An Investigation of Sampling Errors for 7 Different Tandem OSCAT/SCATSAT Mission Scenarios

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The calculations presented here are based on the methodology summarized by Schlax et al. (2001)* and were made by computer code that approximates the satellite orbits as circular. They are based on the following two-line elements for the Oceasat-2 orbit that were obtained from NORAD tracking (http://celestrak.com/NORAD/elements/resource.txt):

OCEANSAT 2
1 35931U 09051A 11132.31127162 .00006034 00000-0 15388-2 0 1281
2 35931 **98.2812** 229.3038 0004463 181.4383 178.6802 **14.50898759** 86423

Using computer code that we developed for past applications, the inclination of 98.2812° and the number of revs per day 14.50898759 corresponds to an orbital altitude of 722.7 km.

The calculations presented here can be sensitive to the precise details of the orbit and should therefore be checked with a more sophisticated set of computer codes before making any decisions on the phasing of the SCATSAT orbit relative to the Oceansat-2 orbit. If the locations of measurements can be provided for a time period of 40 days or longer based on more precise computer codes, our other computer codes can be re-run to produce more precise maps and time series of the errors in wind fields constructed from OSCAT alone and from a tandem OSCAT and SCATSAT mission.

The figures presented here are based on the full 1800-km swath width and we have arbitrarily assumed an initial ascending node of 180°. It is unlikely that this is the actual ascending node, so the longitudes in these figures should not be interpreted rigorously. However, the figures would look the same if the precise ascending node can be provided to us, except that the longitude labels on the figures would change accordingly.

* Schlax, M. G., D. B. Chelton and M. H. Freilich, 2001: Sampling errors in wind fields constructed from single and tandem scatterometer datasets. *J. Atmos. Oceanic Tech.*, **18**, 1014--1036.

The 7 Tandem Orbit Configurations Considered Here

1) SCATSAT shifted -6 hours relative to OSCAT with no offset in longitude. *We believe that this is the presently planned tandem mission for OSCAT and SCATSAT.*

2a) SCATSAT shifted -24 hours relative to OSCAT with no offset in longitude.

2b) SCATSCAT shifted -50 minutes relative to OSCAT with a longitudinal offset of -12.5° (said by Stoffelen to be equivalent to Scenario 2a - it is quite close).

3) Removed from original list, as per Stoffelen's request.

4) SCATSAT shifted -3 hrs 50 min with a longitudinal offset of -12.5°.

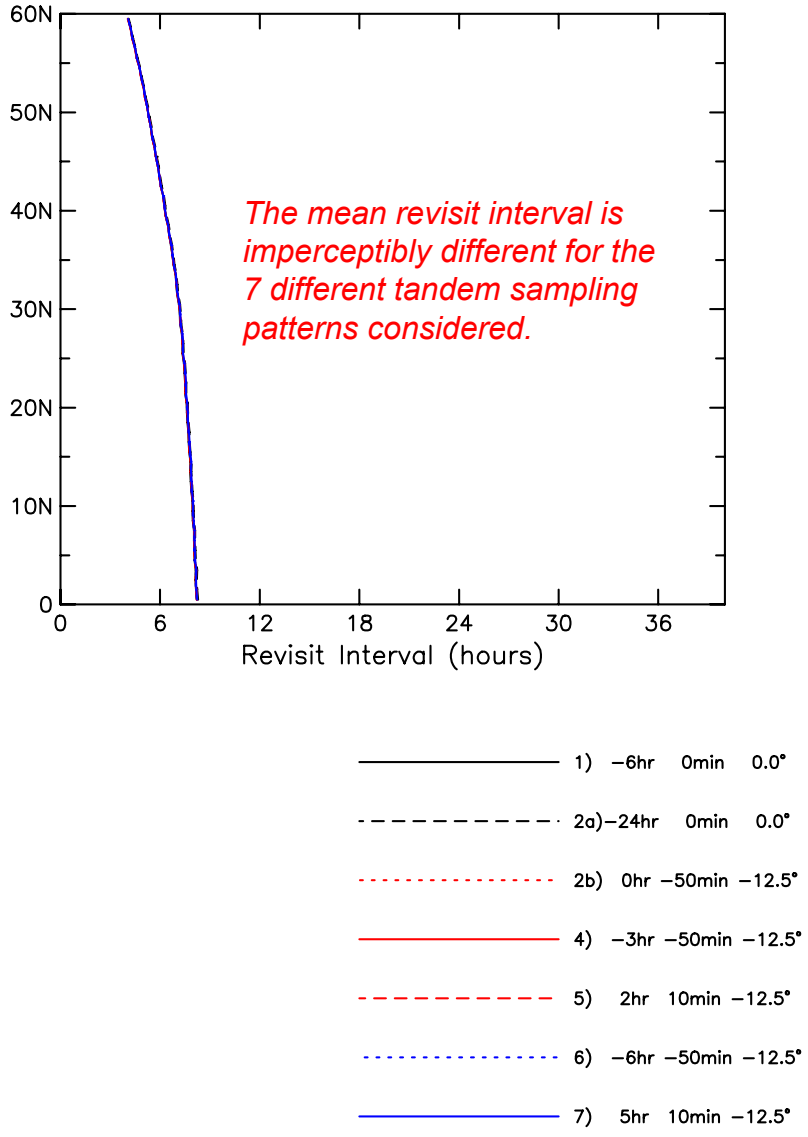
5) SCATSAT shifted +2 hrs 10 min with a longitudinal offset of -12.5°.

