Statistical Evaluation of VIIRS Ocean Color Data Retrievals

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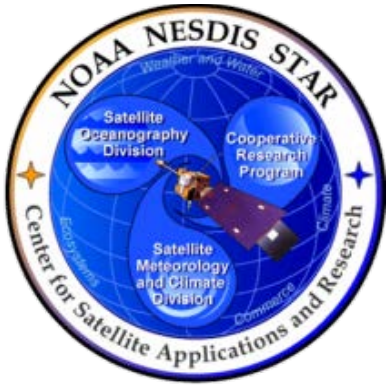


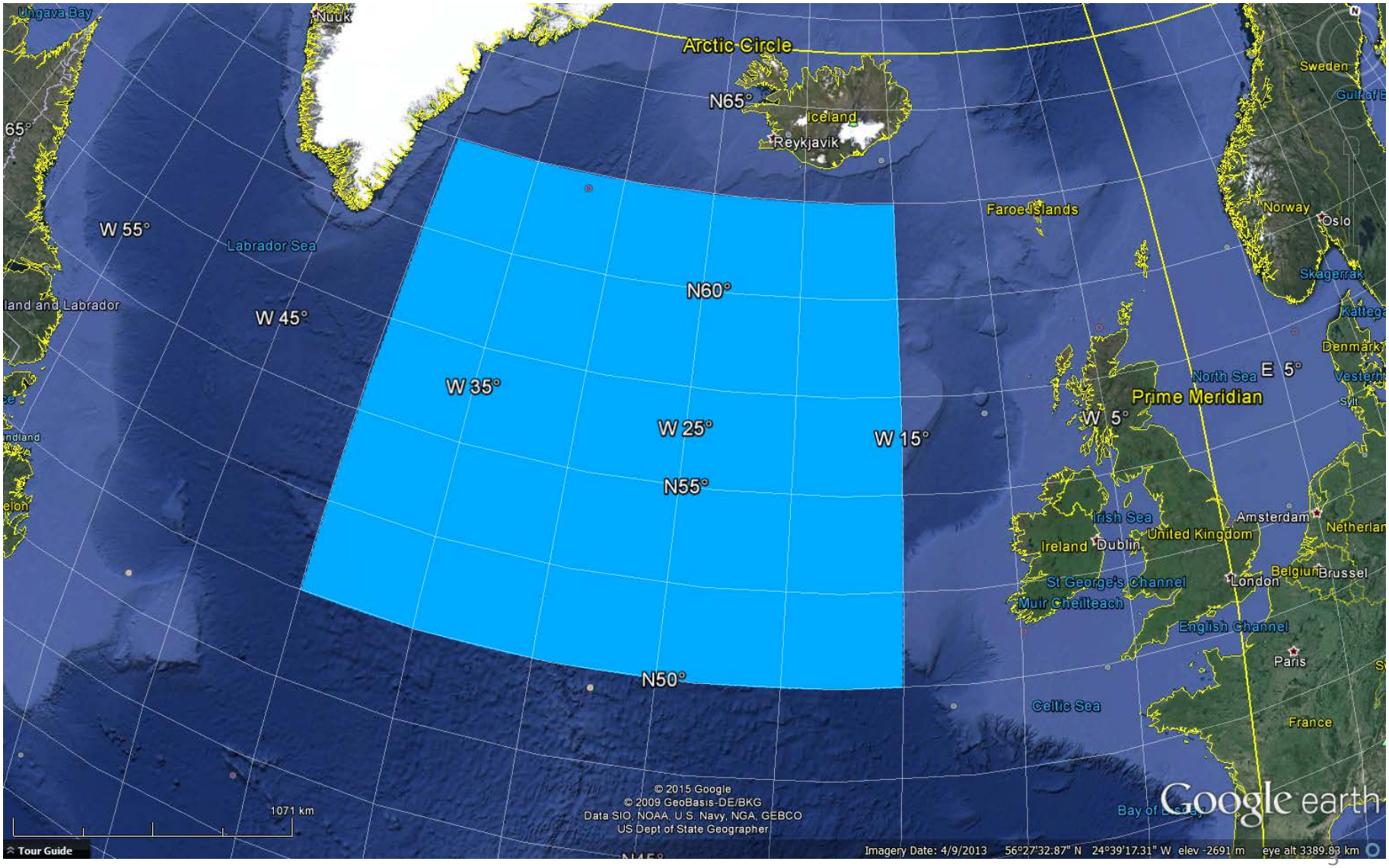
Methodology

- Analyze SNPP-VIIRS ocean color data granules from two regions, from time period 2012 - 2014, processed with the most recent MSL12 (BMW algorithm)
- Exclude all nL_w data flagged as land, clouds, high sun-glint, and atmospheric correction failure, as well as all masked or out-of range nL_w data
- Subtract lat-lon binned and time averaged nL_w over 31 days (day-15…day+15) from nL_w data in each granule: $\Delta nL_w = nL_w$ – time_averaged(binned(nL_w))
- Collect statistics in VIIRS bands M1-M5 for ΔnL_w (410, 443, 486, 551, 671 nm) dependence on solar-zenith angle, sensor-zenith angle, glint coefficient, wind speed, atmospheric pressure, and other retrieval and auxiliary parameters
- Also collect number of data points dependence on retrieval parameters
- Plot ΔnL_w *vs.* retrieval parameters and look for deviations from average and other artifacts

Region 1: North Atlantic

region of study: 50-62.5N, 15-40W box

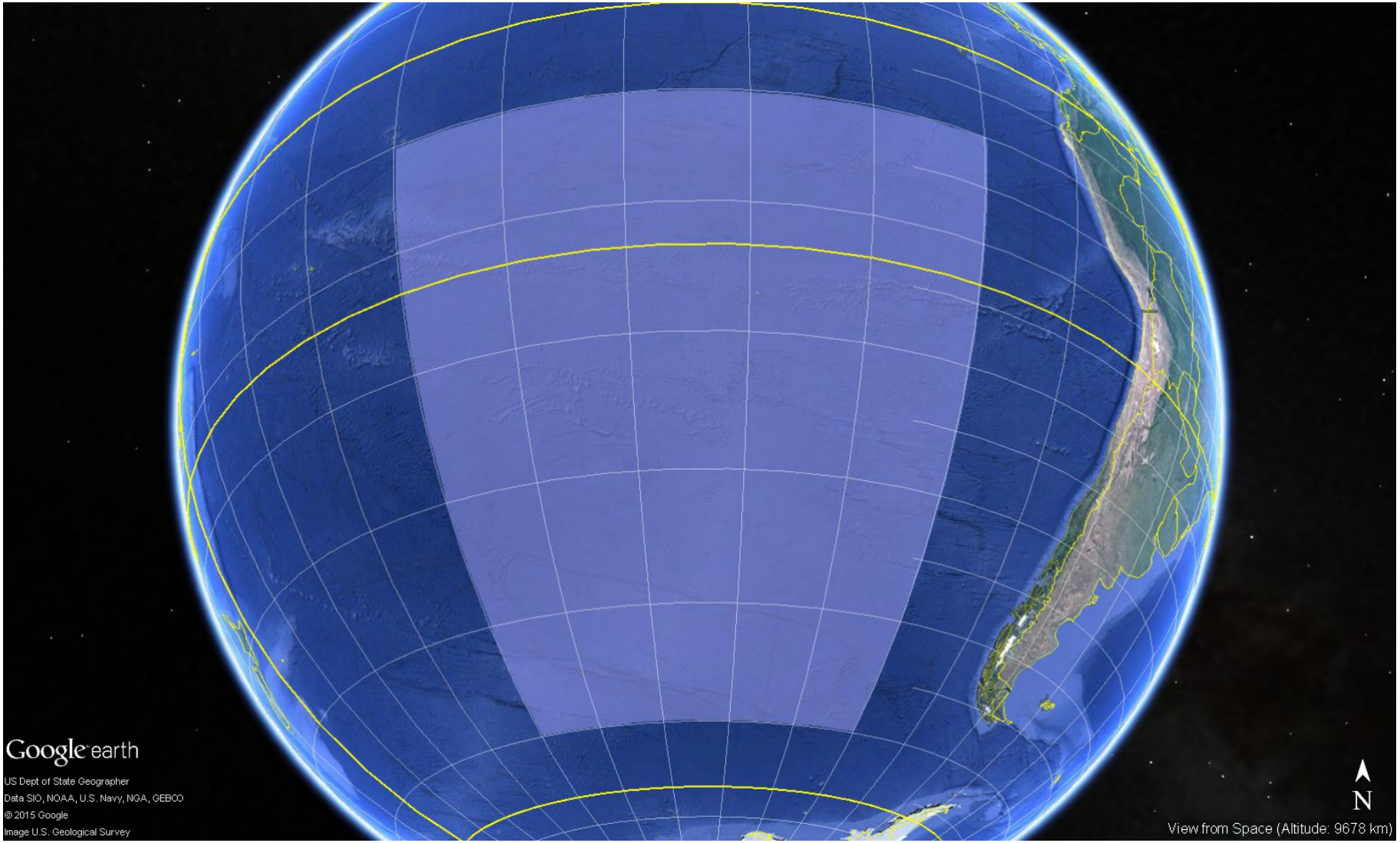
binned nL_w: **(0.5°lat × 1°lon ≈ 50 × 50km)**



