DETERMINATIONS OF THE SITE POSITION AT THE SLR TRACKING STATION (7824) AT SAN FERNANDO, SPAIN.

Isabel Vigo-Aguiar*, **José M. Ferrándiz** and **David García**
Dpt. Applied Mathematics, EPS,
University of Alicante,
E-03080- Alicante, Spain
*vigo@ua.es

Jorge Gárate* and **José MartínDávila**
Real Instituto y Observatorio de la Armada
11110- San Fernando. Cádiz. Spain
*jgarate@roa.es

GEOGRAPHIC SITUATION

REAL INSTITUTO Y OBSERVATORIO DE LA ARMADA. SAN FERNANDO, CADIZ, SPAIN.

The Royal Observatory of the Spanish Navy (ROA) at San Fernando is strategically located near the Gibraltar Straight, by the boundary between the Eurasia and African tectonic plates. A satellite laser ranging (SLR) station, a Global Positioning System (GPS) station and a set of atomic clocks are co-located at this site. While routinely contributing to laser ranging to several satellites as well as the international time service, the San Fernando SLR station is engaged in an improvement process in hardware and software.

PERFORMANCE

A complete overhaul of 7824 SLR Station electronics and its optics have enabled routine tracking of LAGEOS at over 200 successful LAGEOS night passes per year, while at the same time doubled the number of successful night passes for lower orbit satellites.

Below are shown the performance charts taken from the ILRS web page for San Fernando Station.

The ROA at San Fernando and the University of Alicante are currently engaged in a joint research project, which aims at improving the Spanish capabilities with regard to the tracking of geodetic satellites and the analysis of the data.

Special attention has been paid to the SLR tracking station at San Fernando, since it needed urgent instrument upgrade to meet present precision standards, as well as the requirements for computation of crustal motions and other local and regional applications in Geodesy and Geodynamics.

The research is mainly supported by the Spanish Space Research Program funded by CICYT and the Spanish Navy. The Space Geodesy Branch of NASA/GSFC has provided invaluable technical supports in data analysis concerning precise determination of orbits and related geodetic parameters.

THE NEW SLR DOME

SAN FERNANDO SLR 7824 POSITION

	X /Vx	Y /Vy	Z / Vz
		(m/m/s)	
UA00	5105473.9947	-555110.7739	3769892.8067
	-.237661D-09	.646437D-09	.415114D-09
ITRF00	5105473.975	-555110.726	3769892.801
	-. 294901D-09	.431253D-09	.351978D-09

POSITION DETERMINATION

Improved determinations of the site position have been obtained by analyzing precise laser ranging data to LAGEOS I satellite, that together with LAGEOS II have been the mainstay in station positions and velocities for solutions of IERS in the past. The data have been obtained from NASA´s CDDIS and processed using the NASA/GSFC software **GEODYN/SOLVE II**.