6) SCATSAT shifted -6 hrs 50 min with a longitudinal offset of -12.5°.

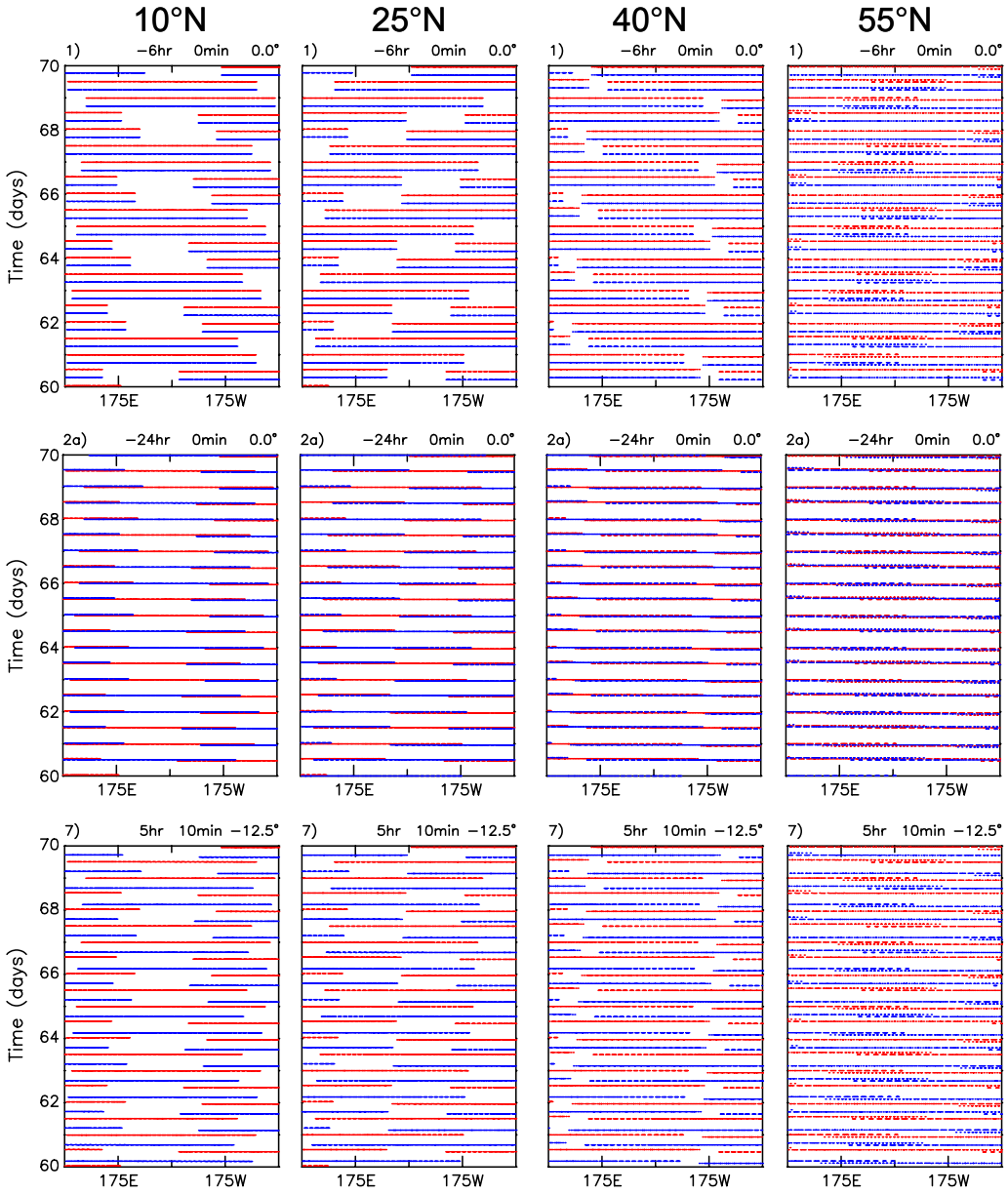
7) SCATSAT shifted +5 hrs 10 min with a longitudinal offset of -12.5°.

