A Comparison of VLBI and SLR Site Velocity Models

D. E. Smith
& The GSFC SLR Analysis Group

T. A. Clark
& The GSFC VLBI Analysis Group

T. A. Herring
& The Harvard-Smithsonian Center for Astrophysics
VLBI Analysis Group

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Overview

- Intersite geodesic rates were derived from the SLR and VLBI vector motion solutions for North America, Europe, the Pacific and Japan.

- Assessment of results highlights the most important tectonic provinces jointly measured by these independent technologies.

- Improved Insight into CDP's contribution to geological plate motion models and deformation at plate boundaries.

GSFC SLR SITE VELOCITY MODEL

NAME	LATITUDE (dec. deg.)	LONGITUDE (dec. deg.)	INPUT MODEL RATE (m/y) NORTH	EAST	SIGMAS (m/y) NORTH	EAST
Quincy	39.9750	239.0553	-0.0037	-0.0254	0.0037	0.0021
Mon Pk	32.8917	243.5773	0.0153	-0.0448	0.0037	0.0021
McDon	30.6770	255.9840	-0.0124	-0.0279	0.0041	0.0027
Mazatl	23.3428	253.5409	0.0011	-0.0140	0.0037	0.0030
Plattev	40.1827	255.2740	-0.0061	-0.0144	0.0093	0.0050
Simosa	33.5777	135.9370	-0.0100	-0.0111	0.0050	0.0054
Wettz	49.1449	12.8781	0.0161	0.0109	0.0050	0.0045
RGO	50.8674	0.3361	0.0269	0.0262	0.0062	0.0041
Huahin	-16.7335	208.9589	0.0346	-0.110	0.0065	0.0084
Matera	40.6488	16.7046	0.0125	0.0133	0.0048	0.0053
Graz	47.0671	15.4933	0.0134	0.0234	0.0051	0.0061
Arequi	-16.4657	288.5068	0.0111	0.0080	0.0028	0.0042
Yarrag	-29.0465	115.3467	0.0561	0.0357	0.0034	0.0027
Greenb	39.0206	283.1723	0.0022	-0.0174	*0.0	*0.0
Hawaii	20.7072	203.7440	0.0373	-0.0677	*0.0	*0.0

* Greenbelt and Hawaii constrained to move as M/J AM0-2.

GSFC VLBI SITE VELOCITY MODEL

NAME	LATITUDE dd.mmss	LONGITUDE dd.mmss	INPUT MODEL RATE (m/y) NORTH	INPUT MODEL RATE (m/y) EAST	SIGMAS (m/y) NORTH	SIGMAS (m/y) EAST
HAYSTK	42.3723	288.3040	0.0046	- 0.0183	0.0001	0.0001
WESTFD	42.3646	288.3020	0.0044	- 0.0190	0.0005	0.0004
HRAS	30.3812	256.0300	- 0.0001	- 0.0130	0.0010	0.0008
PLATVL	40.1058	255.1620	0.0005	- 0.0138	0.0030	0.0019
HAT CR	40.4902	238.3140	- 0.0049	- 0.0213	0.0014	0.0010
QUINCY	39.5830	239.0310	- 0.0074	- 0.0231	0.0019	0.0014
WETTZL	49.0841	12.5230	0.0002	0.0068	0.0028	0.0018
ONSALA	57.2344	11.5530	- 0.0013	0.0047	0.0026	0.0013
KAUI	22.0734	200.2000	0.0299	- 0.0573	0.0018	0.0015
KASHIM	35.5714	140.3940	- 0.0152	0.0004	0.0038	0.0024
MON PK	32.5330	243.3430	0.0251	- 0.0396	0.0014	0.0010

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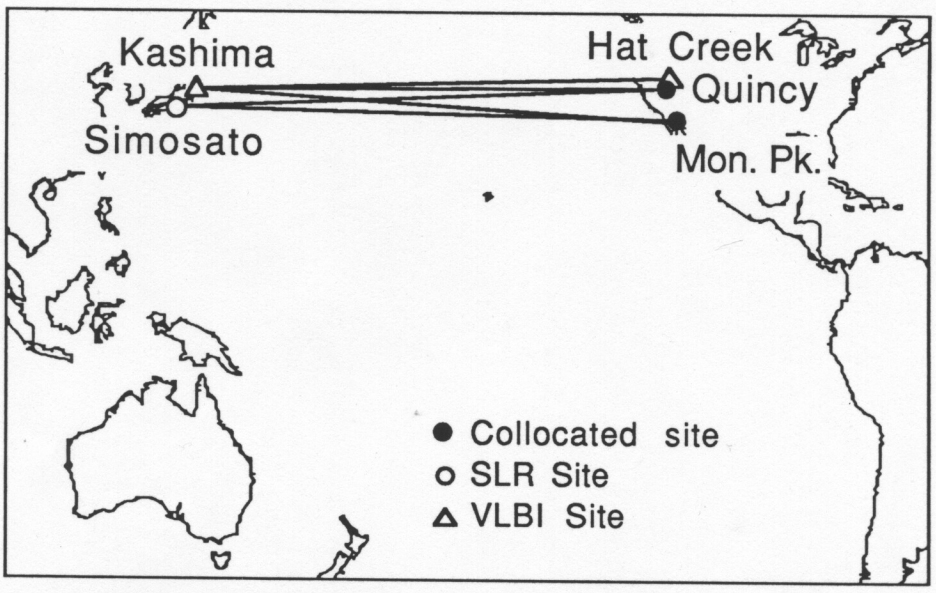
VLBI SITE VELOCITY MODEL