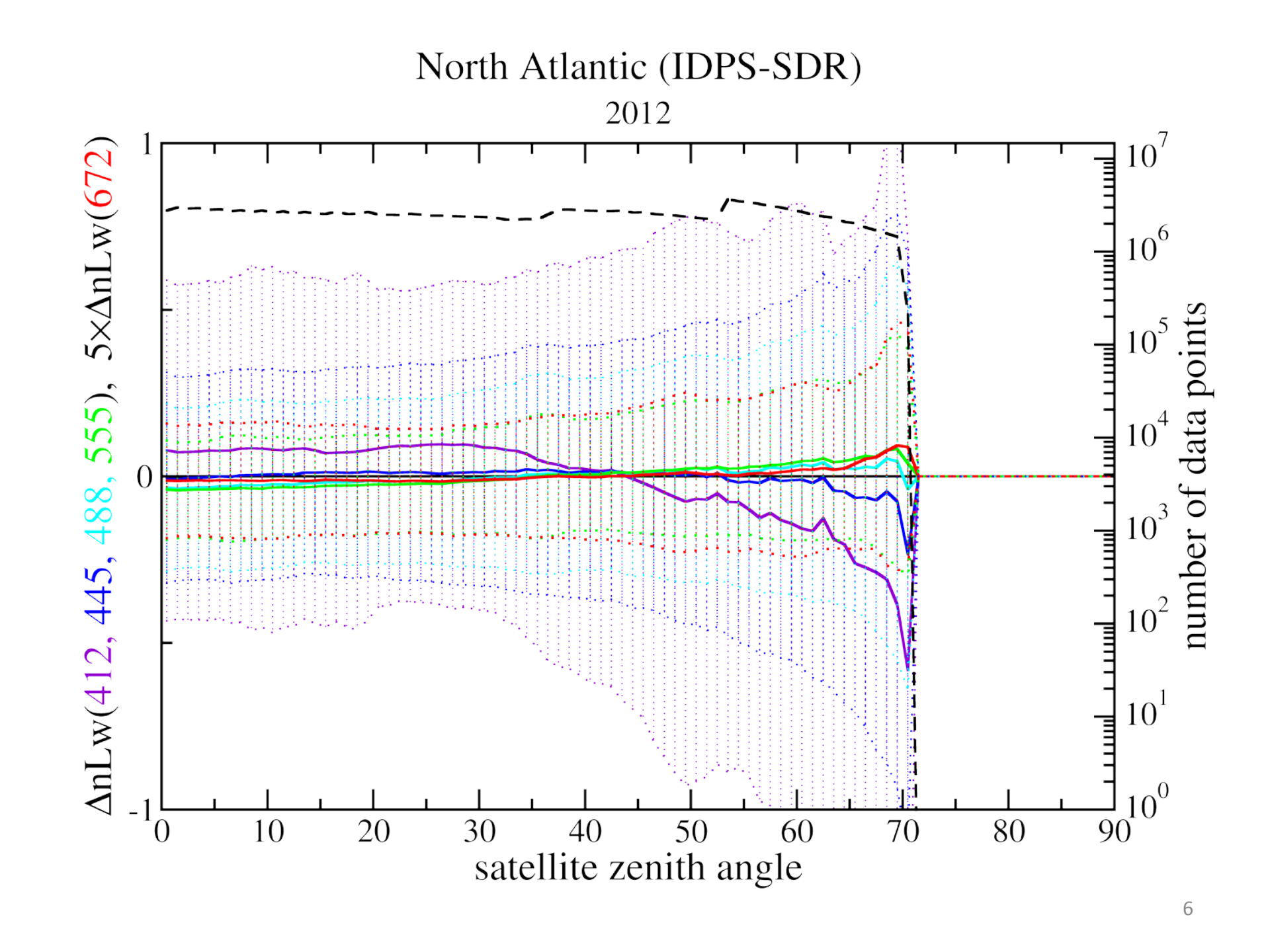
Region 2: South Pacific

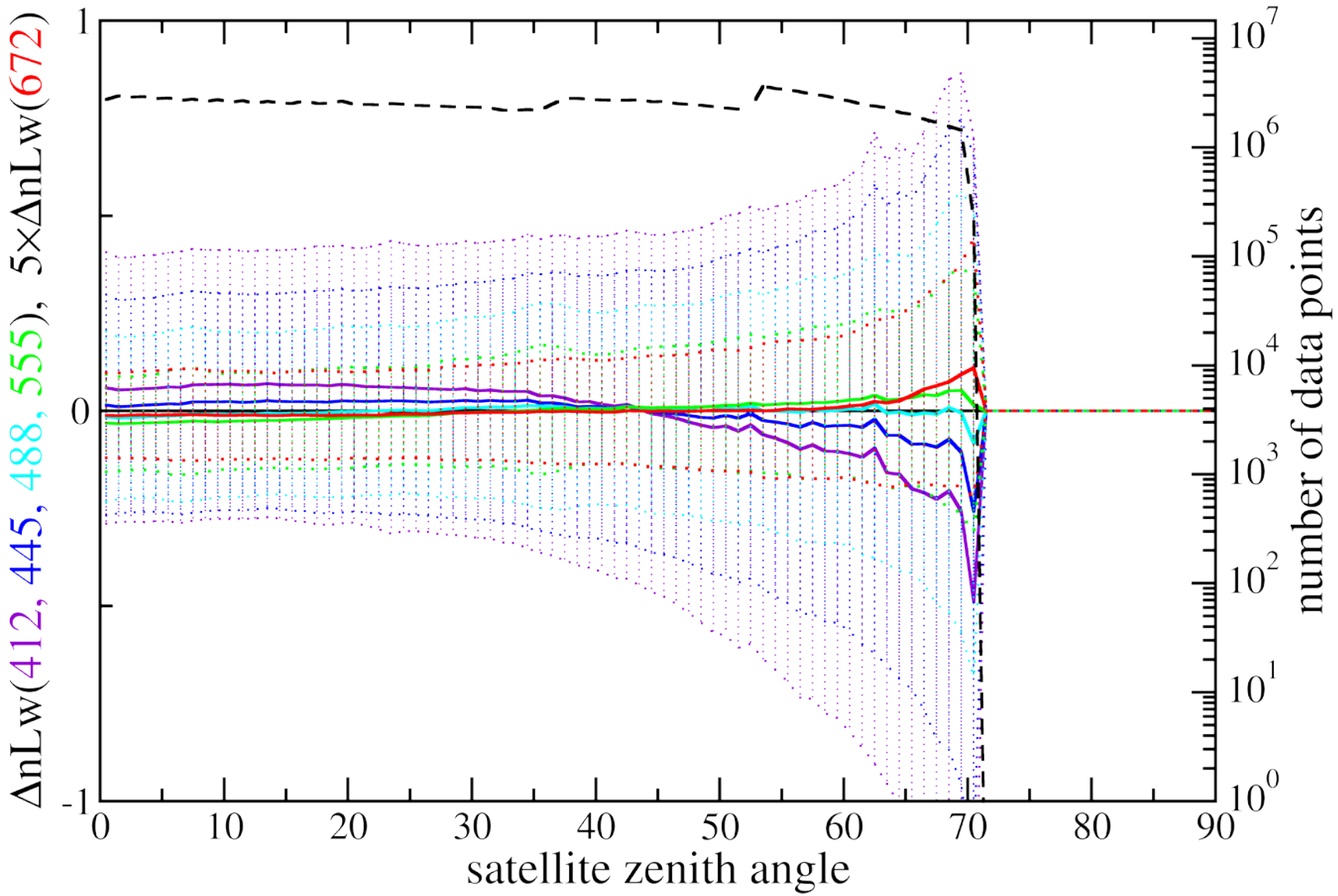
region of study: 10-60S, 90-140W box

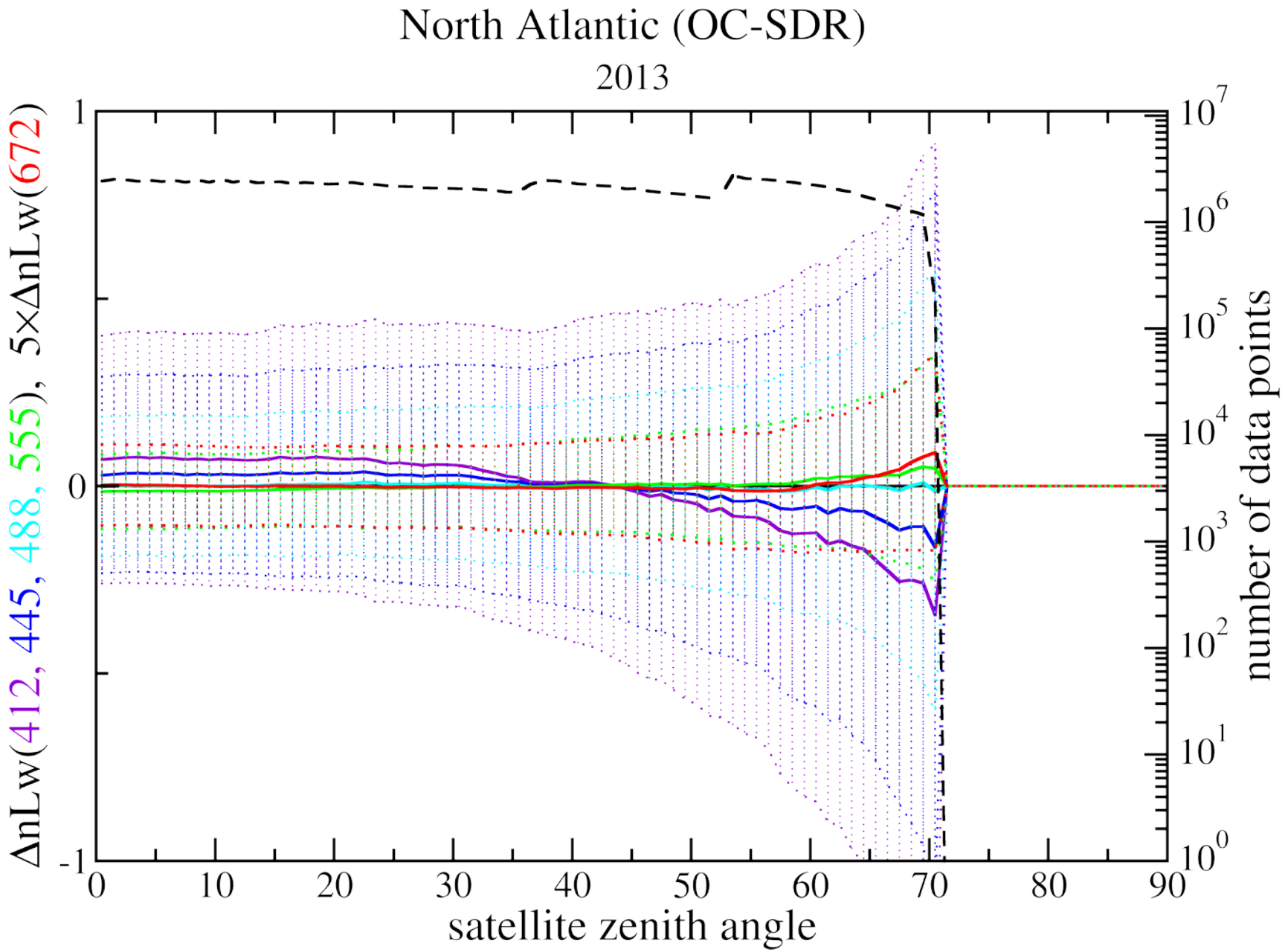
binned nL_w: **(0.5°lat × 0.5°lon)**

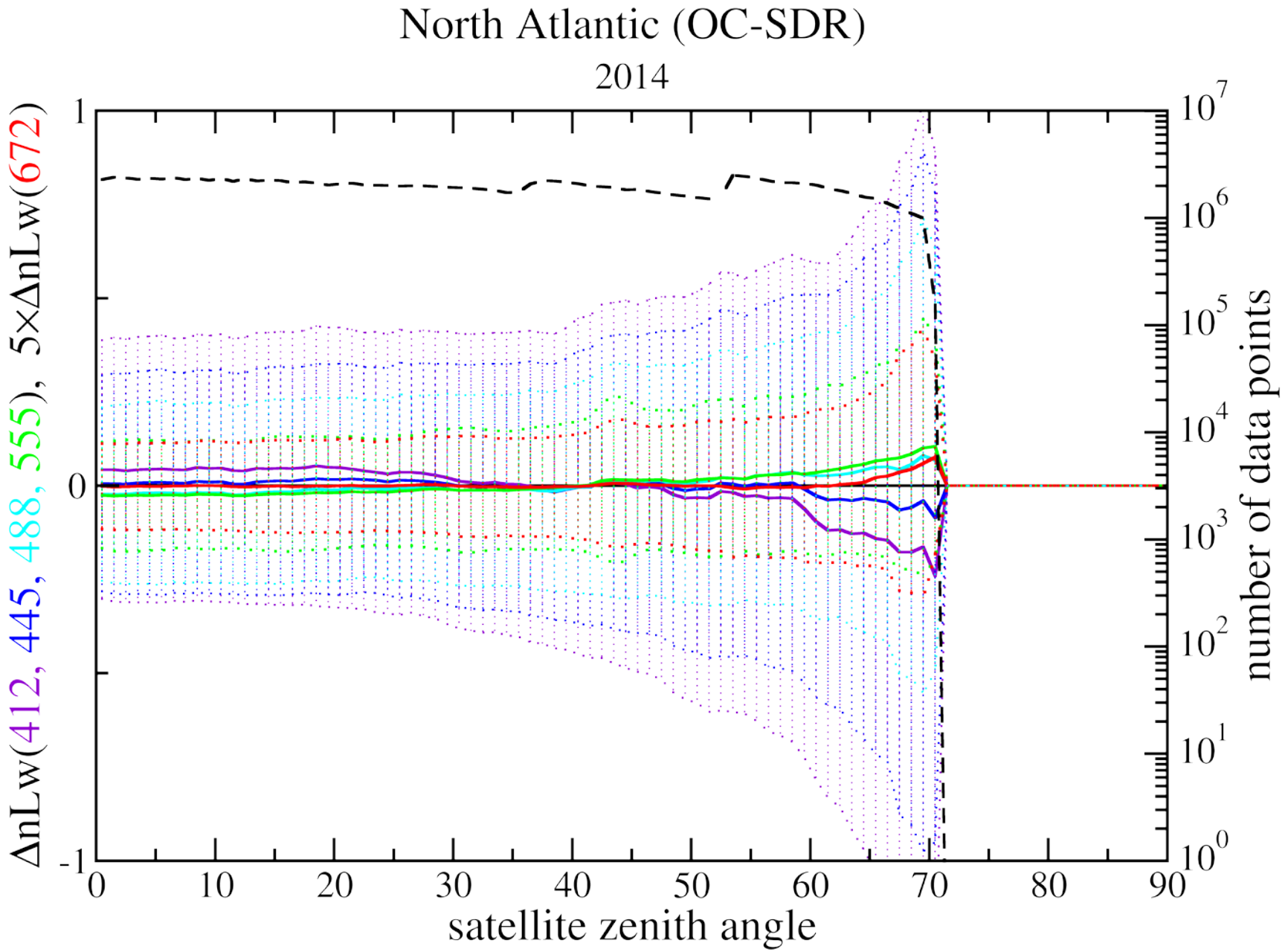


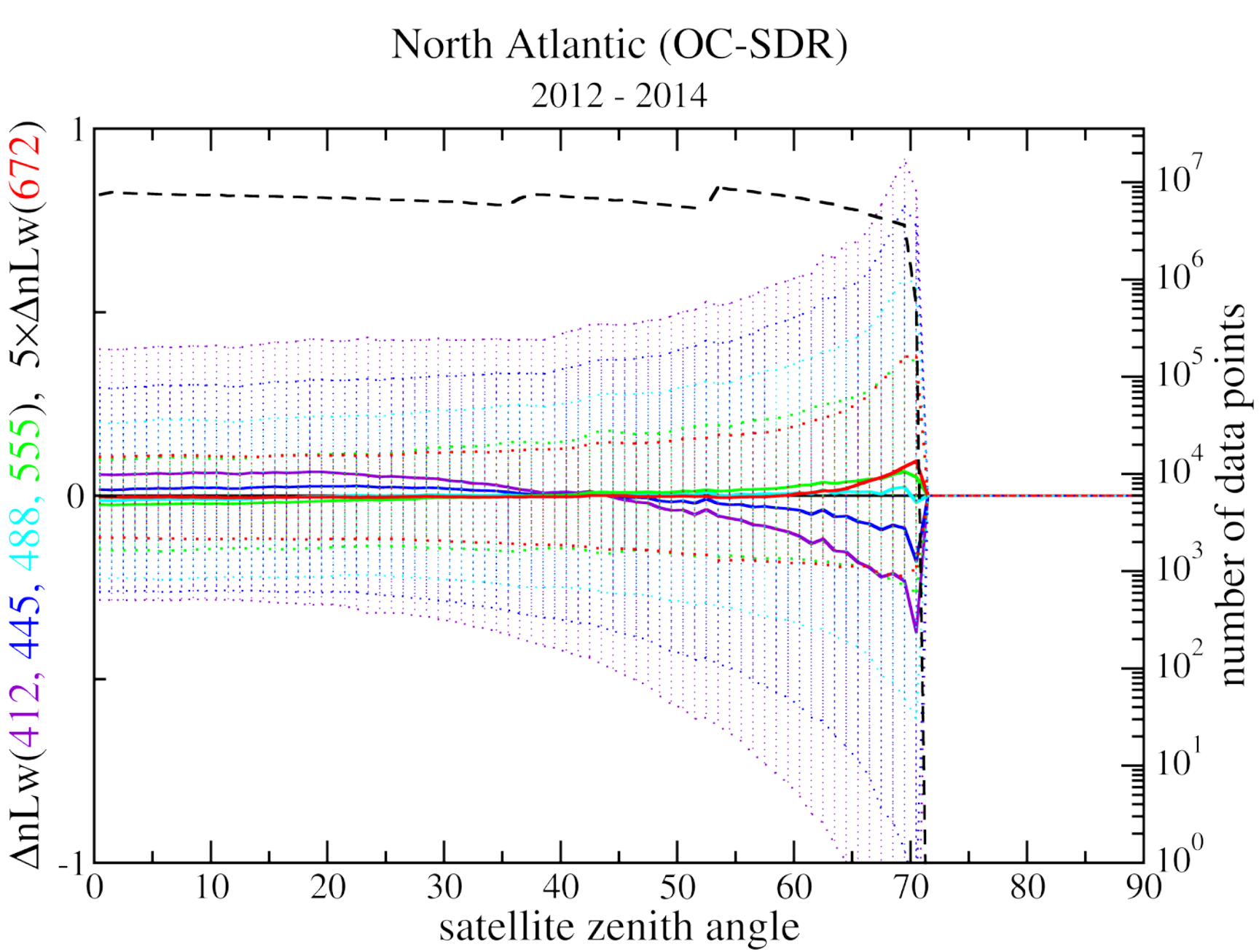
nL_w dependence on sensor-zenith angle

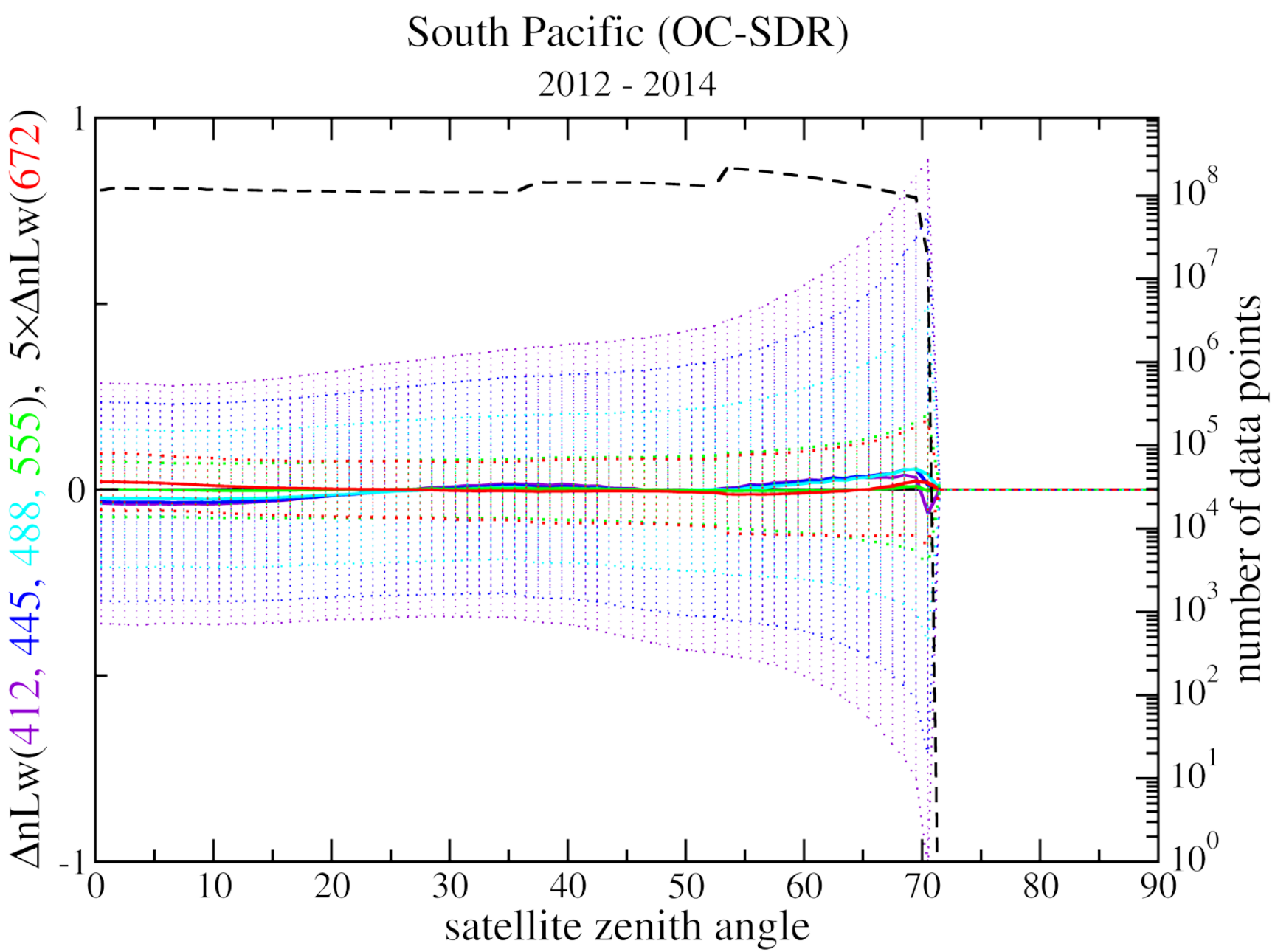

North Atlantic (IDPS-SDR)
2012
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
satellite zenith angle
1
0
-1
0
10
20