Our conclusion: The best sampling patterns, i.e., those with the most spatially and temporally homogeneous mapping errors, are Scenarios #2a, #2b and #5, and the differences between them are insignificant (see mapping errors in a later figure).

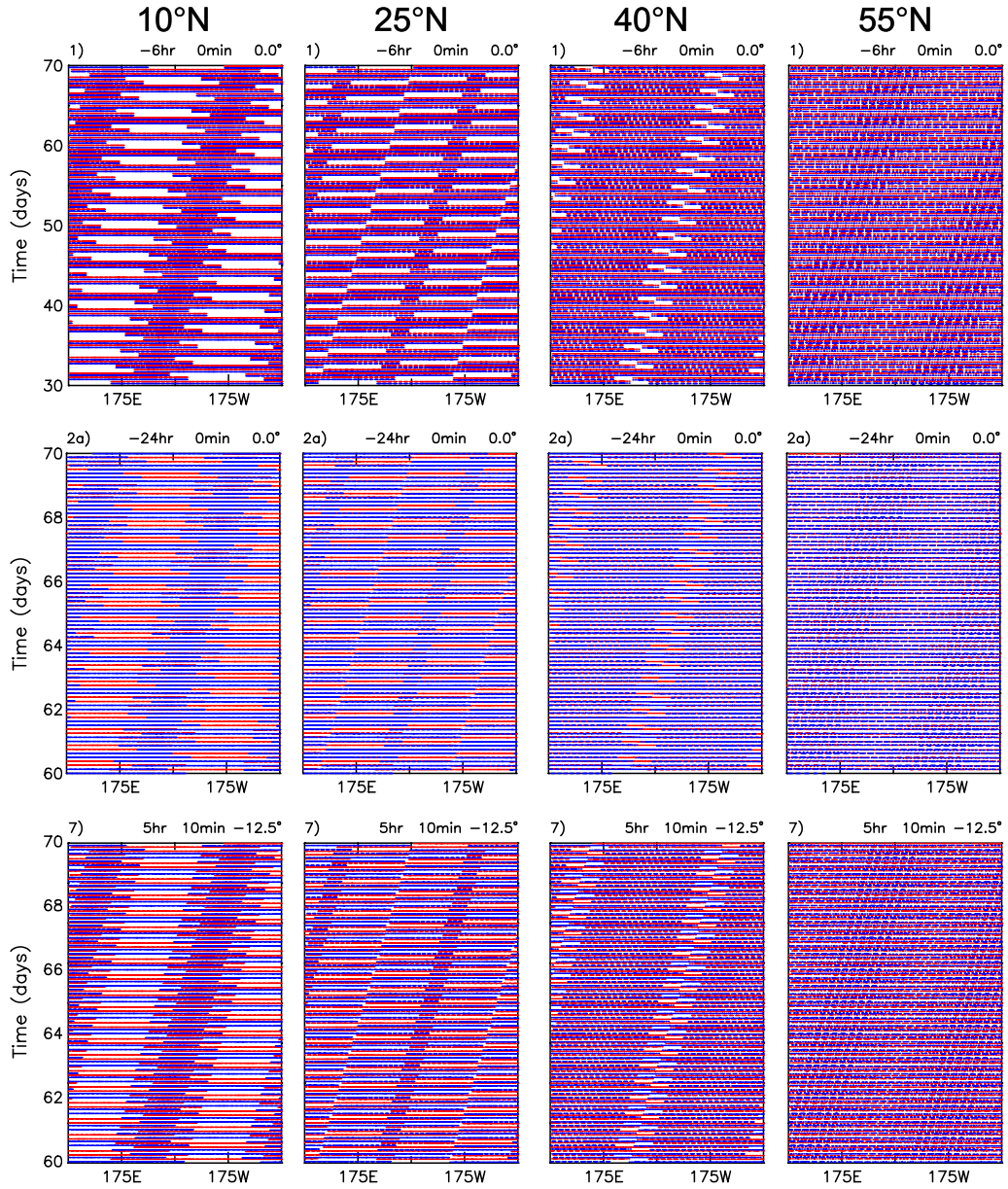
Mean Revisit Interval as a Function of Latitude