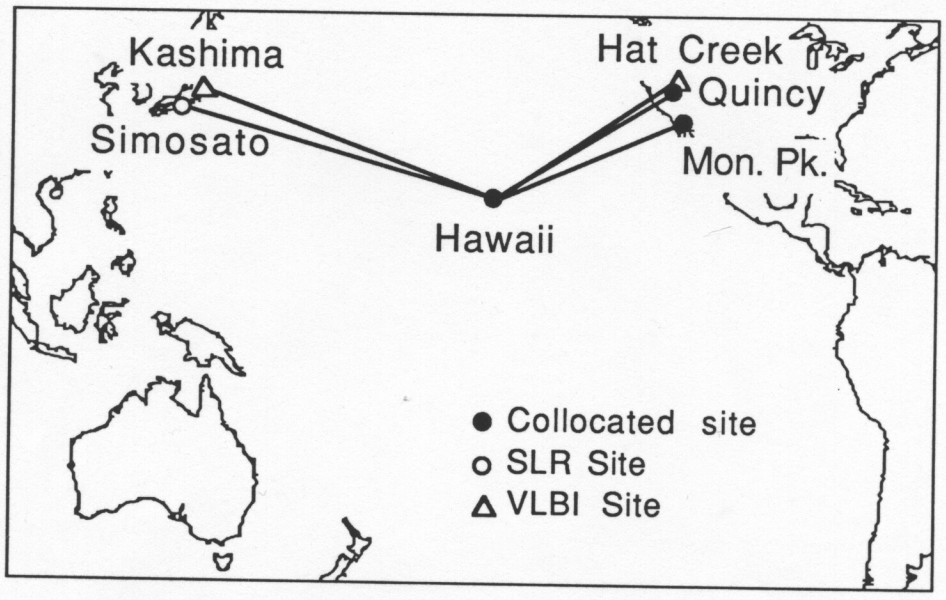
NAME	LATITUDE dd.mmss	LONGITUDE dd.mmss	INPUT MODEL RATE (m/y) NORTH	INPUT MODEL RATE (m/y) EAST	SIGMAS (m/y) NORTH	SIGMAS (m/y) EAST
HAYSTK	42.3723	288.3042	-0.0003	0.0027	0.0018	0.0027
WESTFD	42.3646	288.3022	-0.0001	0.0017	0.0018	0.0026
HRAS	30.3812	256.0309	0.0035	0.0015	0.0018	0.0017
PLATVL	40.1058	255.1626	-0.0082	0.0062	0.0057	0.0044
HAT CR	40.4902	238.3146	0.0088	- 0.0047	0.0021	0.0021
QUINCY	39.5830	239.0319	0.0050	- 0.0049	0.0035	0.0032
WETTZL	49.0841	12.5238	-0.0085	0.0214	0.0036	0.0038
ONSALA	57.2344	11.5534	-0.0107	0.0137	0.0033	0.0036
KAUI	22.0734	200.2005	0.0545	-0.0567	0.0053	0.0050
KASHIM	35.5714	140.3945	0.0102	-0.0117	0.0069	0.0080
MON PK	32.5330	243.3438	0.0311	-0.0262	0.0024	0.0021