30
40
50
60
70
80
90
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0


North Atlantic (OC-SDR)
2012
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
satellite zenith angle
1
0
-1
0
10
20
30
40
50
60
70
80
90
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

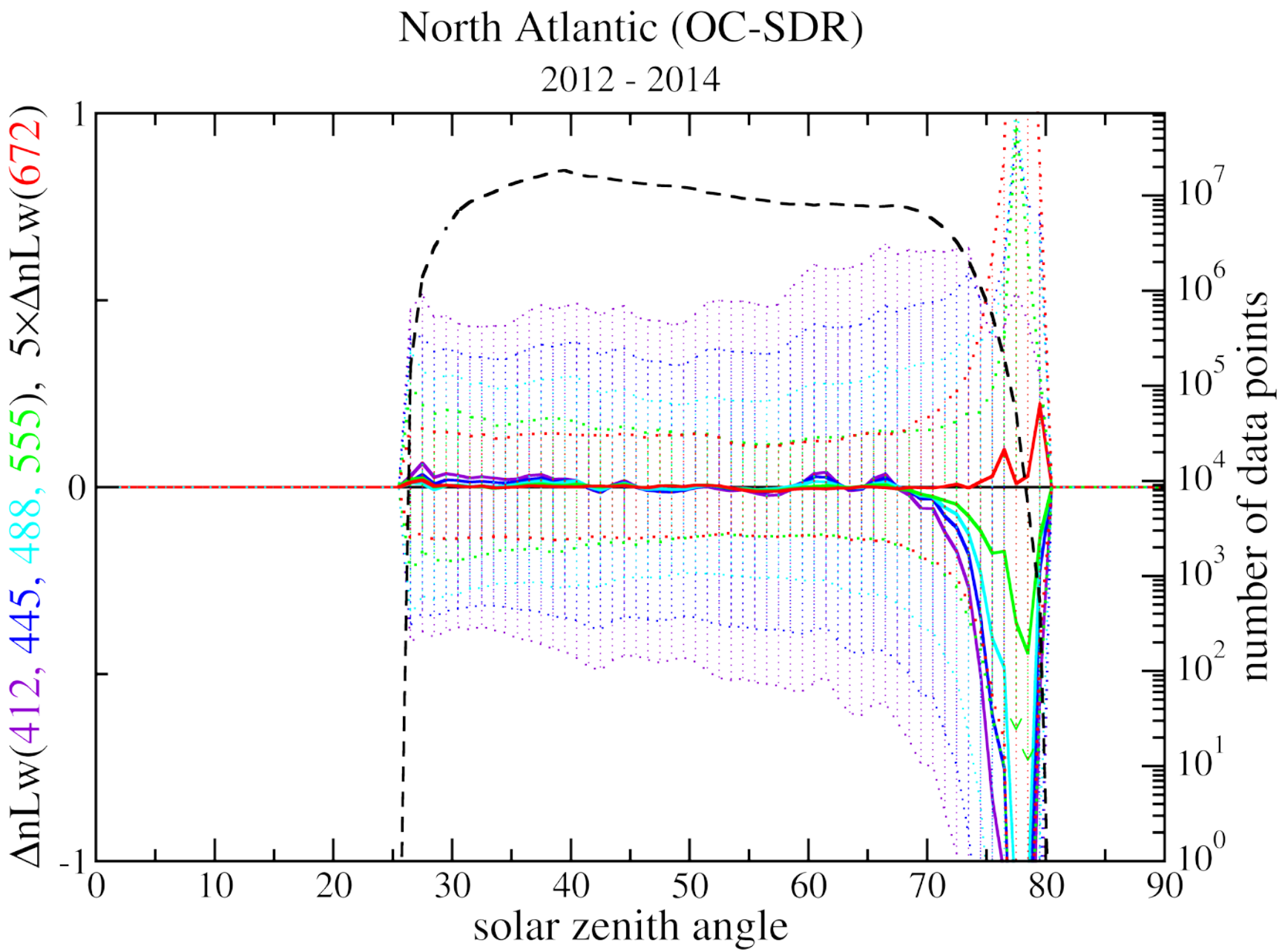

North Atlantic (OC-SDR)
2013
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
satellite zenith angle
1
0
-1
0
10
20
30
40
50
60
70
80
90
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