Time-Longitude Sampling Along 4 Selected Latitudes Over a 10-Day Period for 3 Selected Tandem OSCAT/SCATSAT Mission Scenarios



Time-Longitude Sampling Along 4 Selected Latitudes Over a 40-Day Period for 3 Selected Tandem OSCAT/SCATSAT Mission Scenarios



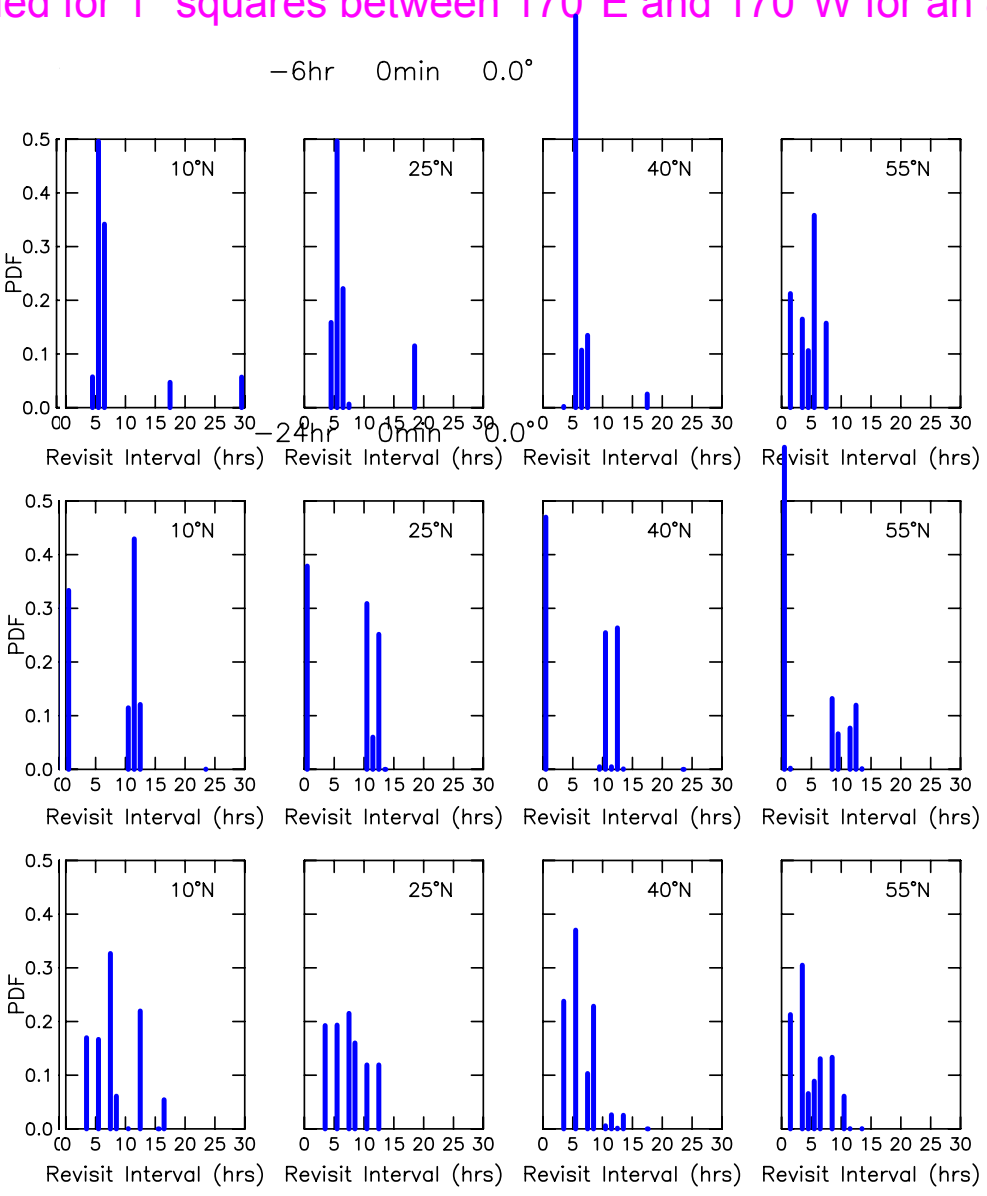
Histograms of Revisit Intervals Versus Latitude for 3 Selected Tandem OSCAT/SCATSAT Mission Scenarios