Western U.S. - Japan



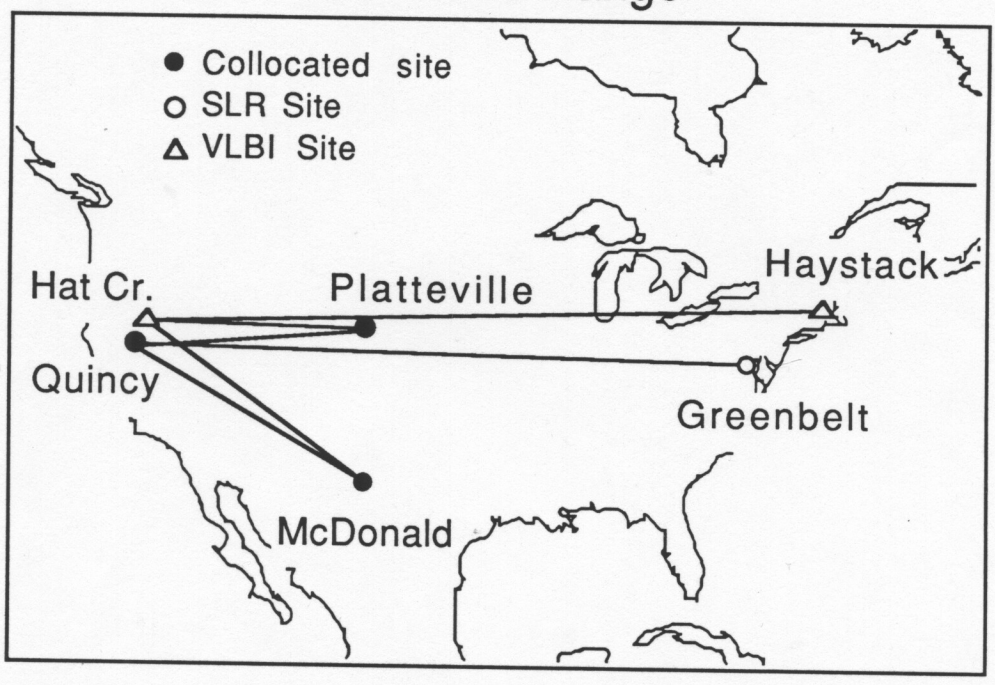
Stations	Geodesic Rate (mm/yr) from Velocity Models		
	SLR	VLBI	
	SL7.1	GSFC	Harvard
Quincy - Simosato	-4±4	-	-
- Kashima	-	-6±3	-4±8
Hat Cr. - Kashima	-	-6±3	-6±8
Mon. Pk. - Simosato	-30±4	-	-
- Kashima	-	-39±2	-36±7

Pacific Basin



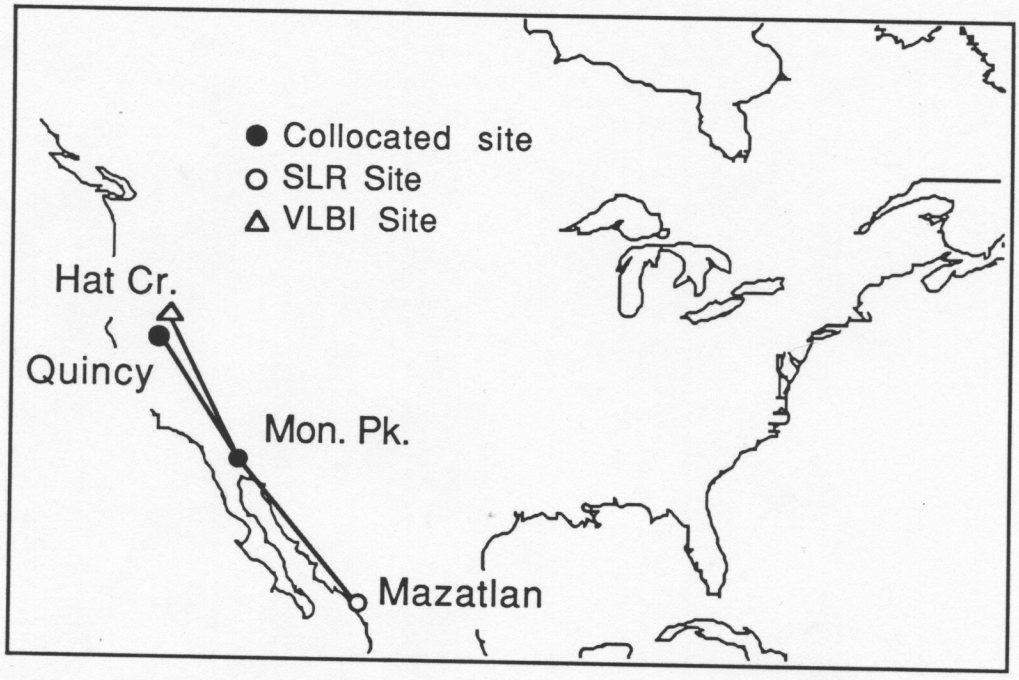
Stations	Geodesic Rate (mm/yr) from Velocity Models		
	SLR	VLBI	
	SL7.1	GSFC	Harvard
Hawaii - Quincy	3±2	3±2	9±6
- Hat Creek	-	4±2	8±6
Hawaii - Mon. Pk.	1±2	2±2	4±5
Hawaii - Simosato	-65±5	-	-
- Kashima	-	-64±3	-65±9