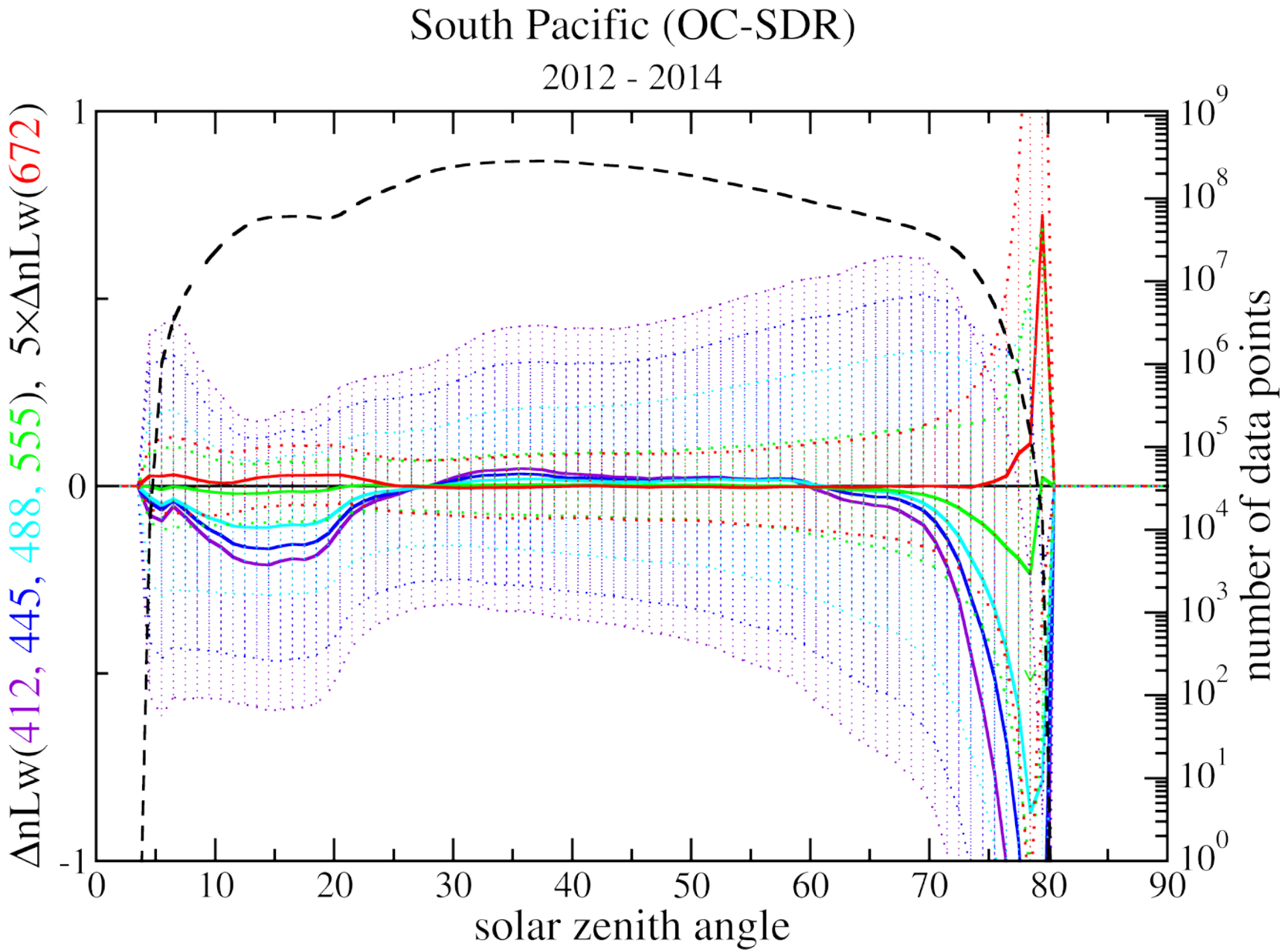

North Atlantic (OC-SDR)
2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
satellite zenith angle
1
0
-1
0
10
20
30
40
50
60
70
80
90
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0


North Atlantic (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
satellite zenith angle
1
0
-1
0
10
20
30
40
50
60
70
80
90
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

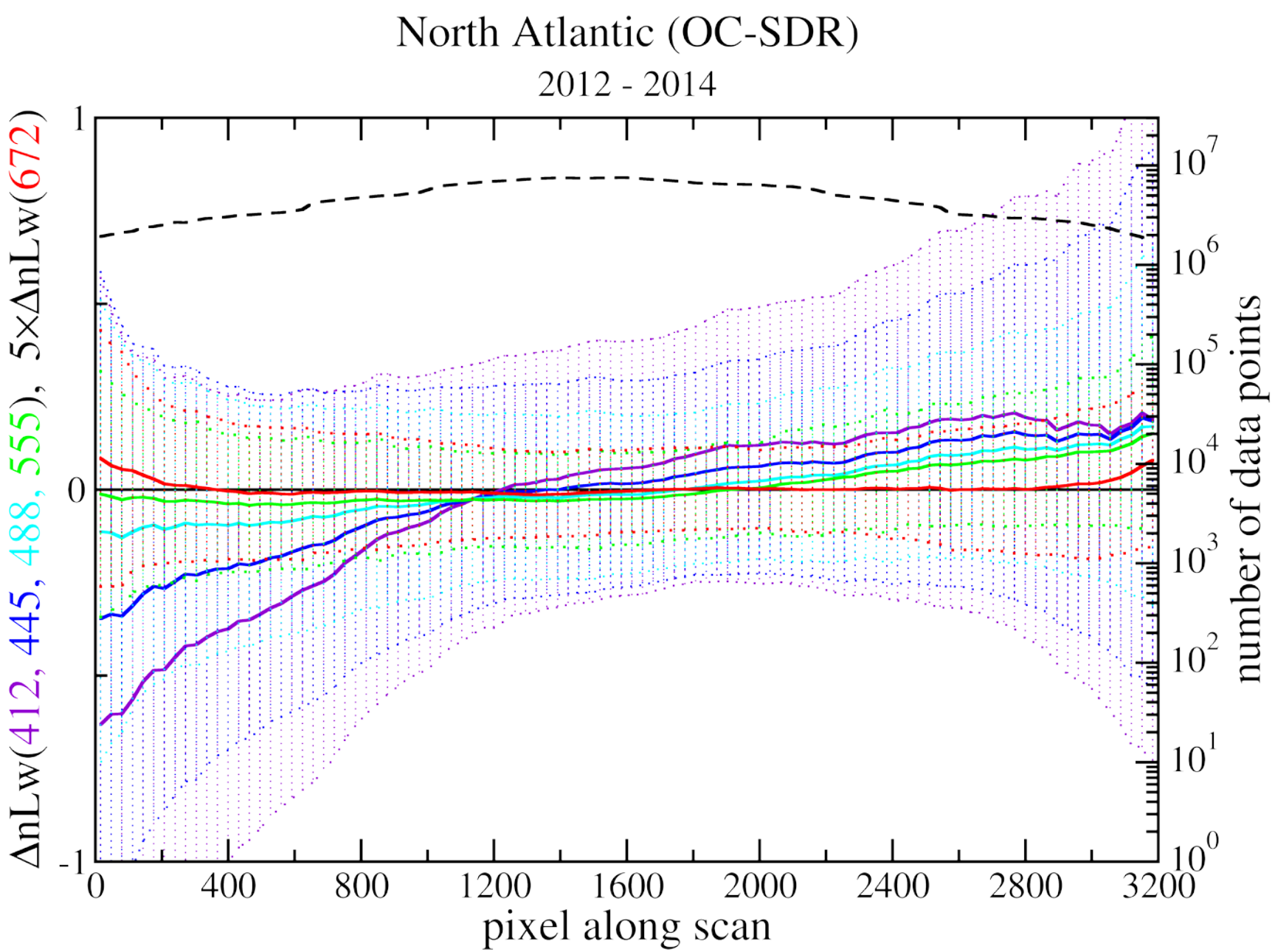

South Pacific (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
satellite zenith angle
1
0
-1
0
10
20
30
40
50
60
70
80
90
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

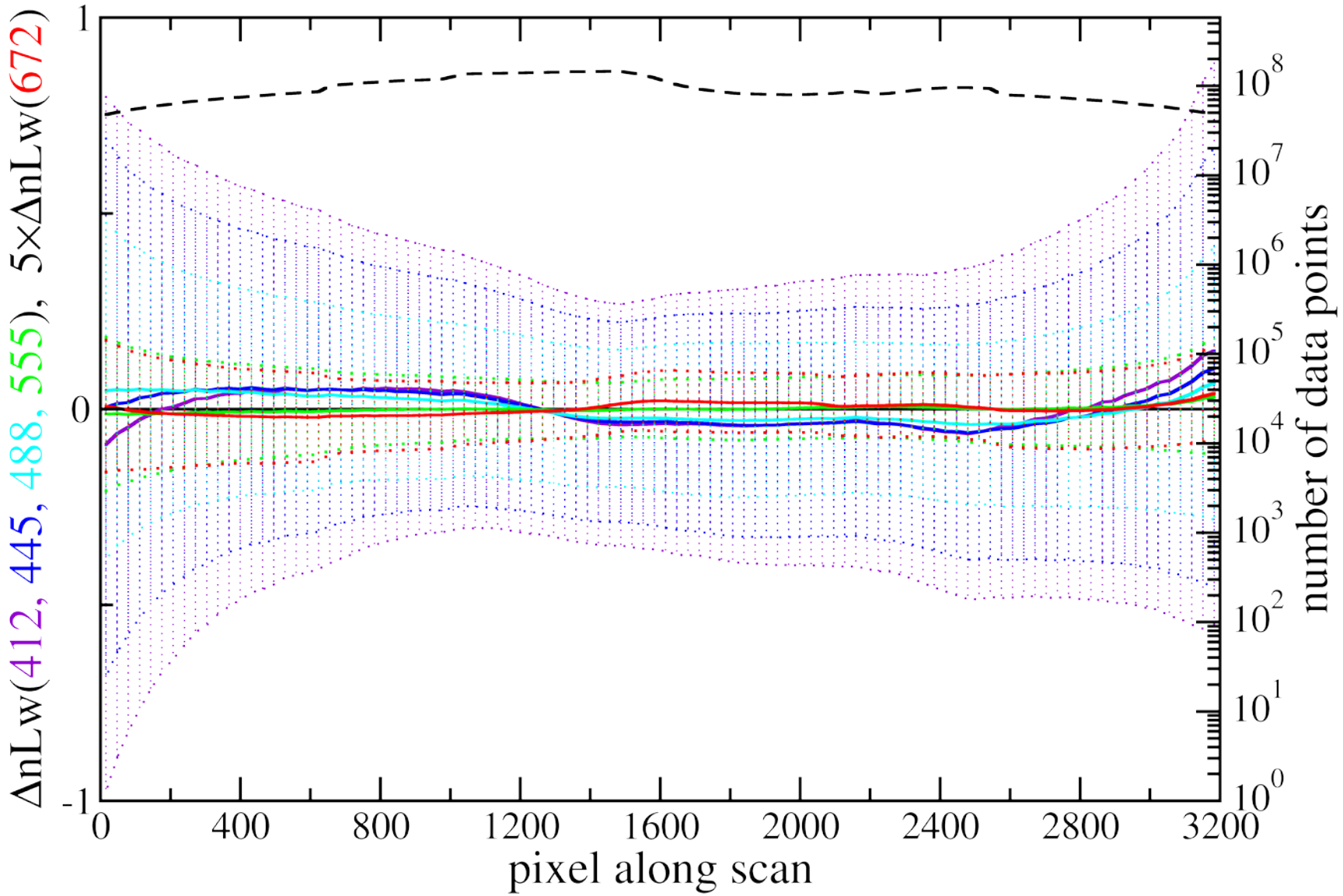
nL_w dependence on solar-zenith angle


North Atlantic (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
solar zenith angle
1
0
-1
0
10
20
30
40
50
60
70
80
90
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7