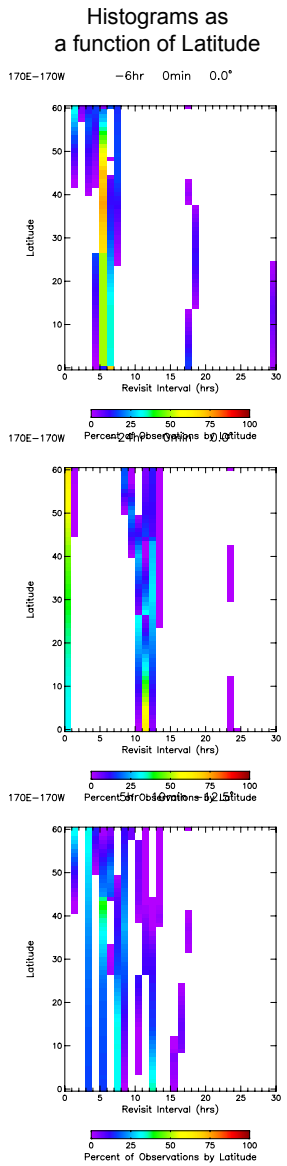
(Compiled for 1° squares between 170°E and 170°W for an 80-day period)

Scenario 1

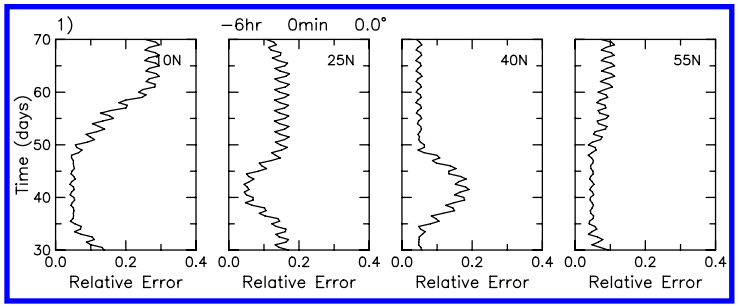
Scenario 2a

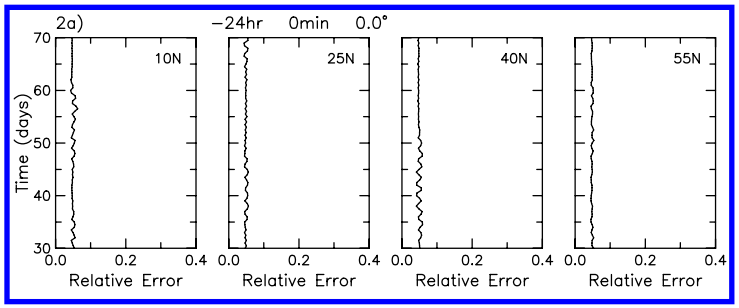
Scenario 7

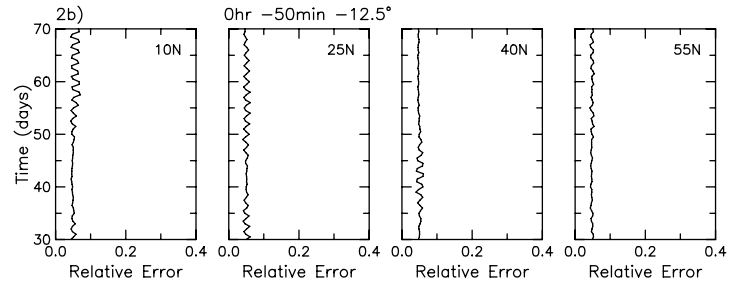


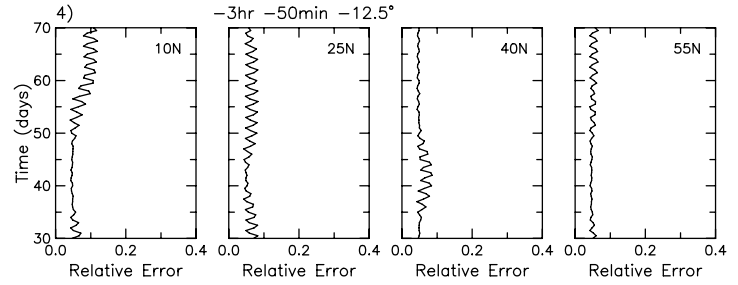


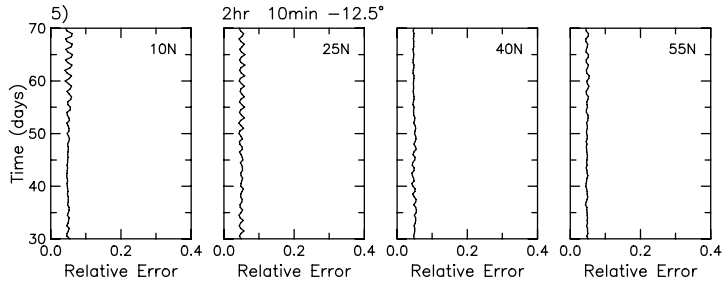
Time Series of Relative Errors of Wind Component Estimates for the Various Tandem OSCAT/SCATSAT Missions with 1.2º by 1.2º by 2.4-day Averages