Basin and Range



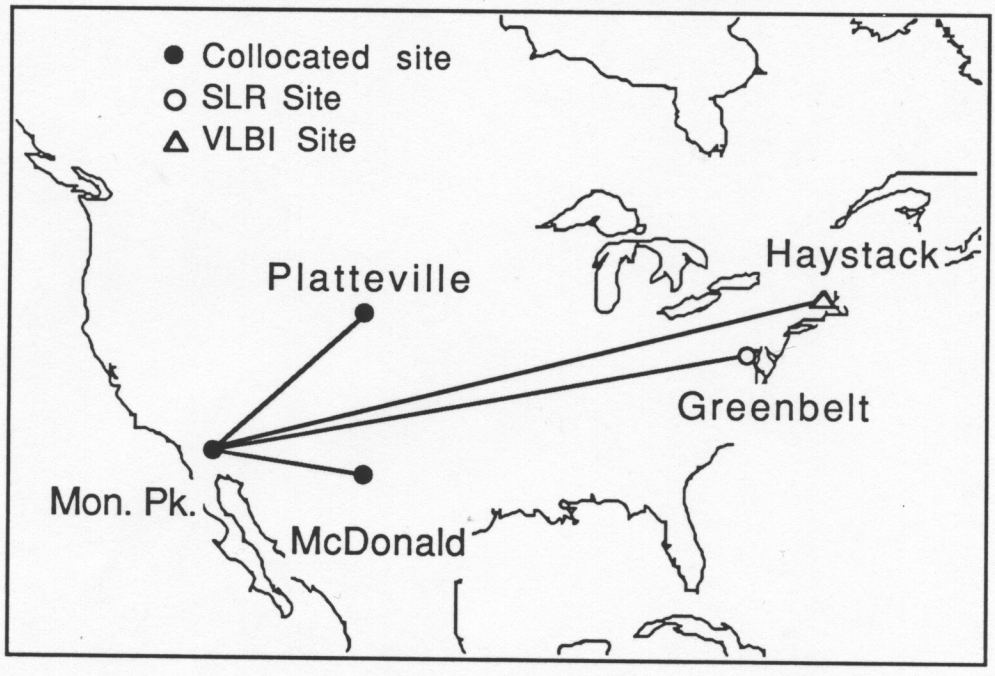
Stations	Geodesic Rate (mm/yr) from Velocity Models		
	SLR	VLBI	
	SL7.1	GSFC	Harvard
Plattv. - Quincy	12±5	10±2	11±5
- Hat Creek	-	8±2	12±5
Quincy - Greenbelt	8±2	-	-
- Haystack	-	5±2	6±4
Hat Cr. - Haystack	-	3±1	4±3
McDonald - Quincy	7±3	7±2	6±4
-Hat Creek	-	6±1	7±3

SAFE



Stations	Geodesic Rate (mm/yr) from Velocity Models		
	SLR	VLBI	
	SL7.1	GSFC	Harvard
Mon. Pk. - Quincy	-24±2	-35±2	-33±4
- Hat Creek	-	-34±2	-29±3
Mon. Pk. - Mazatlan	33±3	-	-

