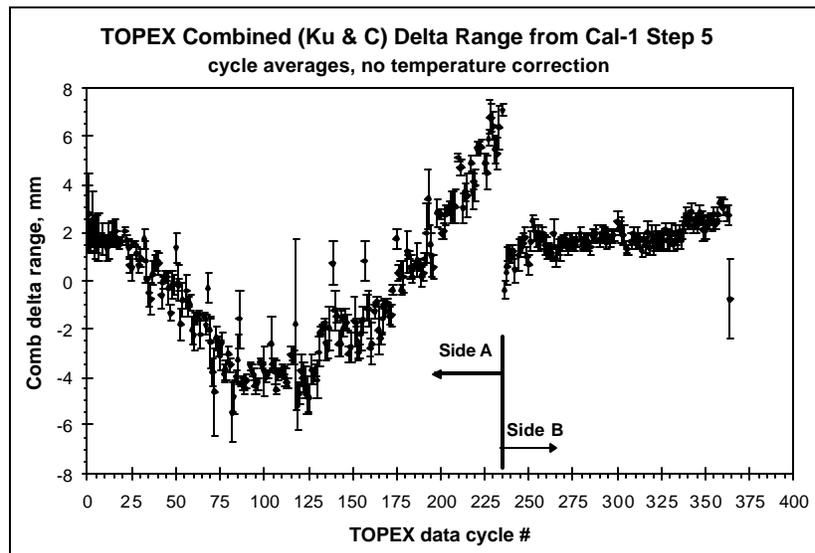


## Discussion of TOPEX Side B Cal Mode Range Drift in Cycle 364

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We discuss here a drift recently observed in the TOPEX altimeter's internal calibration mode range measurement. The calibration mode has two submodes and in the first of these submodes, referred to as Cal Mode 1 or Cal-1, the altimeter internally tracks a delayed and attenuated portion of its transmitted pulse. This Cal-1 range measurement is intended to detect possible drifts in the altimeter's timing. There are 16 separate steps within Cal-1, each step having a different AGC (power) level ; our analyses and summaries have concentrated on step 5 which has an AGC level close to that of typical over-ocean normal tracking operation. For this paper we will present only the results from step 5 of Cal-1. The Cal Mode has been executed



**Figure 1**

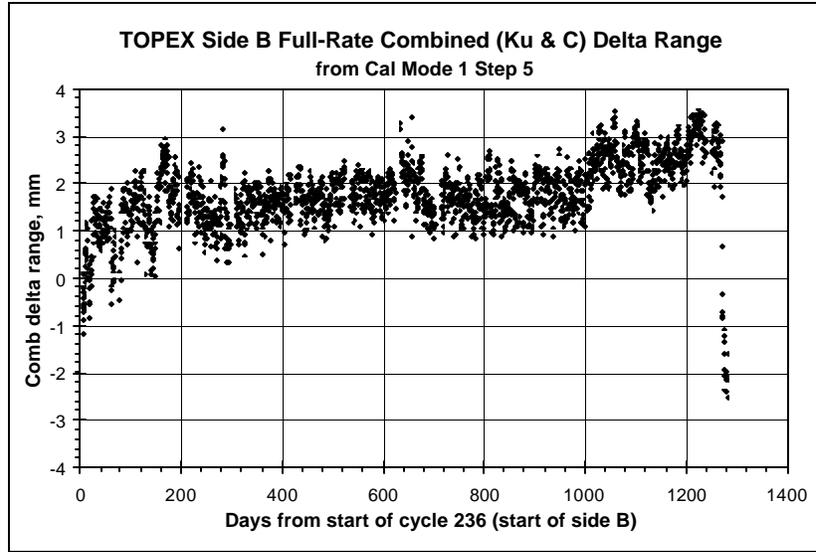
twice per day over the entire TOPEX operation, and we have provided monthly updates to the Cal-1-derived range stability estimates at <http://topex.wff.nasa.gov/docs/RangeStabUpdate.html> .

