

Specific analyses of the SCRIP interpolation
library for OASIS coupler

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The SCRIP interpolation library defines the multiplication matrix used by OASIS to interpolate coupling fields between different model grids.

This working note presents the following points:

- 1) Interpolation error obtained with the SCRIP library in OASIS3-MCT_3.0
- 2) Interpolation error obtained with the SCRIP library in OASIS3-MCT_4.0
- 3) Impact of Lambert projection near the poles
- 4) Review of weights generated for the CONSERV FRACAREA remapping

This table shows the different types of interpolation (or remapping) techniques applied to specific source and target grids for interpolation analyses:

Source grid	Target grid	Bilinear	Bicubic	Distwgt(1)	Conserv 1 st	Conserv 2 nd
nogt (e-ORCA1)	ssea (t127)	×	×	×	×	×
ssea (t127)	nogt (e-ORCA1)	×	×	×	×	
nogt (e-ORCA1)	bggd (lmdz)	×	×	×	×	×
bggd (lmdz)	nogt (e-ORCA1)	×	×	×	×	×
nogt (e-ORCA1)	icos (n15212)	×	×	×	×	×
icos (n15212)	nogt (e-ORCA1)			×	×	

1) Interpolation error with the SCRIP library in OASIS3-MCT_3.0

The interpolation errors obtained with OASIS3-MCT_3.0 (branch "trunk", revision 2133) are summarized on these figures:

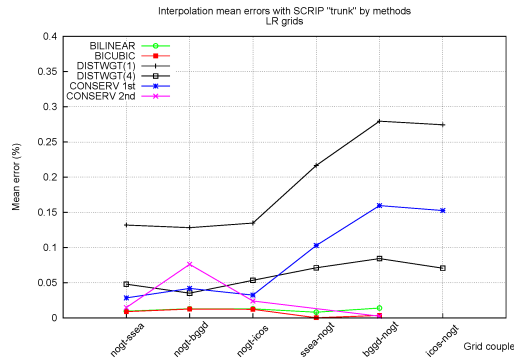
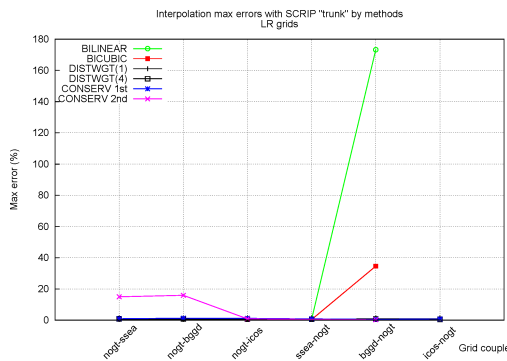
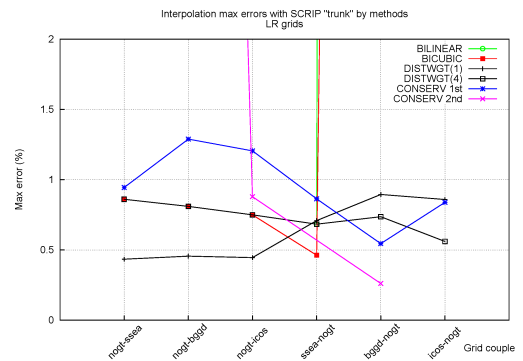


Figure 1: Mean interpolation error



(a) Y-axis upper bound is 180%



(b) Y-axis upper bound is 2%

Figure 2: Max interpolation error

The following pages show plots of geographical distribution of the interpolation errors on target grid for each couple of grids and each type of interpolation technique. The first column shows the error between 0 and 1, the second column shows the error between 0 and the maximum case error, and the third column shows target grid points which did not received a field value because of mask considerations.