After the upgrade process that the San Fernando SLR station has been under, past determinations of the station coordinates with respect to ITRF97 had root-mean-square (RMS) values as large as 18 centimeters, hindering a definitive contribution to the determination of satellite orbits, and plate motions for related geodetic studies. Currently, a series of solutions has been obtained in all cases fitting data from LAGEOS I in 10-day arcs, using normal points from the global SLR tracking network. The 10-day arcs were combined to derive a set of station positions and station velocities, including the 7824 San Fernando station relative to certain other fiducial stations such as the 7110 Monument Peak as a reference to check the procedure evolution. Earth Orientation Parameters were estimated as independent values of time and polar motion at daily intervals. The IERS standards were followed except for the adoption of the EGM96 gravity field with expanded ocean tidal terms and a value of GM = 398600.4415 km^3/s^2.
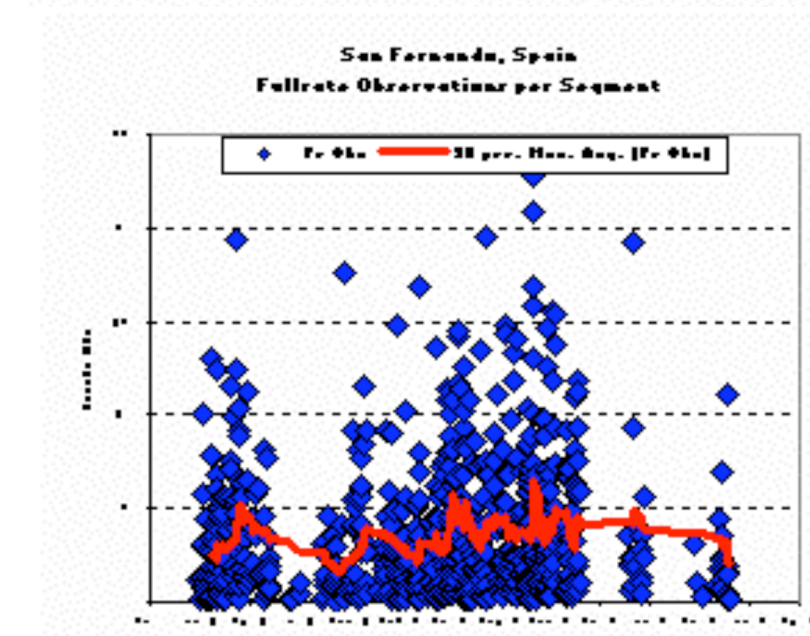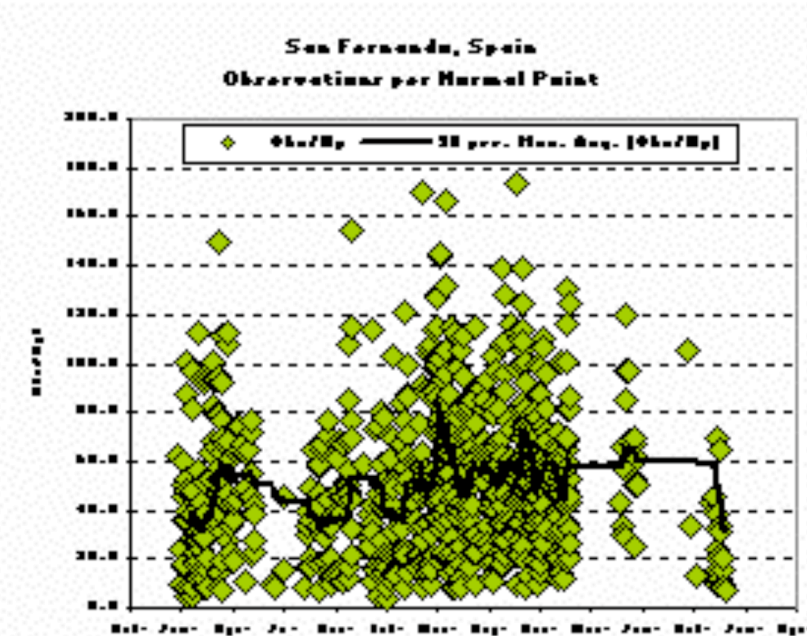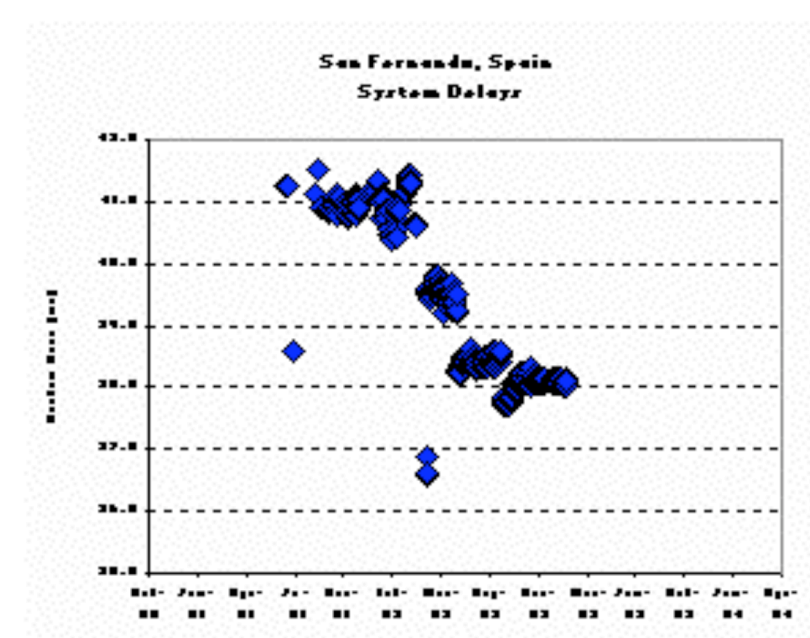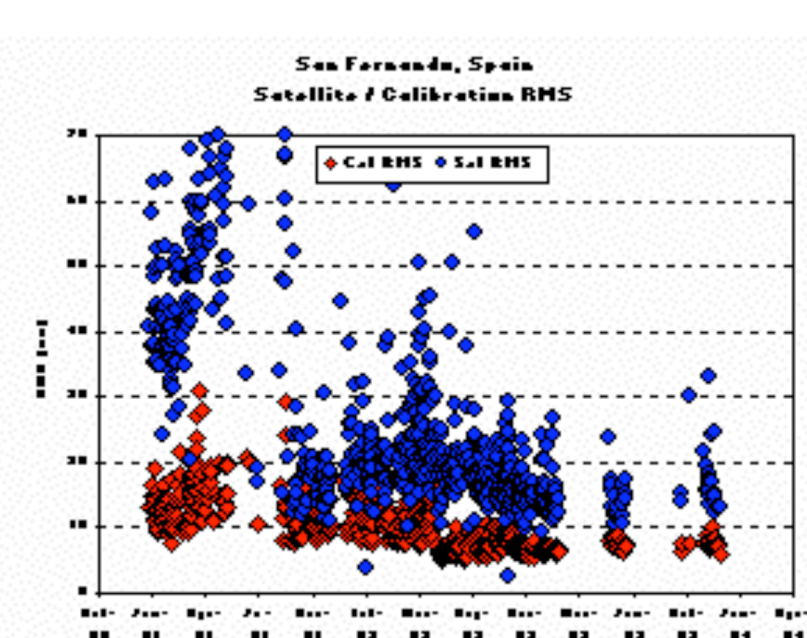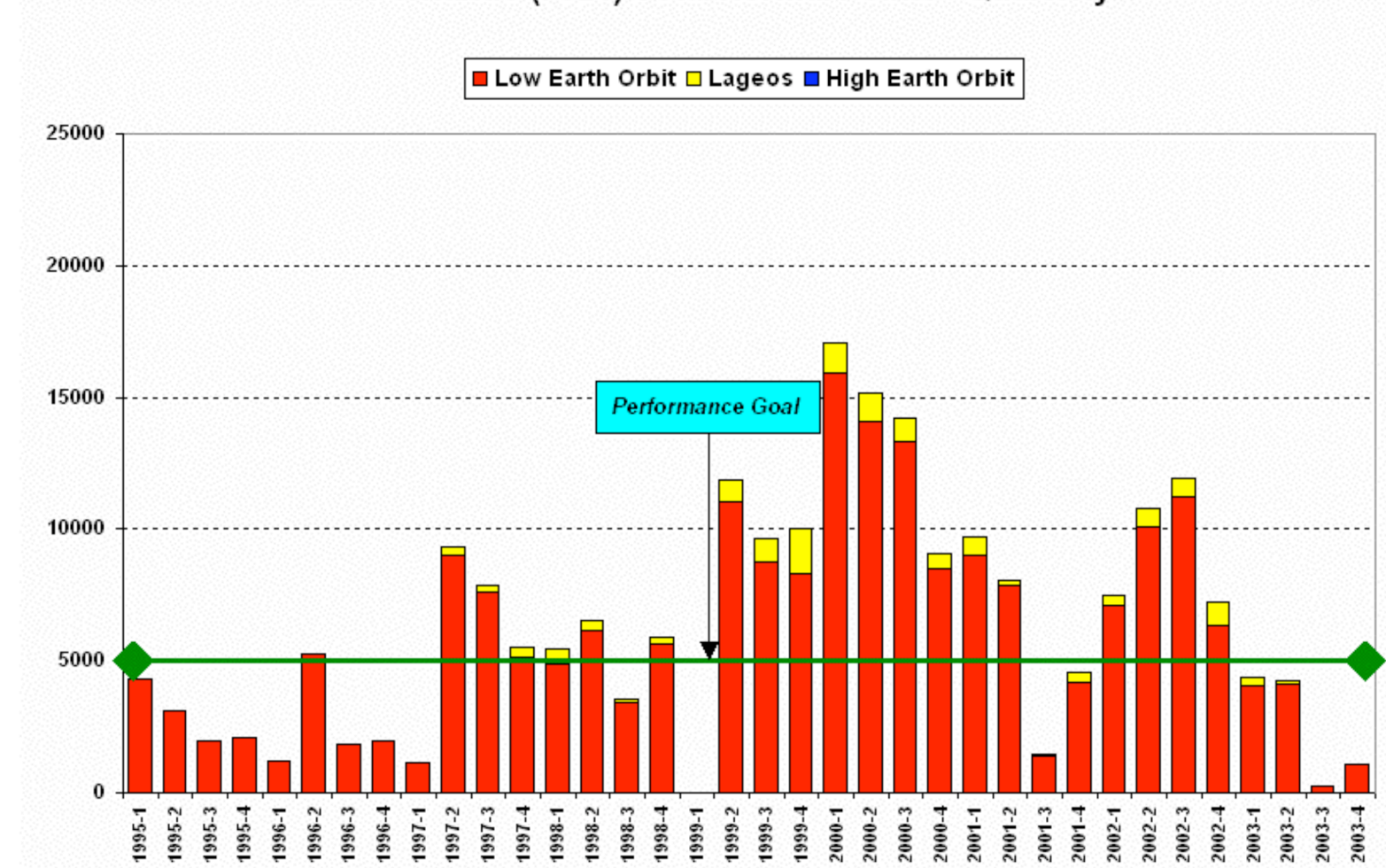
Thus in fitting data between March and June 1998, a first solution was obtained showing RMSs bellow 3cm. That's is referred as UA98 when comparing to ITRF97 and ITRF00 in the table below. We applied the correction for the new position, 35 cm higher, on the former leading to UA98-UP solution. At presently, fitting data between September and December 1999 we have obtained a new solution UA00, deriving a San Fernando station position which yields RMSs between 1 and 4 cm. for LAGEOS POD and between 2.5 and 4.9 cm. for T/P POD.