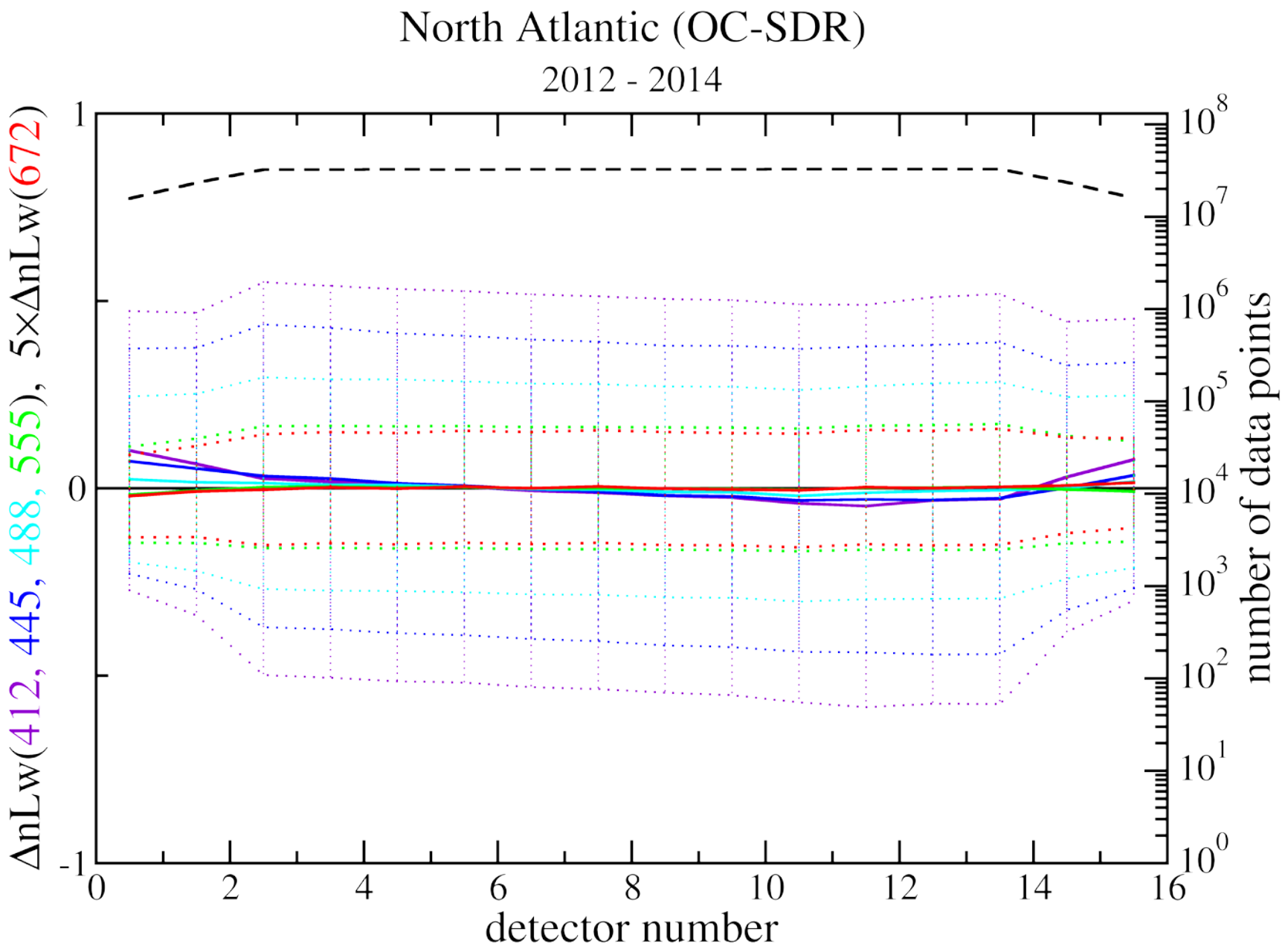

South Pacific (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
solar zenith angle
1
0
-1
0
10
20
30
40
50
60
70
80
90
10^9
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

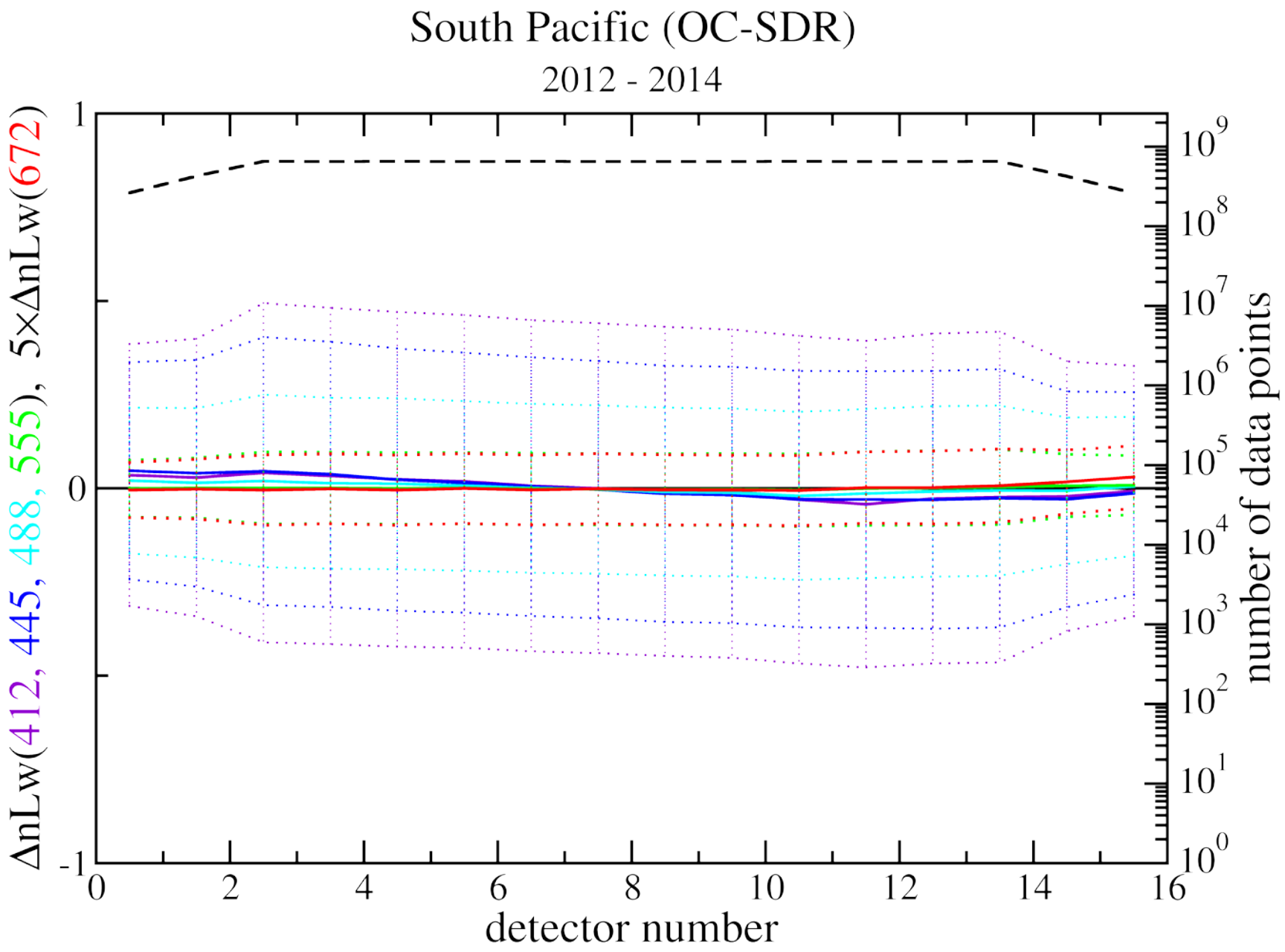
nL_w dependence on pixel number along the scan


North Atlantic (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
pixel along scan
1
0
-1
0
400
800
1200
1600
2000
2400
2800
3200
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

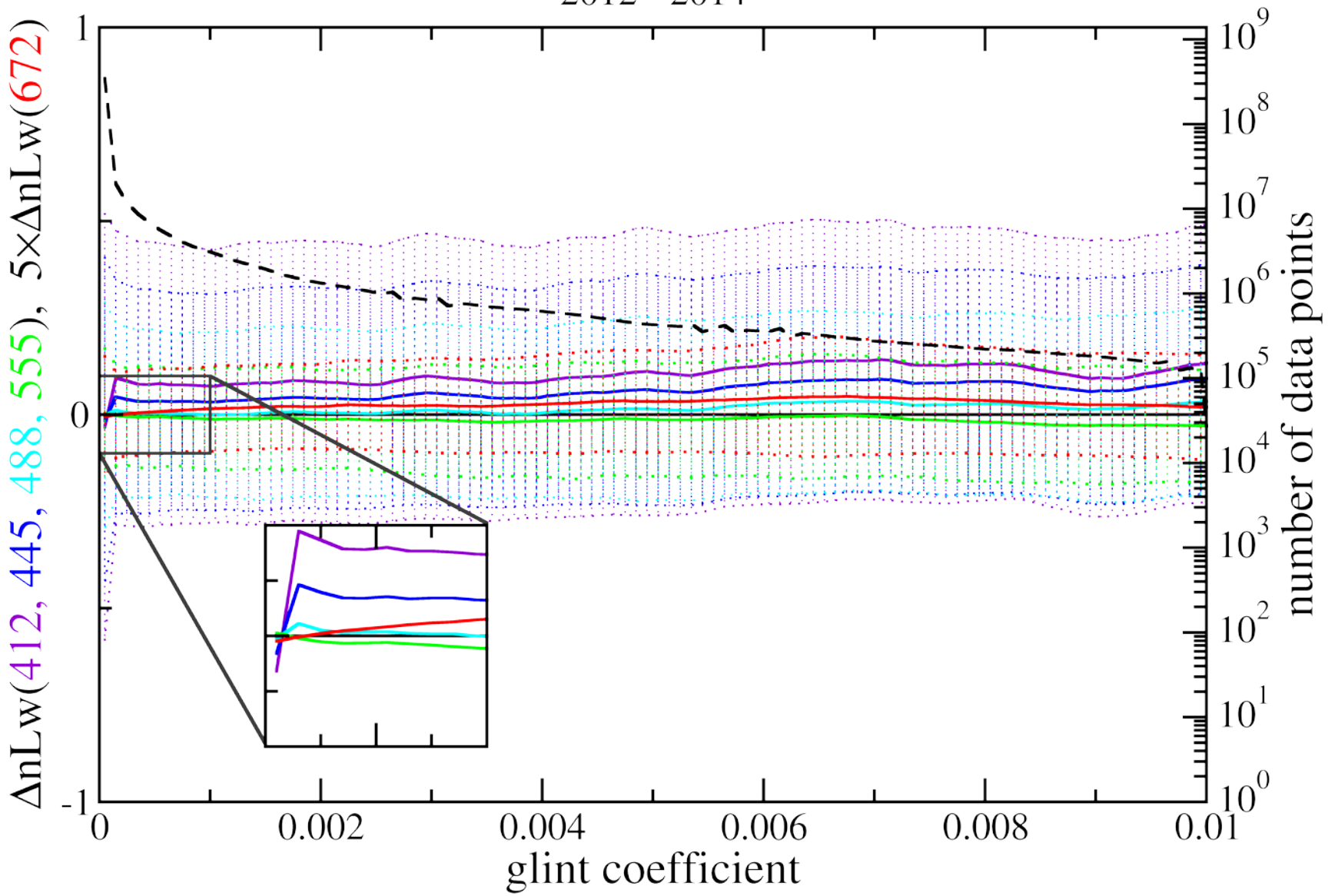

South Pacific (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
pixel along scan
1
0
-1
0
400
800
1200
1600
2000
2400
2800
3200
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