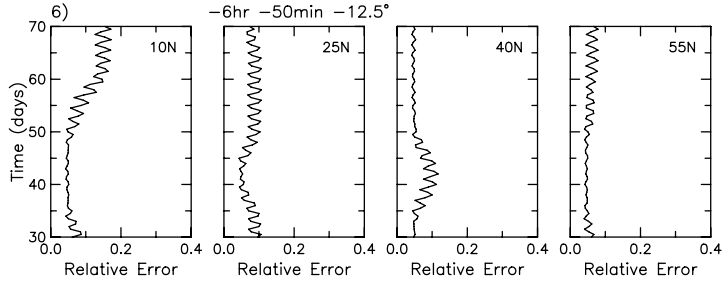


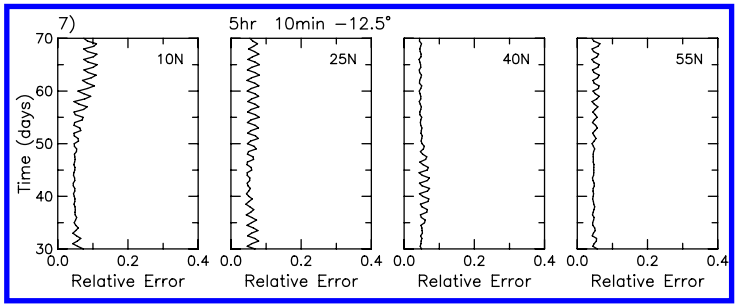






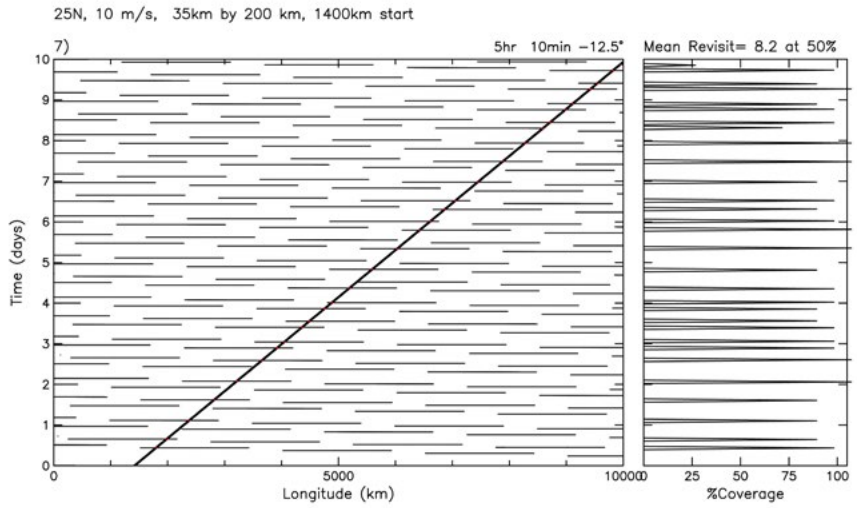


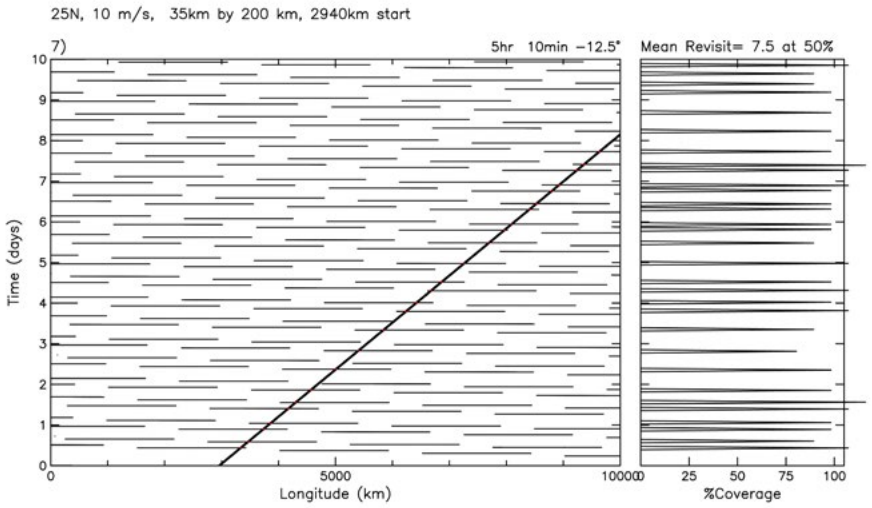


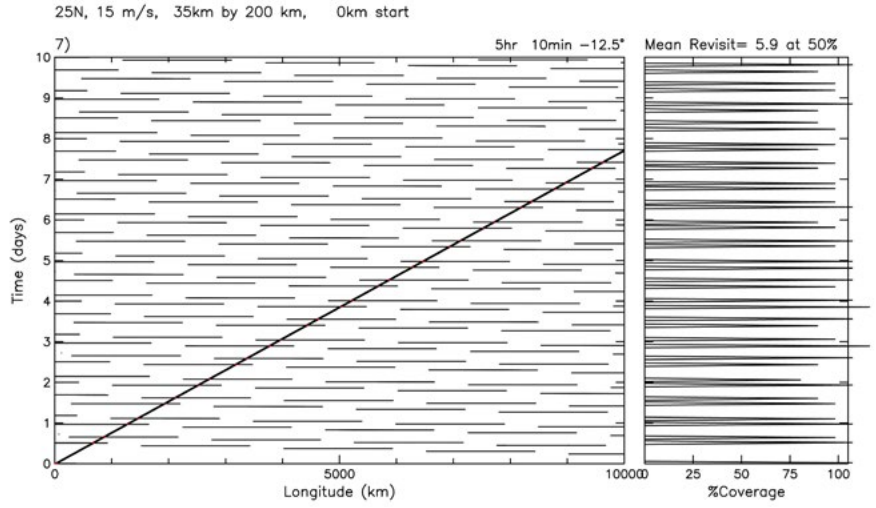


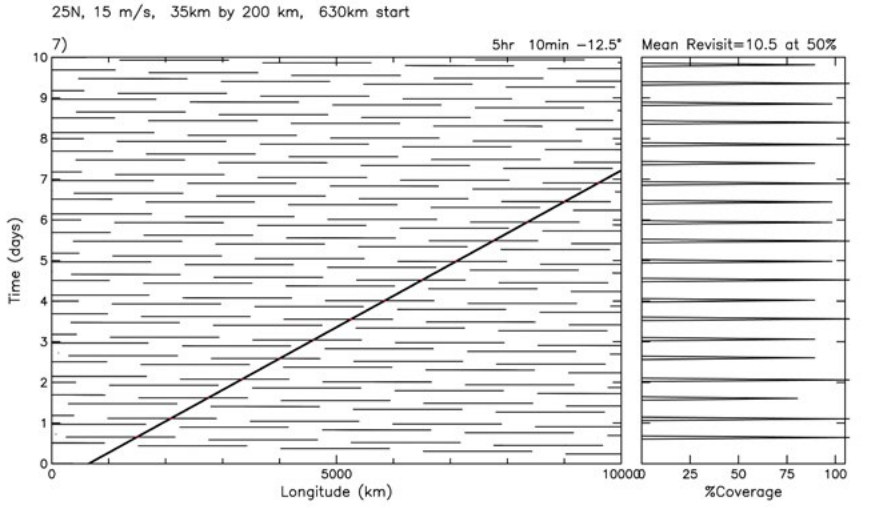
1. *The mapping errors are very inhomogeneous spatially and temporally for Scenario #1, which is the presently planned tandem configuration.*
2. *The mapping errors are also significantly inhomogeneous spatially and temporally for Scenarios #4, #6 and #7 that offered improved sampling at the higher latitudes in the previous figures.*
3. *The best sampling patterns, i.e., those with the most homogeneous mapping errors, are Scenarios #2a, #2b and #5, and the differences between them are insignificant.*

