68	62	68	0	0	0	0	56	1	4	0	535
Orroral	Australia	7843	7	6	5	7	0	5	9	3	8	0	2	10	7	0	9	0	0	0	78
Potsdam	Germany	7836	11	0	1	9	0	12	19	12	12	17	0	0	0	0	8	0	0	0	101
Shanghai	China	7837	22	0	1	11	5	24	22	22	14	28	0	3	2	2	13	0	0	0	169
Simeiz	Ukraine	1873	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
Simosato	Japan	7838	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	3
Tahiti	French Polynesia	7124	8	0	0	4	0	4	6	6	3	9	0	0	0	0	1	0	1	0	42
Tateyama	Japan	7339	4	0	0	1	0	5	1	4	2	1	0	0	0	0	1	0	0	0	19
Wettzell	Germany	8834	61	18	3	19	12	49	42	34	42	27	7	25	25	30	23	0	0	0	417
Wuhan	China	7236	2	2	1	0	1	4	3	4	6	1	0	0	0	0	2	0	0	0	26
Yarragadee	Australia	7090	157	0	22	148	0	114	102	121	139	154	0	0	0	0	104	0	12	0	1,073
Zimmerwald	Switzerland	7810	27	0	5	20	0	27	30	34	31	31	0	0	0	0	25	0	0	0	230
Totals:		30	810	63	106	709	69	752	742	775	892	770	27	89	93	94	577	7	48	16	6,639

Site Name	Country	Sta.	Number of Normal Points																	
			GL-62*	GL-64	GL-65*	GL-66*	GL-67	GL-68	GL-69*	GL-70*	GL-71*	GL-72*	GL-74	GL-75	GL-76	GL-77	GL-79*	GL-80*	GL-81*	GL-82*	Totals
Beijing	China	7249	89	0	0	29	0	46	56	68	67	31	0	0	0	0	0	0	0	0	386
Borowiec	Poland	7811	5	0	0	9	0	3	13	20	18	7	0	0	0	0	9	0	0	0	84
Changchun	China	7237	335	153	35	71	55	258	294	236	275	233	69	131	136	93	154	0	0	4	2,532
Grasse	France	7835	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	10
Grasse (LLR)	France	7845	228	0	23	266	0	161	216	218	466	304	0	0	0	0	258	0	0	0	2,140
Graz	Austria	7839	640	66	64	358	0	446	466	595	562	557	47	217	274	316	364	0	0	0	4,972
Greenbelt	USA	7105	174	0	50	215	0	270	264	243	234	249	0	0	0	0	128	12	66	19	1,924
Haleakala	USA	7210	174	0	30	370	0	331	155	177	360	198	0	0	0	0	2	0	0	0	1,797
Herstmonceux	United Kingdom	7840	249	37	12	148	158	235	241	265	249	239	0	0	0	0	191	0	0	0	2,024
Kashima	Japan	7335	0	0	0	0	0	0	3	10	3	0	0	0	0	0	0	0	0	0	16
Koganei	Japan	7328	14	0	0	0	0	7	6	30	40	4	0	0	0	0	9	0	0	0	110
Komsomolsk-na-Amure	Russia	1868	0	0	0	28	0	0	0	0	118	0	0	0	0	0	0	0	0	0	146
Kunming	China	7820	13	5	0	9	0	4	49	22	35	51	0	0	0	6	5	0	0	0	199
Maidanak	Uzbekistan	1864	3	0	0	21	0	17	15	15	81	1	0	3	0	0	13	0	0	0	169
McDonald	USA	7080	139	0	20	181	3	111	120	110	189	114	0	0	0	0	109	0	12	0	1,108
Metsahovi	Finland	7806	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	7
Miura	Japan	7337	4	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	9
Monument Peak	USA	7110	569	0	46	447	0	611	800	697	681	715	0	0	0	0	398	8	73	60	5,105
Mount Stromlo	Australia	7849	315	0	37	316	0	312	277	291	297	322	0	0	0	0	251	4	24	0	2,446
Orroral	Australia	7843	21	18	19	36	0	18	23	8	25	0	6	42	20	0	22	0	0	0	258
Potsdam	Germany	7836	49	0	5	35	0	67	91	51	66	69	0	0	0	0	36	0	0	0	469
Shanghai	China	7837	196	0	9	93	19	152	220	193	94	282	0	24	19	11	101	0	0	0	1,413
Simeiz	Ukraine	1873	0	0	0	0	0	0	0	0	4	23	0	0	0	0	0	0	0	0	27
Simosato	Japan	7838	0	0	0	7	0	0	7	0	7	0	0	0	0	0	0	0	0	0	21
Tahiti	French Polynesia	7124	37	0	0	19	0	17	31	22	11	39	0	0	0	0	2	0	2	0	180
Tateyama	Japan	7339	19	0	0	4	0	25	4	19	9	8	0	0	0	0	3	0	0	0	91
Wettzell	Germany	8834	249	72	13	81	46	258	177	159	168	153	27	108	98	131	101	0	0	0	1,841
Wuhan	China	7236	21	13	6	0	12	53	30	61	67	8	0	0	0	0	15	0	0	0	286
Yarragadee	Australia	7090	775	0	70	586	0	456	442	506	678	773	0	0	0	0	399	0	60	0	4,745
Zimmerwald	Switzerland	7810	300	0	28	127	0	220	262	225	196	282	0	0	0	0	175	0	0	0	1,815
Totals:		30	4,618	364	467	3,456	293	4,100	4,262	4,241	5,000	4,662	149	525	547	557	2,745	24	237	83	36,330

Notes: * indicates GLONASS satellites specifically requested for SLR tracking
GLONASS-65 failed in December 1998
GLONASS-80, -81, -82 launched December 30, 1998

The CDDIS also archived the products generated by IGEX analysis centers from the GLONASS data sets. These products consisted of precise orbits of the GLONASS satellites and station positions of the tracking network. Orbit files were made available in SP3 format; station position files in the Software Independent Exchange (SINEX) format. Table 3 lists the analysis centers contributing products to the data centers.

Table 3. IGEX-98 Analysis Centers Supplying Results to the CDDIS

Acronym	Source	Time Period
BKG	Bundesamt für Kartographie und Geodäsie (BKG), Germany	Weeks 0980 through present
COX	Center for Orbit Determination (CODE), AIUB, Switzerland	Weeks 0979 through present
ESX	European Space Agency Space Operations Center (ESA/ESOC), Germany	Weeks 0980 through present
GFX	GeoForschungsZentrum Potsdam (GFZ), Germany	Weeks 0983 through 1001
JPX	Jet Propulsion Laboratory (JPL), USA	Weeks 0991 through present
MCC	Mission Control Center (MCC), Russia	Weeks 0980 through present
IGX	Combined IGEX Solution, University of Technology, Vienna, Austria	Weeks 0981 through 0989

Problems Encountered

It was soon apparent that the data processing for GLONASS would not be as routine as that experienced by the CDDIS in support of the IGS. A list of typical problems encountered can be found in [Noll, 1999].

Future Plans

The CDDIS plans to continue the archive and distribution of GLONASS data and products as part of a future service, the International GLONASS Experiment Pilot Service (IGEX-PS), within the auspices of the IGS.

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