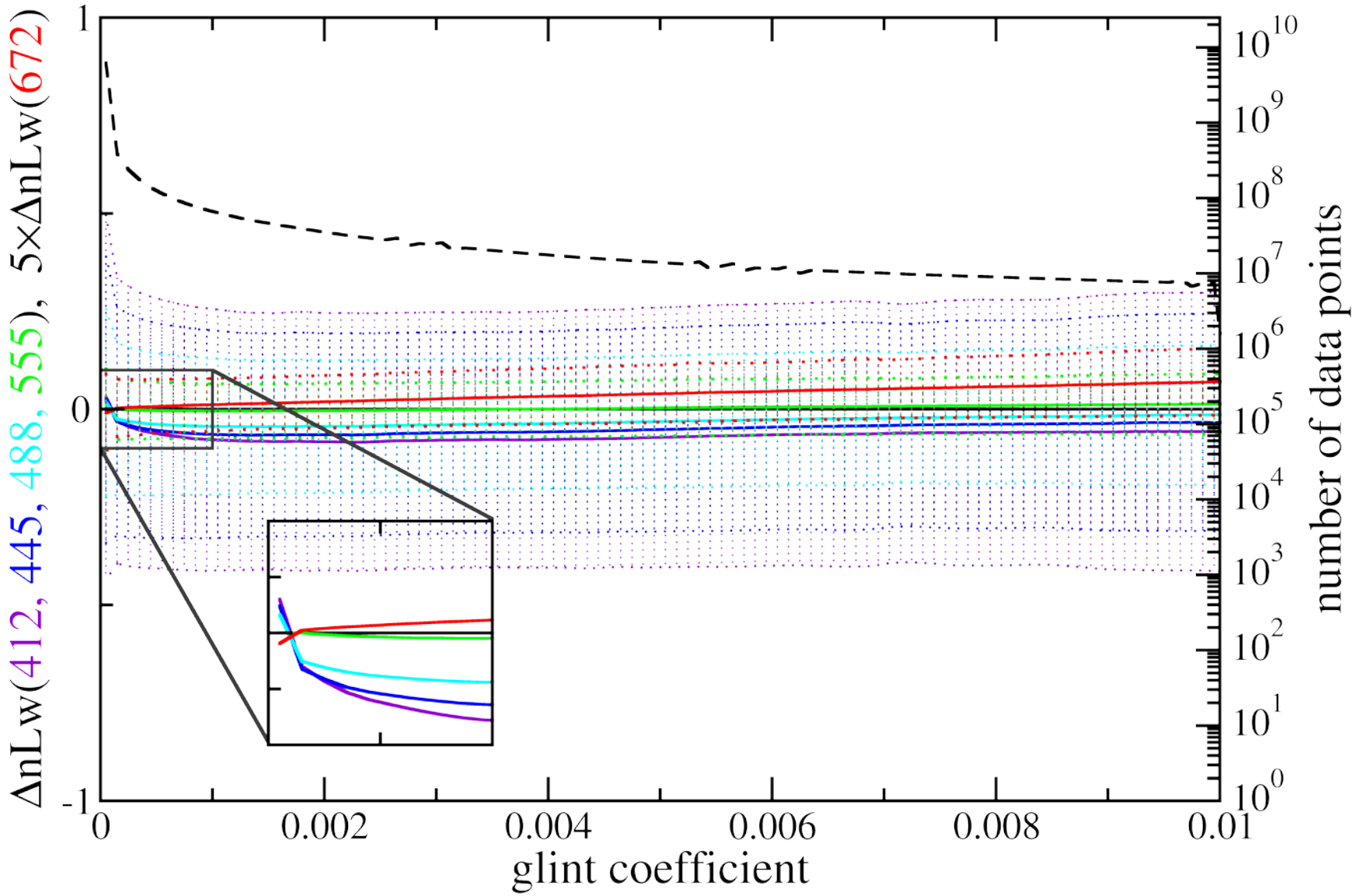
nL_w dependence on detector number


North Atlantic (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
detector number
1
0
-1
0
2
4
6
8
10
12
14
16
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

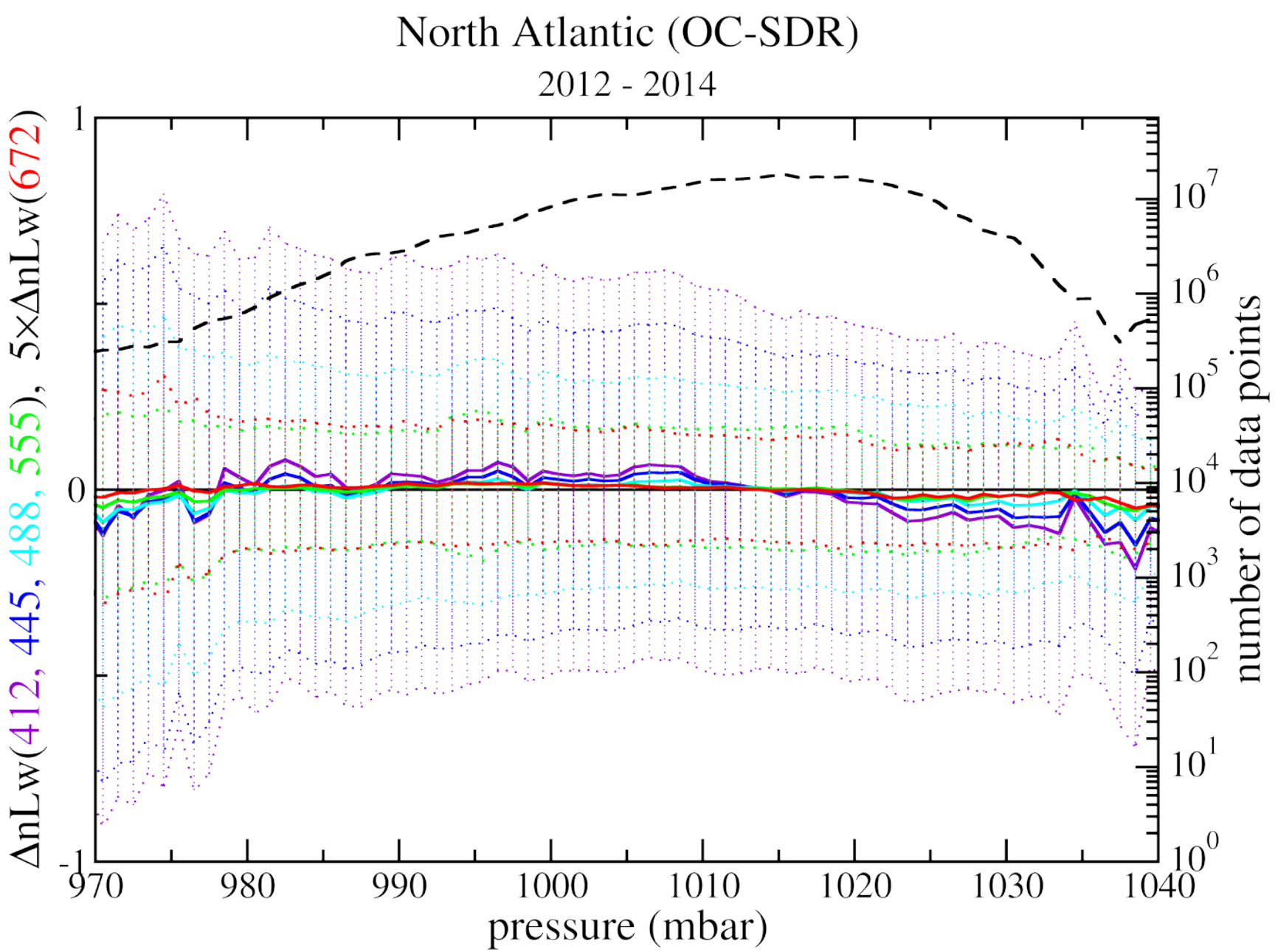

South Pacific (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
detector number
1
0
-1
0
2
4
6
8
10
12
14
16
10^9
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

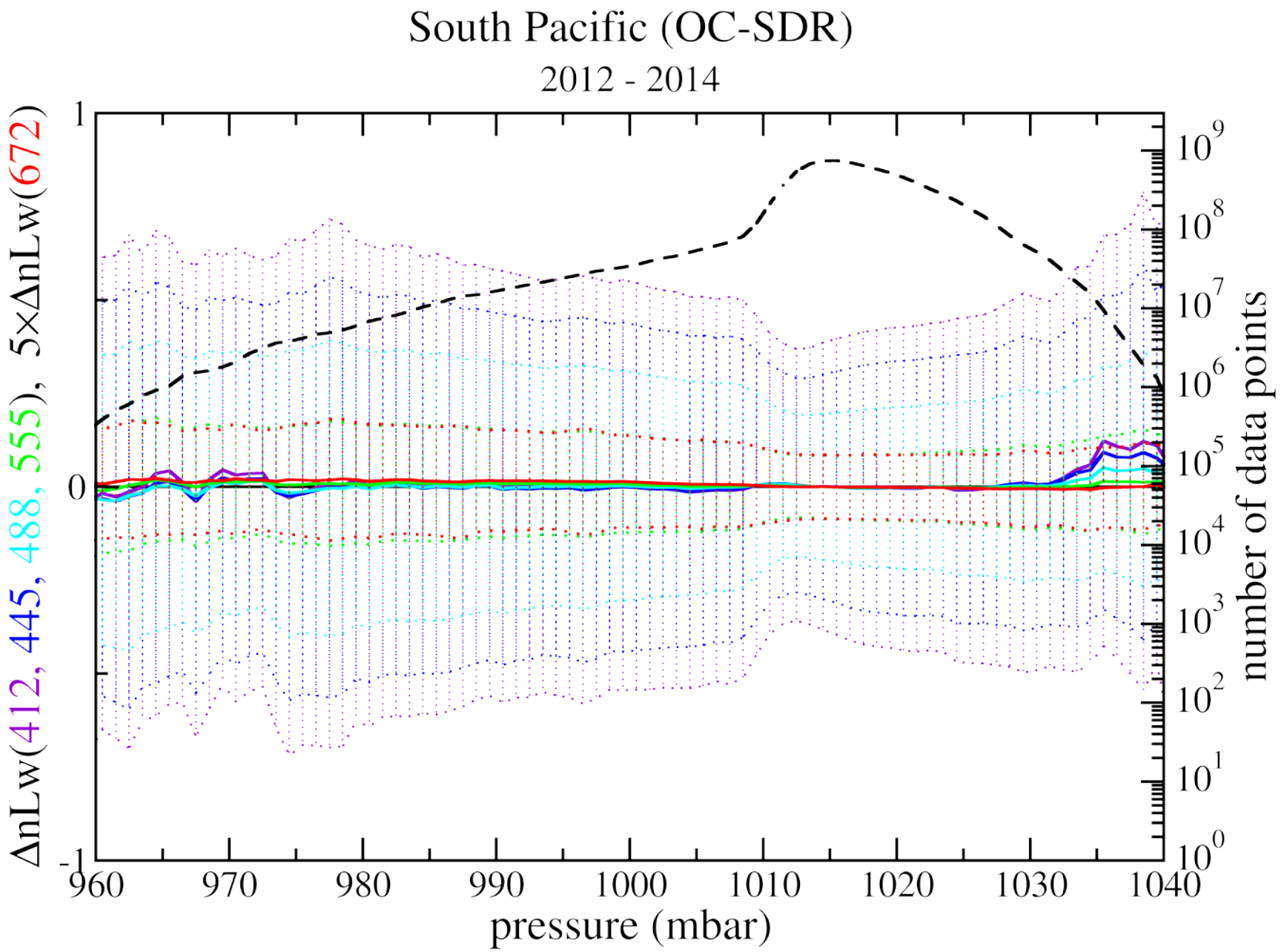
nL_w dependence on sun glint coefficient


North Atlantic (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
glint coefficient
1
0
-1
0
0.002
0.004
0.006
0.008
0.01
10^9
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