Time-Longitude Sampling with Scenario 7 of a Moving Front with a “width” of 200 km and a “length” of 35 km

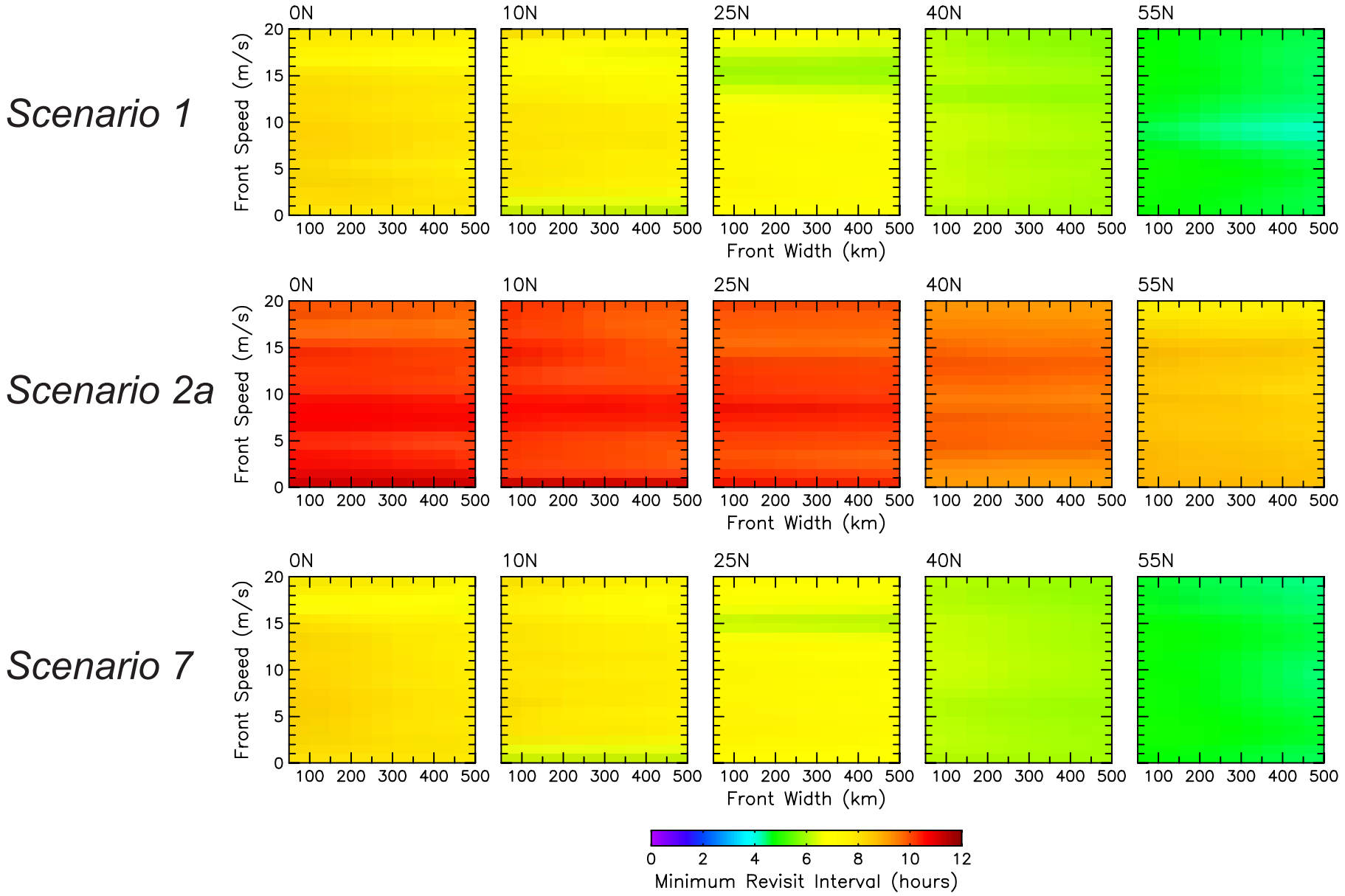








Minimum Revisit Interval as a Function of Frontal Width and Propagation Speed



Range of Revisit Interval as a Function of Frontal Width and Propagation Speed

Scenario 1

Scenario 2a

Scenario 7