Review of:
Multi-satellite Rainfall Sampling Error Estimates: A Comparative Study
by: M. Itkin and A. Loew

Overview
There is very little to recommend this paper -- it has three very fundamental problems: (I) there is little new scientific knowledge herein; (II) there are multiple points where the information presented by the authors is at best, imprecise, while at worst factually incorrect; and (III) there is an obvious lack of familiarity with the foundation literature that precludes the analysis and in which the most salient of this literature has already accomplished virtually all that the authors have unknowingly duplicated. (IV) In addition, even if there were something new, the scientific strategy behind the analysis is weak and ineffective. (V) Finally, the paper has numerous technical shortcomings in the way of stilted English usage, misuse of articles, spelling errors, sophomoric tutorial excess and inclusion of irrelevant diagrams. In essence, it is a carelessly (or hastily) prepared paper. It also might be presumed that this analysis was carried out as an excuse to exercise an orbit analysis software package [SGP4 embedded in PREDICT] rather than to make a serous attempt to understand some new aspect of precipitation retrieval error due to sampling limitations. In my opinion, a herculean effort would be required to transform this manuscript into a publishable paper. [Prof. Eric A. Smith]

Major Shortcomings
1. The topic of the paper has been examined extensively with almost nothing new being considered in the analysis. Moreover, whatever is new has not been identified.
2. The authors are apparently unaware of the salient literature addressing this topic. For starters the foundational studies of Salby (1982a-b, 1988/JAS; 1989/JCLIM) concerning asynoptic satellite observations and the review article by Arnold & Dey (1986/BAMS) concerning the history of how OSSEs were designed would have been essential citations in setting the stage for their analysis. Then, more up-to-date articles concerning satellite sampling strategies and OSSEs would have greatly helped them understand the critical issues in studying how incomplete satellite sampling introduces errors in mean values, *e.g.*, Kirk-Davidoff *et al.* (2005/JCLIM), Lahoz *et al.* (2005/QJRMS), Stoffelen *et al.* (2006/QJRMS), Gelaro & Zhu (2009/Tellus), Sugimoto *et al.* (2009/MWR) and Matsutani *et al.* (2010/JGR). However, and most importantly, had the authors become knowledgeable of the studies of, *e.g.*, McConnell & North (1987/JGR), Bell et al. (1990/JGR), Salby *et al.* (1991/BAMS), North *et al.* (1993/JAM), Bell & Kundu (1996/JCLIM), Morrissey & Janowiak (1996/JAM), Steiner (1996/WRR), Astin (1997/SG) and Huffman (1997/JAM), they would have fully understood how exhaustively their chosen topic had been examined -- even before the post-TRMM-launch rash of articles in the first decade of the new century coming from such authors as Arkin & co-authors (particularly Sapiano & Xie), Ebert, Gottschalck, Huffman and co-authors, Joyce, Levizzani, Soorooshian and co-authors, Turk and very recently Fischer and Wolff (2011/JAMC) that have essentially put to bed the topic of how multiple satellite sampling affects precipitation retrieval errors from space. They also demonstrated a lack of knowledge concerning the topic of rainfall diurnal sampling from satellite by ignoring such important studies as, *e.g.*, Bell & Reid (1993/JAM), Soman *et al.* (1995/JAM), Negri et al. (2002/JAOT), Janowiak *et al.* (2005/JGR), and Yang & Smith (2006/JCLIM).

I have drawn attention to these papers (there are others) to help the authors understand that it was their responsibility to carry out a thorough literature examination before attempting to publish a paper in a reviewed journal -- for the specific purpose of determining, *a priori*, if their intended research was new or simply redundant. They would have found that what they were doing was essentially, NOT new, nor would it have led to <u>new knowledge</u> -- which is the fundamental test for publication approval.

3. Assuming there was something new in their study, by limiting their analysis to two small and arbitrary study areas within West Africa and Germany (for which no explanation or justification is provided) renders their conclusions of little value, especially outside the small study areas themselves where rainfall diurnal cycles, seasonal cycles and annual cycles undergo large variations, and for which those variations are greatly different from the counterpart variations within the two study areas. I also draw attention to the authors disregard of retrieval errors in their study, particularly those associated with geo-IR which are insensitive to rainfall altogether -- while at the same time implying that 2nd order orbit drift effects represent an important source of sampling error.

4. There are numerous instances where the information provided by the authors is either imprecise or factually incorrect. A non-exhaustive set of examples are: (1) P-11679/~L19-15: although the GPCP, TMPA and CMORPH procedures use a great abundance of satellite precipitation observations, they do not use "all" available satellite precipitation observations; (2) P-11681/~L5: this discussion concerning point measurements is irrational in the context of beam filling error and 1- or 2-diminsional times series; (3) P-11681/~L15-25: beyond the unnecessary tutorial aspects of this discussion and the fact that you now bring up retrieval error after immediately prior disregarding it as a component of your analysis, the equation on Line 20 is incorrect since the covariant terms have been left out; (4) P-11682/L11-12: these two sentences are self contradictory and you cannot just "think" yourself into use of hourly data without analyzing whether it serves the purpose, particularly after just claiming that 5-min data are essential; (5) P-11683/L16: should say "approximately constant"; (6) P-11683/L18: "7" should be "6.9"; (7) P-11683/~L25: this statement is untrue -- there are multiple reasons associated with why MW measurements have mainly been made on satellites using LEO orbits, including cost limitations, antenna size allowances, use of real instead of synthetic aperture antennas, design of receiver gain electronics -- and other reasons associated with limited dwell times; (8) P-11684/~L15: definitions are not consistent as to use of term "LEO satellites" / it is not clear whether fourth group considers one or multiple GEO satellites / analysis should include group using only conical scanners; (9) P-11685/L13: "regular" should be "irregular"; (10) P-11686/L8 & L20: SE should be defined as a modified "index of dispersion" or "index of variation" rather than "sampling error"; (11) P-11686/~L15: the discussion describing RMSE requires better clarification; (12) P-1168/L1: "field of view" is the incorrect term, it should be "swath" instead.

5. There are numerous technical deficiencies in the way of English usage and grammar, spelling, unneeded tutorial passages and inclusion of irrelevant diagrams. A few examples are: (1) Abstract: various improper uses of articles plus the inclusion of misleading phrase "of the common type"; (2) P-11683/L25: "orbits do" instead of "orbit does"; (3) P-11684/L25: "forth" is a misspelled word; (4) P-11687/L3-5: this last sentence is not needed; (5) Figures 1 and 4 are unnecessary.