Comparison of solutions for SANF 7824 to the ITRF00 solution

	$\Delta X_{(m)}$	$\Delta Y_{(m)}$	$\Delta Z_{(m)}$
CSR93	-0,2122	-0,0988	-0,3970
UA98	-0,2133	-0,0397	-0,2527
ITRF97	-0,228	0,0290	-0,1880
UA98-UP	0,0667	-0,0660	-0,0444
UA00	0,0197	-0,0479	0,0057

The present solution UA00, was obtained applying ocean loading and measurement bias adjustments, although the latter were almost negligible (in the order of a few millimeters). The table below shows how RMSs for the station have been lowered, reaching the standards of the best stations of the SLR network.

* All solutions have been obtained with SANF 7824 data withheld (downweighted)		TOPEX DATA			LAGEOS DATA		
		ARC 1 991025	ARC 2 991123	ARC 3 991203	ARC 1 991004	ARC 2 991014	ARC 3 991014
ITRF97	7824 STATION RMS	0,2203	0,1294	0,1813	0,2562	0,2062	0,2156
	POD RMS (2W RNG)	0,0601	0,0372	0,0435	0,0620	0,0415	0,0606
UA98-UP	7824 STATION RMS	0,0690	0,0490	0,0533	0,0367	0,0461	0,0340
	POD RMS (2W RNG)	0,0339	0,0318	0,0355	0,0560	0,0409	0,0508
UA00	7824 STATION RMS	0,0497	0,0253	0,0405	0,0165	0,0101	0,0246
	POD RMS (2W RNG)	0,0319	0,0311	0,0351	0,0498	0,0333	0,0365
ITRF00	7824 STATION RMS				0,0542	0,0436	0,0566
	POD RMS (2W RNG)				0,0548	0,0333	0,0397

It is expected that further analysis of the data will yield further and better adjustments of the station position. Currently, we are in the process of analyzing additional data while combining LAGEOS I and II.