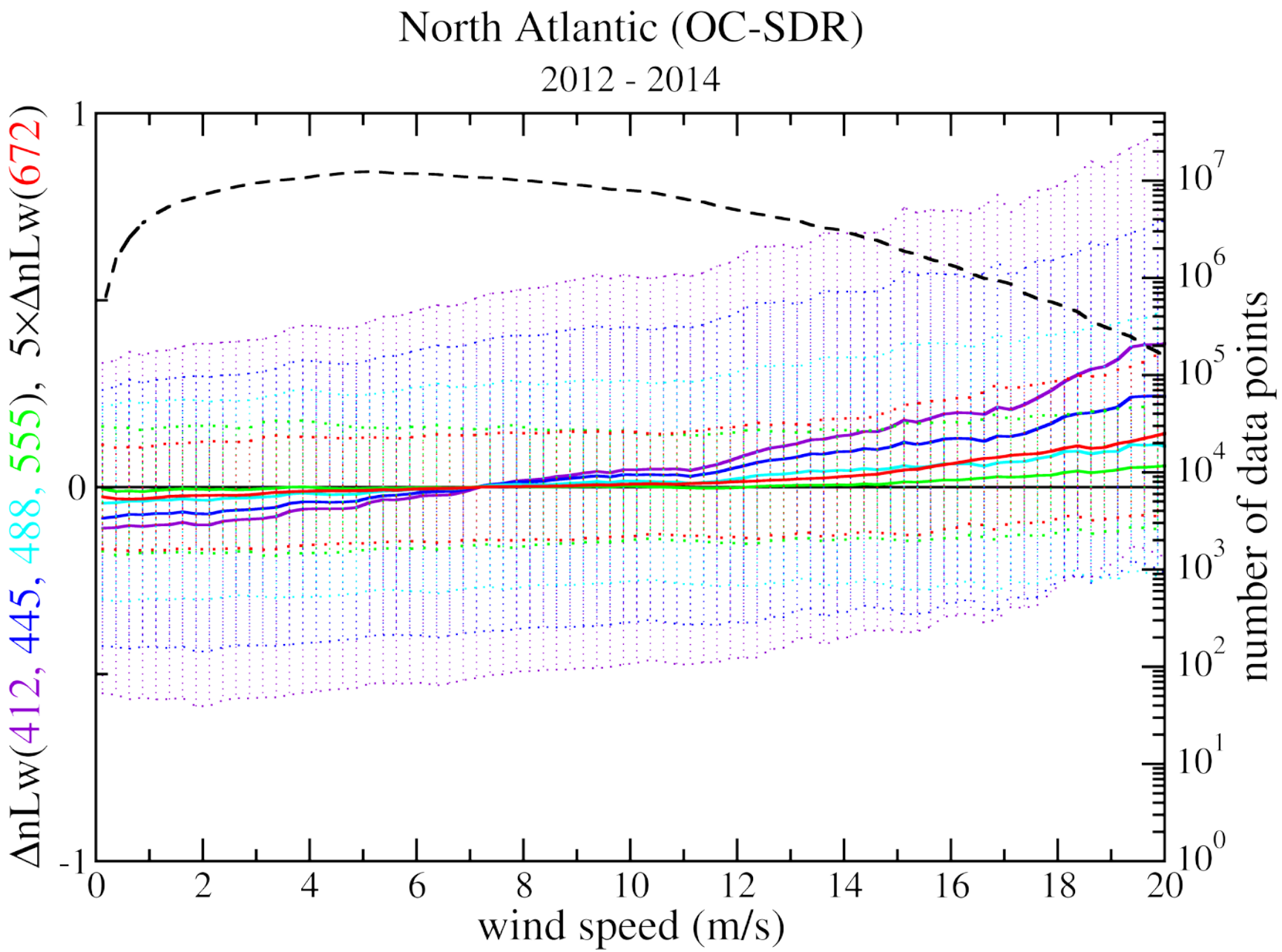

South Pacific (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
glint coefficient
1
0
-1
0
0.002
0.004
0.006
0.008
0.01
10^{10}
10^{9}
10^{8}
10^{7}
10^{6}
10^{5}
10^{4}
10^{3}
10^{2}
10^{1}
10^{0}

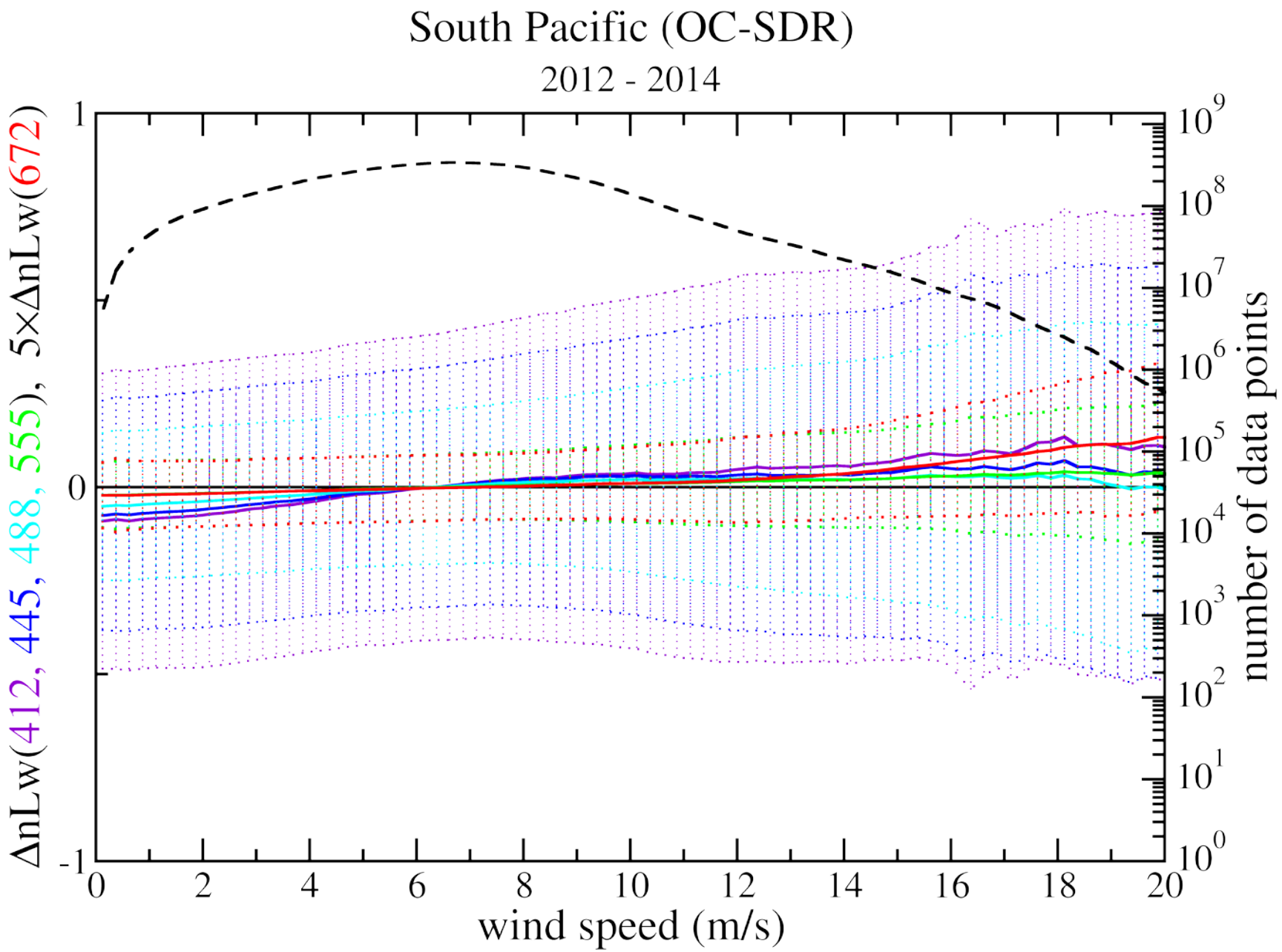
nL_w dependence on atmospheric pressure


North Atlantic (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
pressure (mbar)
1
0
-1
970
980
990
1000
1010
1020
1030
1040
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7

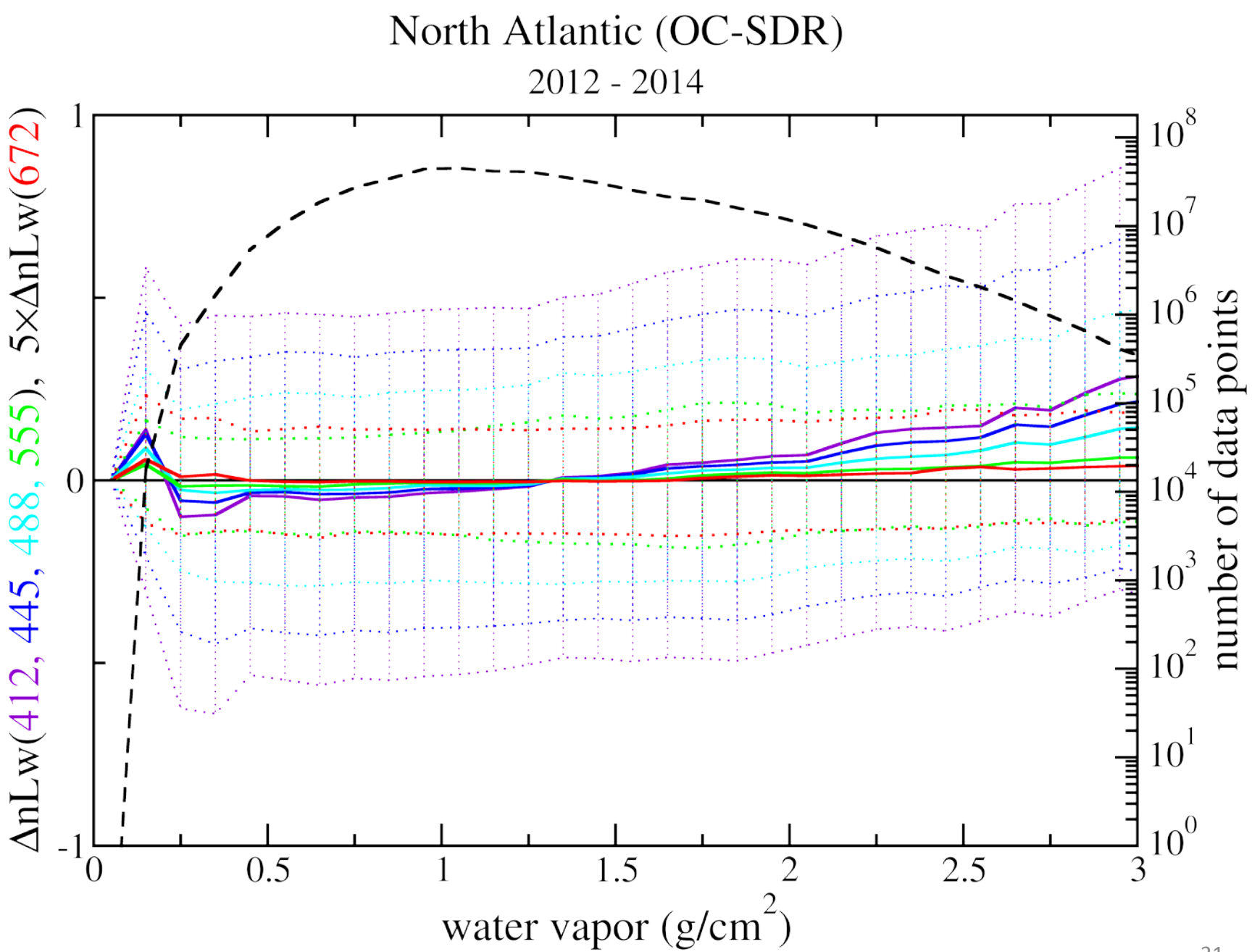

South Pacific (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
pressure (mbar)
1
0
-1
960
970
980
990
1000
1010
1020
1030
1040
10^9
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