Figure 1 presents the TOPEX cycle averages of the Cal-1-derived delta ranges for the combined Ku- and C-band result. "Combined" refers to the weighted sum of Ku- and C-band results which eliminates path delays due to the ionospheric electron content, and "delta range" refers to the Cal-1 range after subtraction of an arbitrary but constant reference value. The last data cycle in Figure 1 is 364, and its Cal Mode combined delta range is significantly lower than any other TOPEX Side B cycle.

Each of the cycle averages in Figure 1 is the result of about twenty individual Cal Modes, and Figure 2 presents the full-rate Cal Mode combined ranges for Side B only. Notice that the Figure 2 horizontal axis

is days relative to the start of Side B operation, not cycle number. The last Cal Mode plotted in Figure 2 was from 2002 day 226.

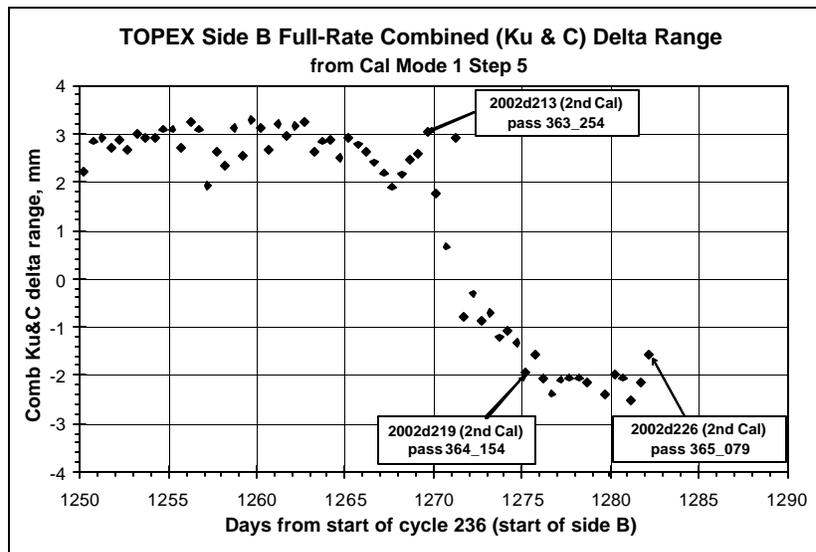
Our immediate concern is with the last two dozen or so Cal Mode delta ranges shown at the rightmost part of Figure 2. These Cal-1 combined delta ranges show a relatively sudden decrease of about 5 millimeters, and nothing like this sharp change has been seen anywhere else in the Side B operation.



**Figure 2**

Figure 3 shows just the last 30 days or so of Figure 2. A rough characterization of Figure 3 is: 1) the Cal-1 combined range is approximately stable through the second Cal Mode of 2002 day 213; 2) this range decreases over the next six days; and then 3) the Cal-1 combined range has a new approximately stable value starting with the second Cal Mode of 2002 day 219. The final lower stable value is approximately 5 mm lower than the initial stable value in Figure 3.

Our Figures have concentrated on the combined (Ku & C) Cal-1 range change, because it is the combined range that is of interest to the end user of the TOPEX data. This Cal-1 combined range change is almost entirely due to a change in the Cal-1 Ku-band range, and the Cal-1 C-band range has very little if any change over the time of the Ku-band change.



**Figure 3**

We have searched in all the temperatures, voltages, currents, and powers which are monitored in the TOPEX engineering mode data, and we have been unable to find any parameters which seem to be correlated with the Cal-1 range change reported here. We have seen no significant changes in the altimeter's point target response (effectively, the transmitted pulse shape as observed by the receiver) which is monitored monthly by execution of a special calibration sweep (Cal Sweep) mode. The latest regularly scheduled Cal Sweep occurred on 2002 day 213. We requested an additional Cal Sweep which was

executed on 2002 day 223, and we found no significant changes in that Cal Sweep from any of the other recent Cal Sweeps.

We note that the magnitude of the recent Cal-1 range change is only half a centimeter so it is the rate of the change, not the magnitude, which we find puzzling. For now we can only wait, continue to monitor closely the altimeter data, and hope that the new Cal-1 range apparent stability continues.