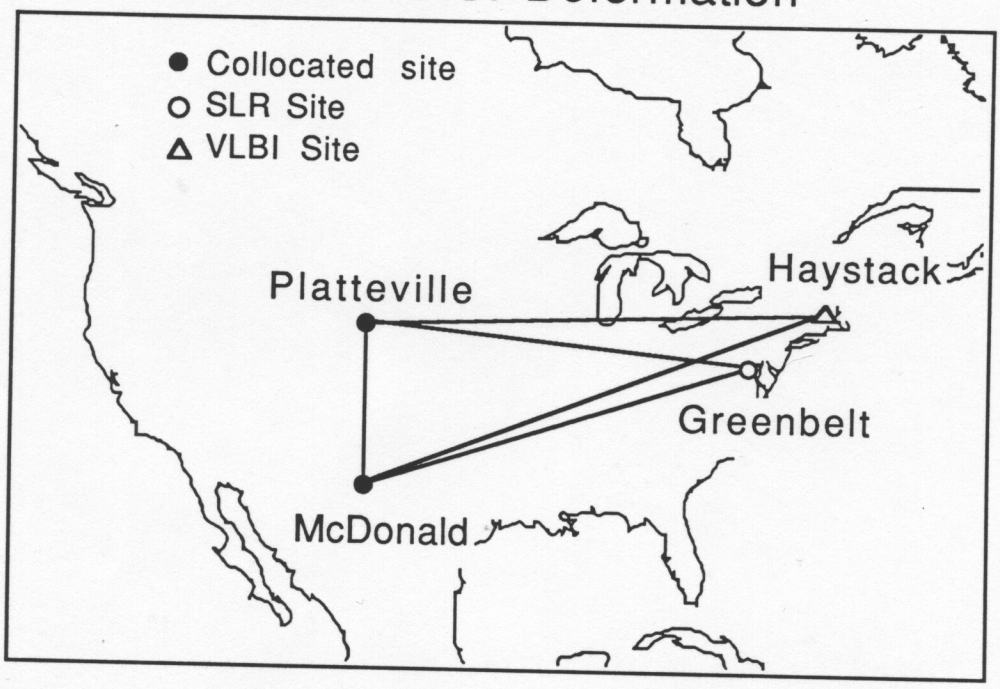
Transverse - San Andreas



Stations	Geodesic Rate (mm/yr) from Velocity Models		
	SLR	VLBI	
	SL7.1	GSFC	Harvard
Mon. Pk. - Plattev.	8±6	2±2	0±4
Mon. Pk. - McDonald	23±3	30±2	31±3
Mon. Pk. - Greenbelt	18±2	-	-
(w/ geom. corr)*	(12±2)*	-	-
- Haystack	-	4±1	11±4

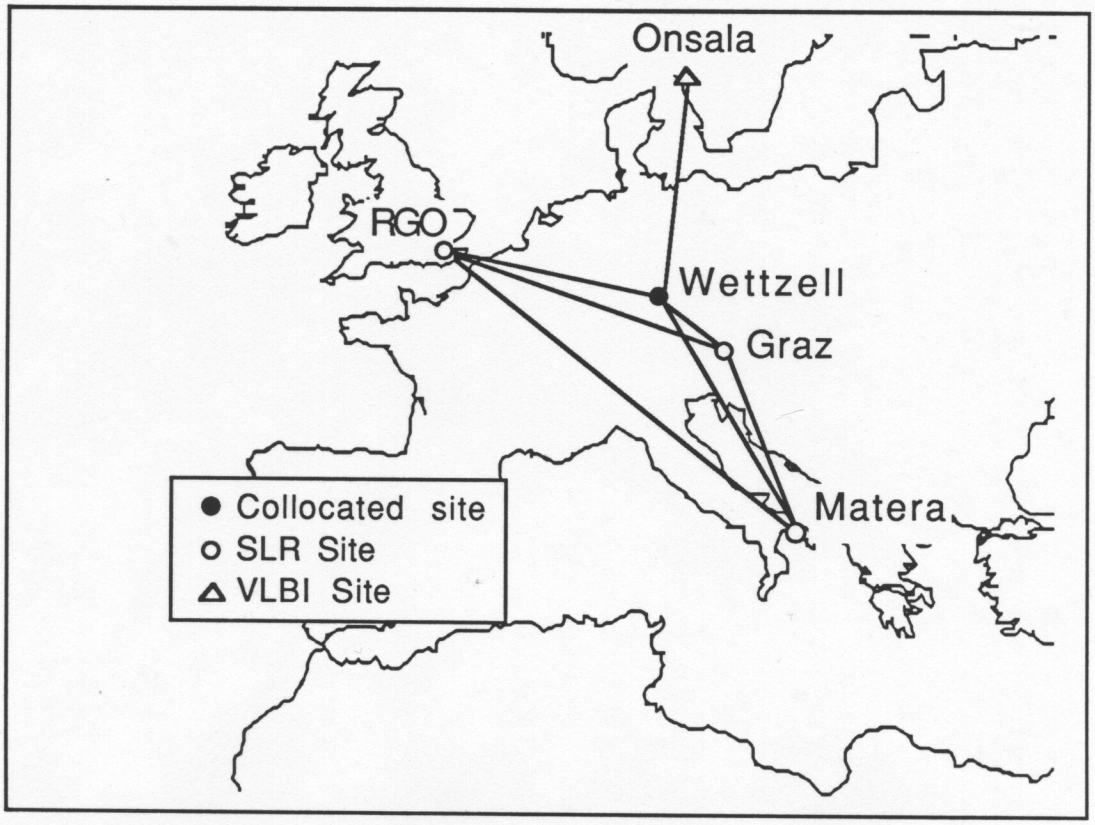
* AM0-2: Mon. Pk. - Greenbelt 16 mm/yr
AM0-2: Mon. Pk. - Haystack 10 mm/yr

Eastern U.S. Deformation



Stations	Geodesic Rate (mm/yr) from Velocity Models		
	SLR	VLBI	
	SL7.1	GSFC	Harvard
McDonald - Haystack	-	-6±1	-0±3
- Greenbelt	14±3	-	-
Plattev. - Haystack	-	-6±2	-1±5
- Greenbelt	-2±5	-	-
Plattev. - McDonald	6±9	1±3	-12±6