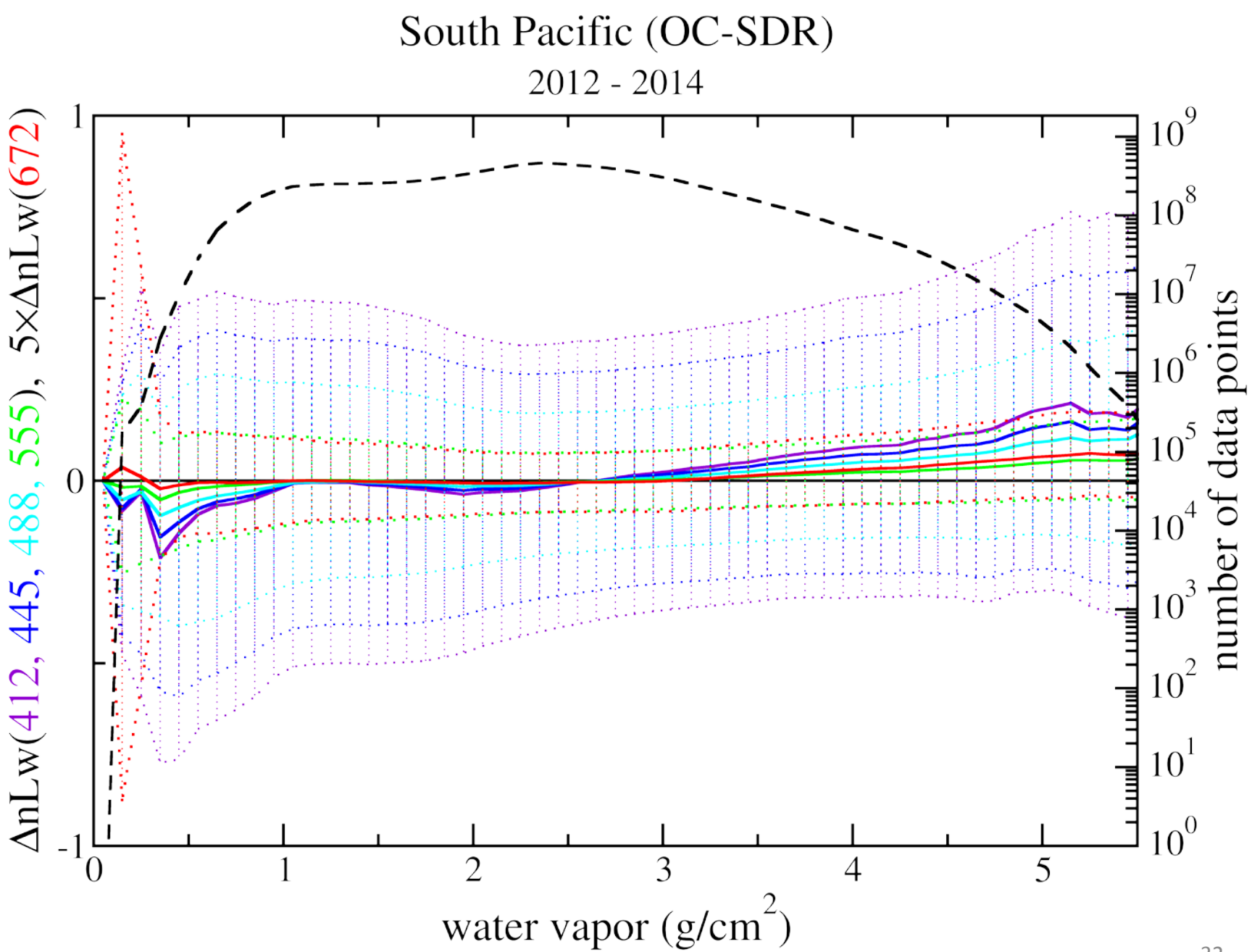
nL_w dependence on wind speed


North Atlantic (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
wind speed (m/s)
1
0
-1
0
2
4
6
8
10
12
14
16
18
20
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7

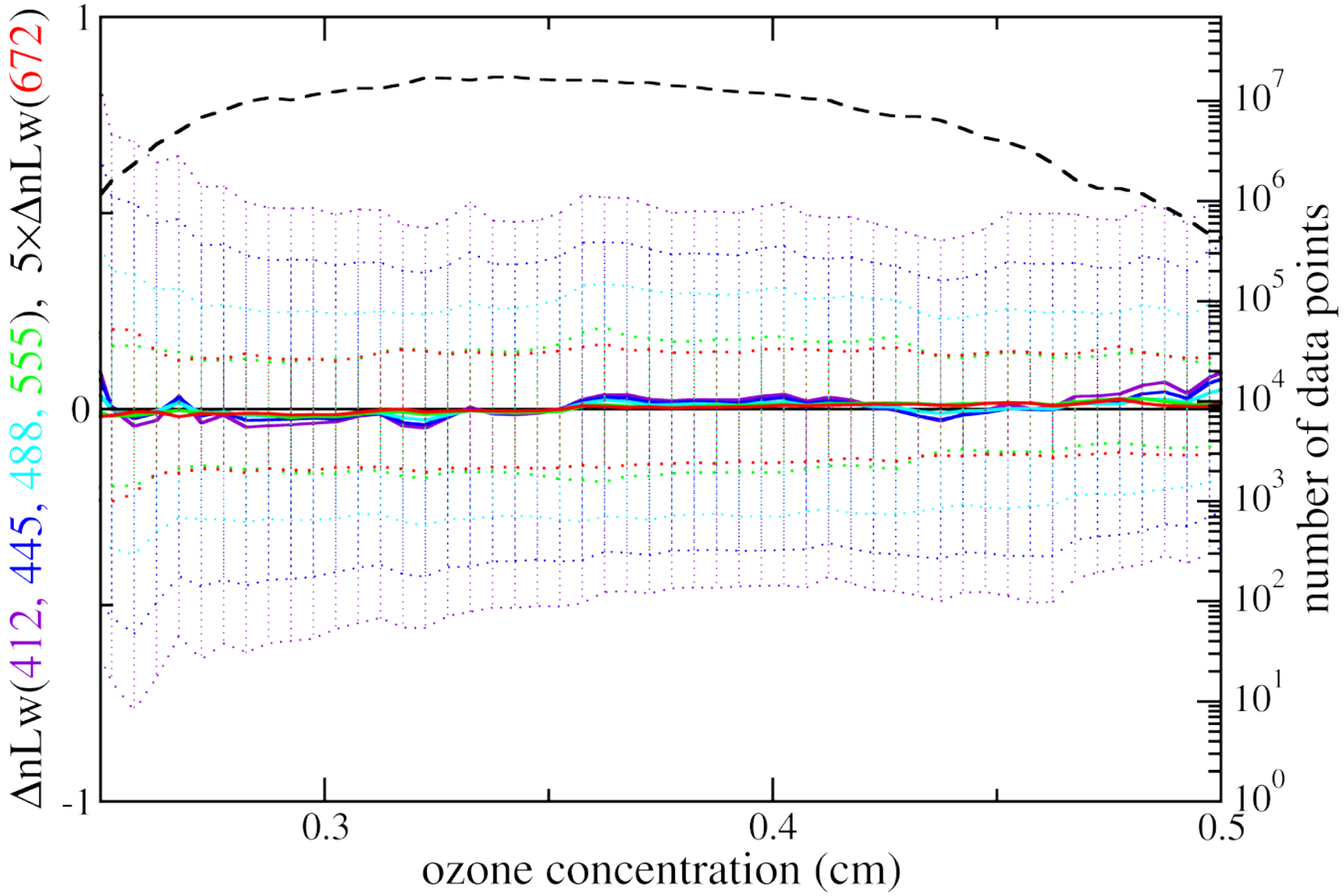

South Pacific (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
wind speed (m/s)
1
0
-1
0
2
4
6
8
10
12
14
16
18
20
10^9
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

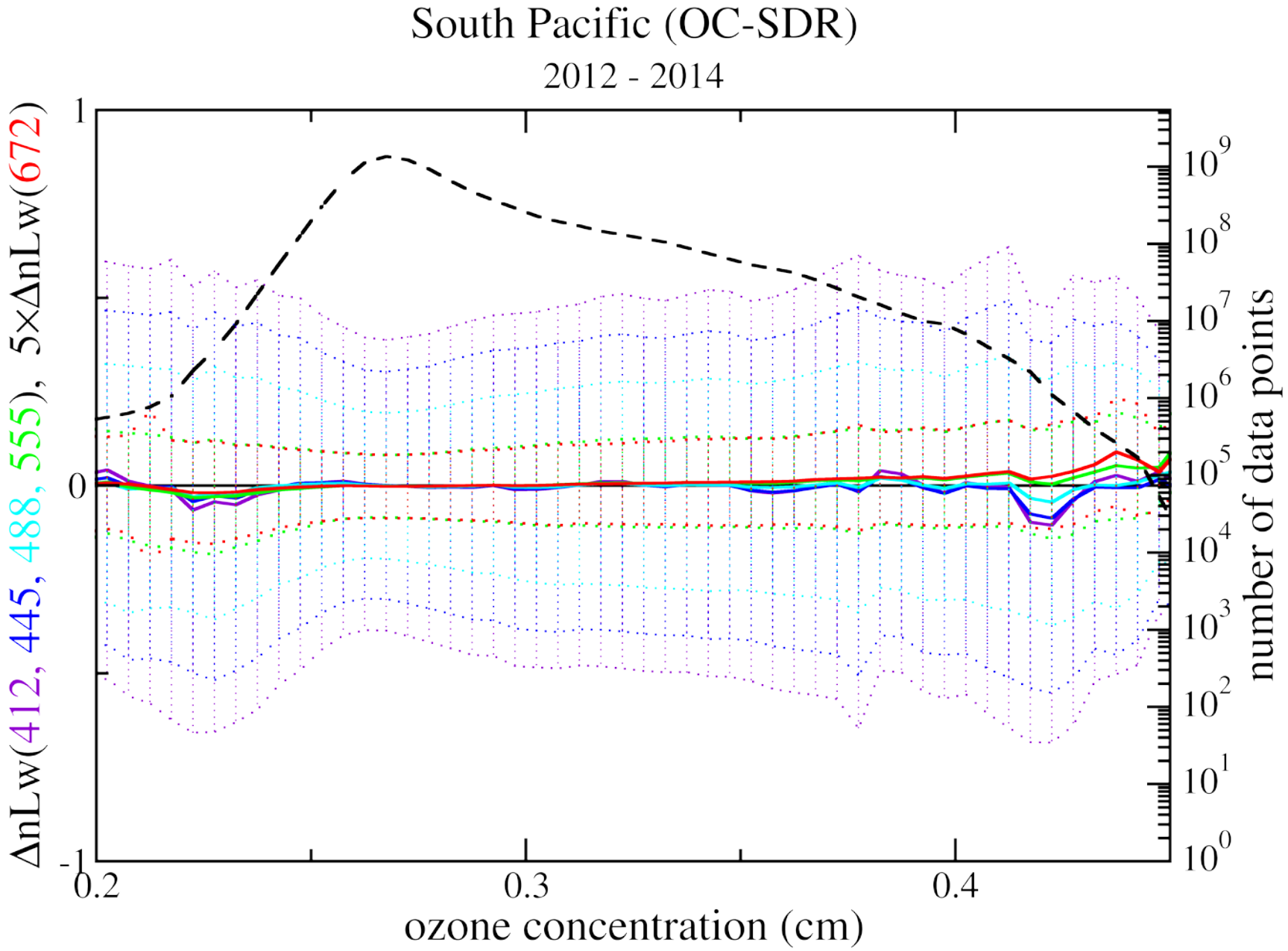
nL_w dependence on water vapor concentration


North Atlantic (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
water vapor (g/cm2)
1
0
-1
0
0.5
1
1.5
2
2.5
3
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0


South Pacific (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
water vapor (g/cm2)
1
0
-1
0
1
2
3
4
5
10^9
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

nL_w dependence on ozone concentration


North Atlantic (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
ozone concentration (cm)
1
0
-1
0.3
0.4
0.5
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0


South Pacific (OC-SDR)
2012 - 2014
ΔnLw(412, 445, 488, 555), 5×ΔnLw(672)
number of data points
ozone concentration (cm)
1
0
-1
0.2
0.3
0.4
10^9
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0

Summary

1. Better calibration in OC-SDR significantly improves retrieval consistency for 2012
2. Statistical dependence of nL_w on most retrieval parameters is nearly flat, signifying consistency of the new MSL12 ocean color data processing system in various conditions
3. In all cases, no significant year-to-year changes in statistics were observed
4. Good nL_w retrievals for satellite zenith angle up to 50° (North Atlantic) and nearly 70° (South Pacific)
5. nL_w underestimated for solar zenith angles > ~67° in both regions
6. Significantly decreased nL_w for low values of solar zenith angle (<25°) in South Pacific (likely due to seasonal effects/variations in the region)
7. Noticeable dependence on pixel along the scan in North Atlantic
8. Slightly increased nL_w with higher wind speed (whitecaps?) and higher water vapor concentration