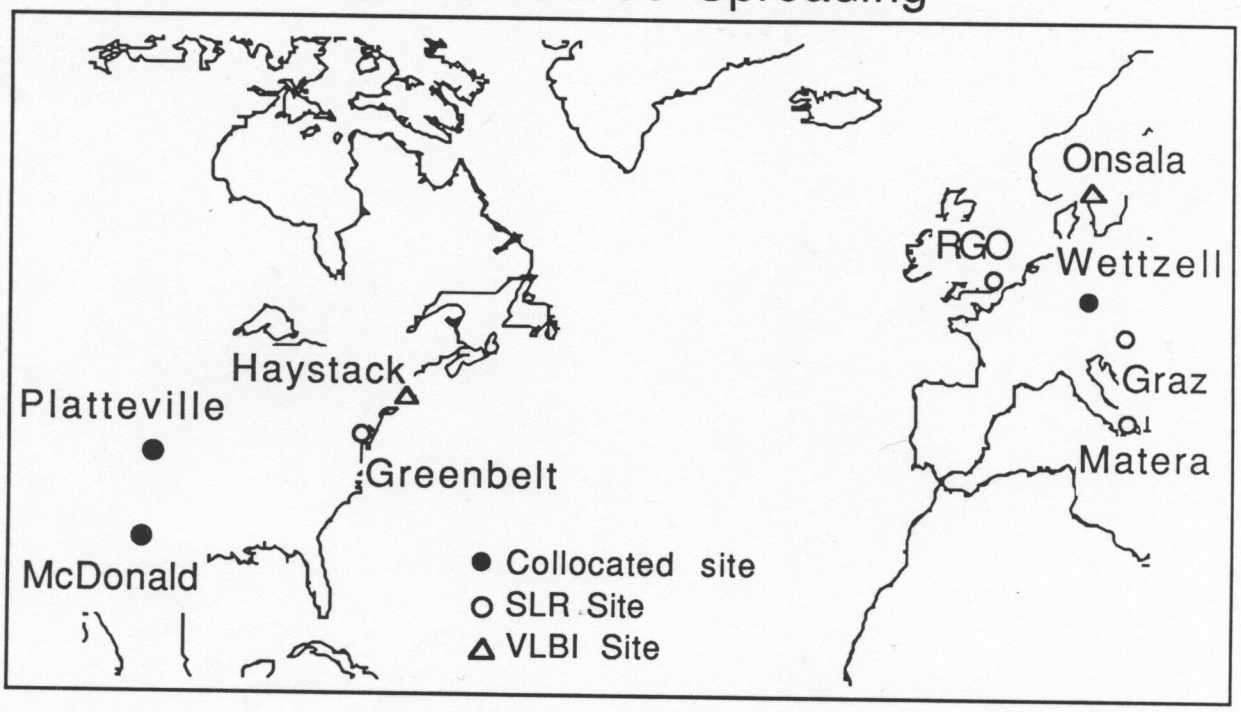
Internal European Deformation



Stations	Geodesic Rate (mm/yr) from Velocity Models		
	SLR	VLBI	
	SL7.1	GSFC	Harvard.
Onsala - Wettzell	-	-1±3	-2±3
Matera - Graz	-1±3	-	-
- Wettzell	3±4	-	-
- RGO	-6±4	-	-
Graz - Wettzell	9±4	-	-
- RGO	-3±5	-	-
Wettzell - RGO	-17±4	-	-

All Numbers, excepting those boxed, Indicate no significant motion.

North Atlantic Spreading



Stations	Geodesic Rate (mm/yr) from Velocity Models		
	SLR	VLBI	
	SL7.1	GSFC	Harvard.
Wettzell - Greenbelt	14±3	-	-
- Haystack	-	17±2	21±4
- Plattev.	10±8	13±3	24±5
- McDonald	25±4	13±2	18±4
Greenbelt - Graz	25±4	-	-
* - RGO	28±3	-	-
Haystack - Onsala	-	14±2	15±4
Plattev. - Graz	19±8	-	-
** - RGO	19±8	-	-
- Onsala	-	11±2	21±4

* Geometry : AM0-2 Greenbelt-Graz 22 mm/yr
-RGO 22 mm/yr
Haystack-Onsala 19 mm/yr

** Plattev. - Graz 20 mm/yr
- RGO 21 mm/yr
- Onsala 19 mm/yr

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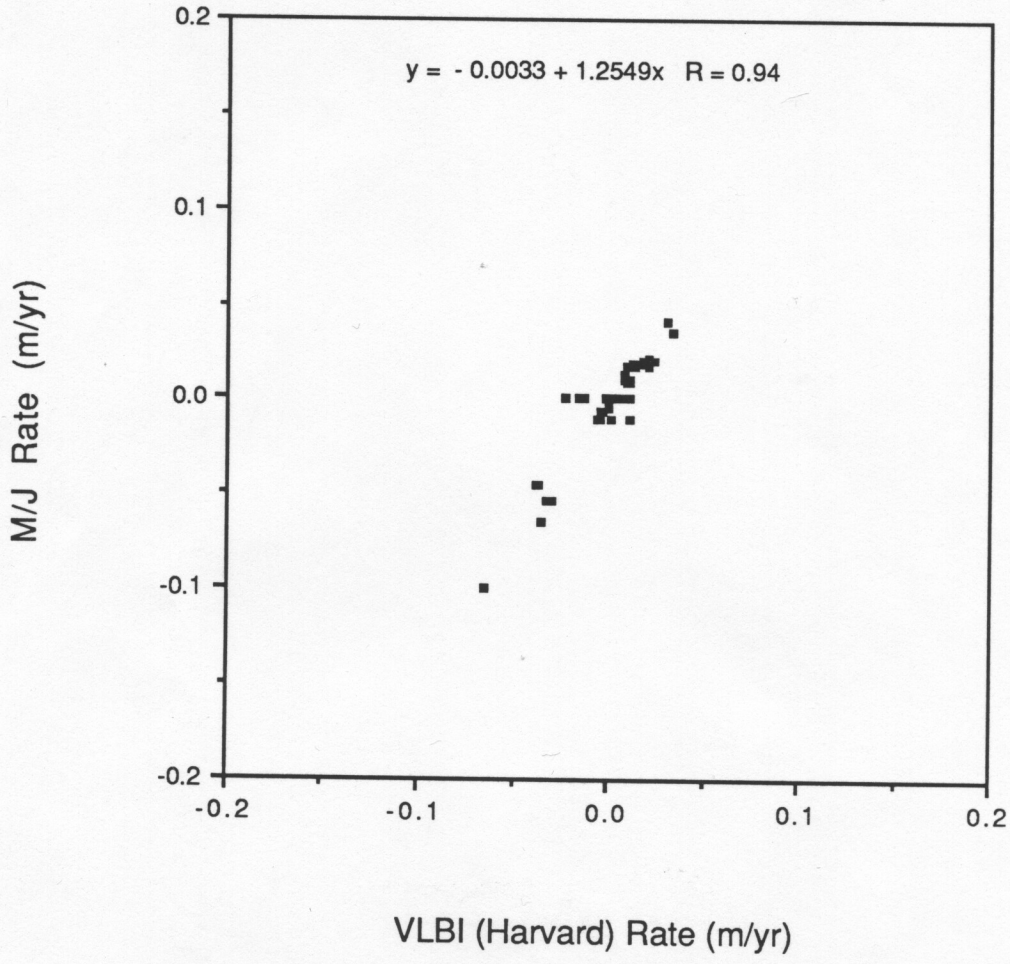
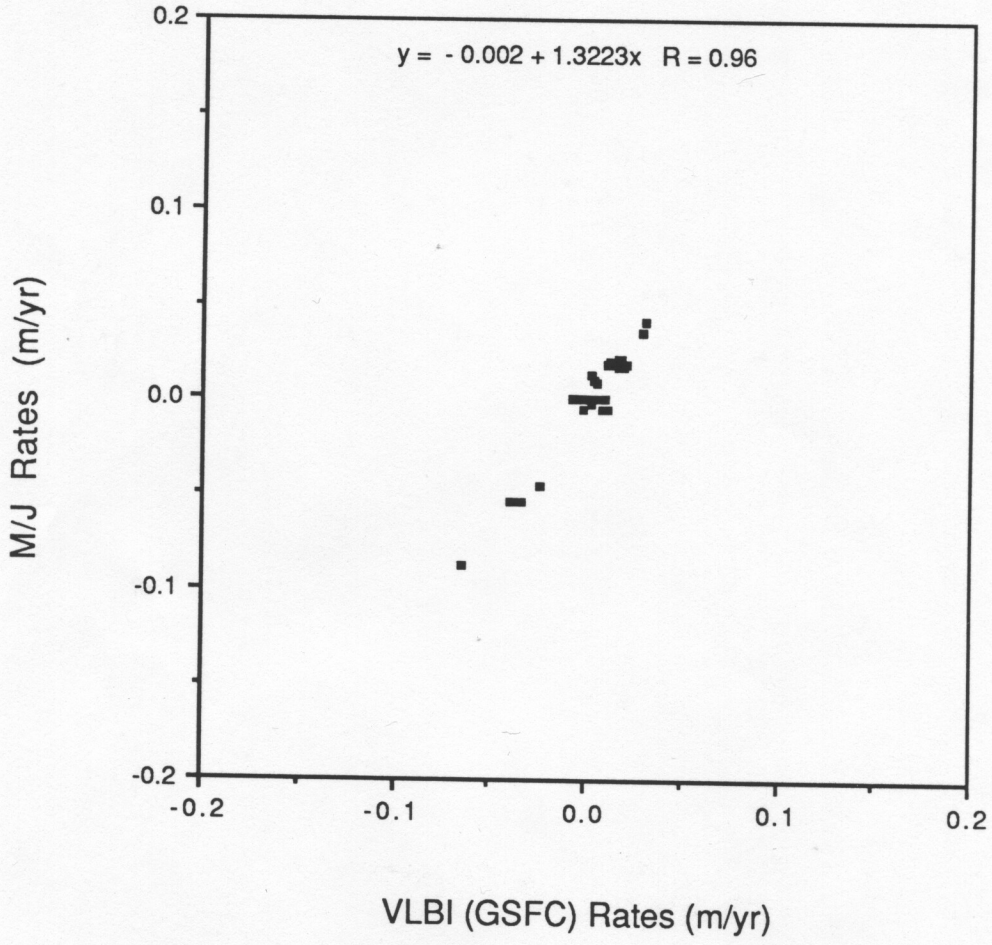
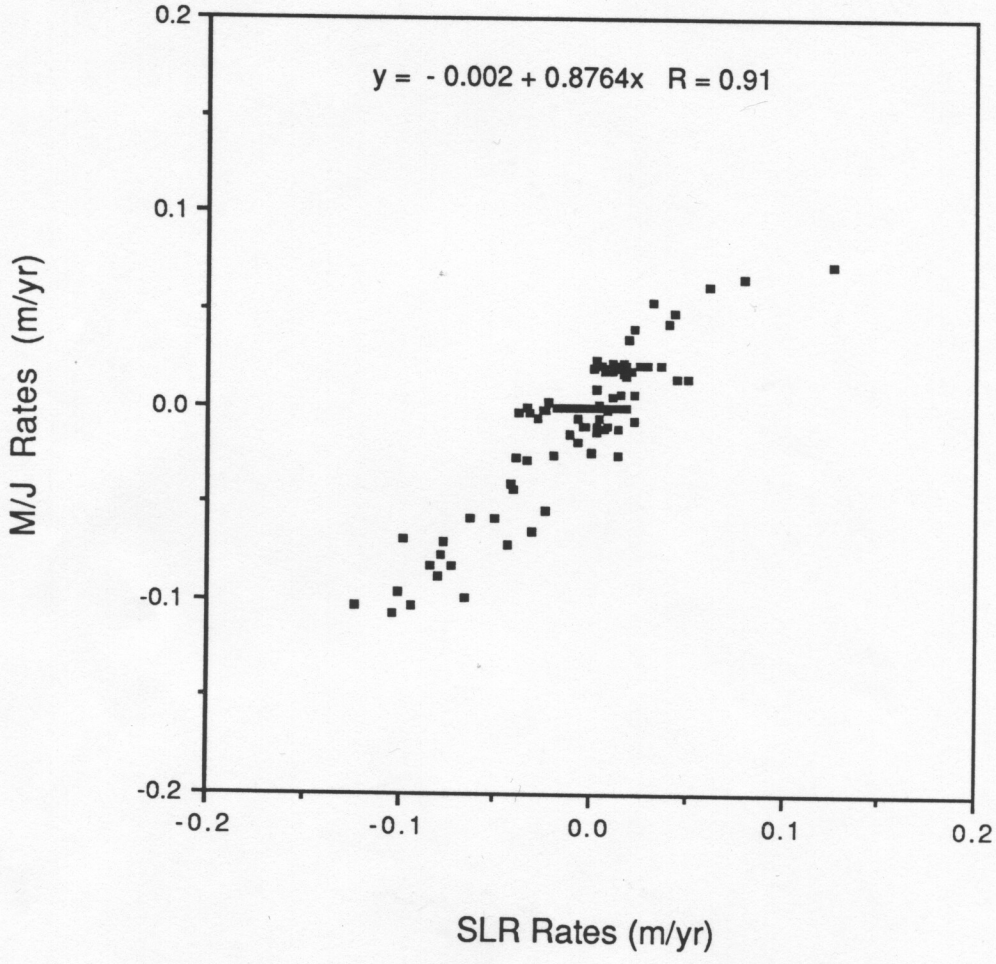
Correlation: VLBI (Harvard) vs. M/J Model



Correlation: VLBI (GSFC) vs. M/J Model



Correlation: SLR Geodesy vs. M/J Model



Summary

- Site vector motion models from VLBI and SLR technologies permit direct interstation comparisons.

- Qualitative agreement between technologies overall at the 5 mm/yr level (and within solution accuracies) demonstrated for:

  - Basin & Range Spreading.
  - Mid-Atlantic Ridge Spreading.
  - North America, Hawaii, and Japan interstation motions.

- While both technologies differ somewhat, San Andreas Fault Experiment shows rates departing greatly from geologic models (-30 mm/yr for Quincy to Mon. Pk. from SLR/VLBI vs. -55 mm/yr from AM0-2).

- Certain problem stations have been identified.