nogt → ssea

BILINEAR

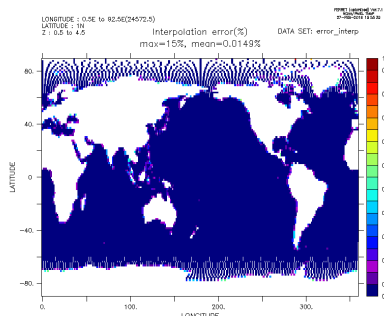
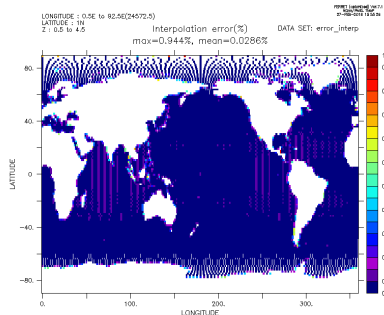
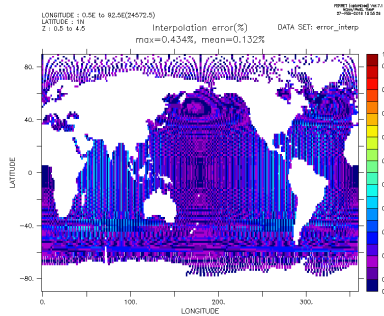
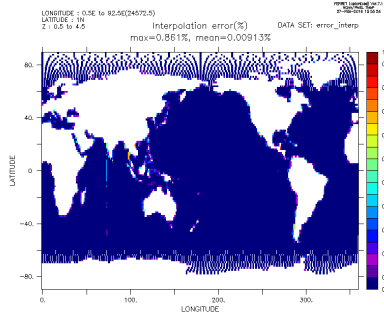
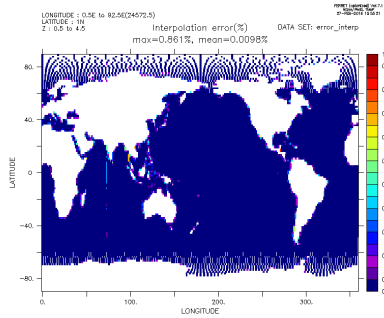
BICUBIC

DISTWGT

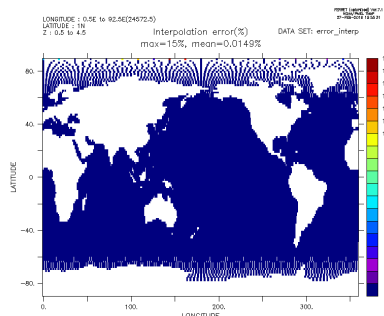
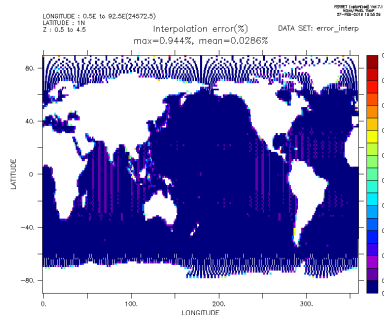
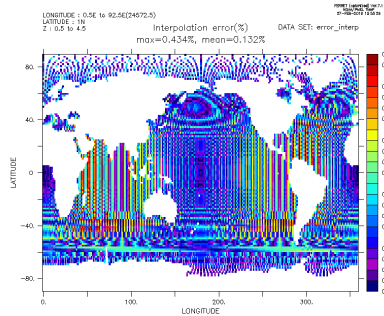
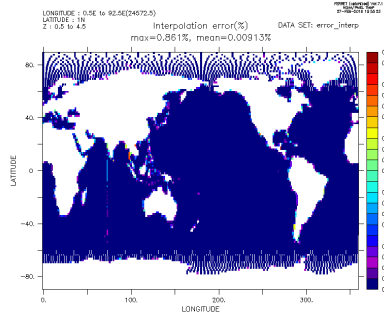
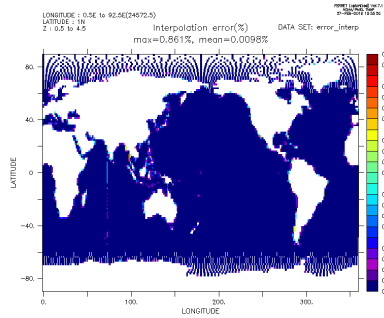
CONSERV 1st order

CONSERV 2nd order

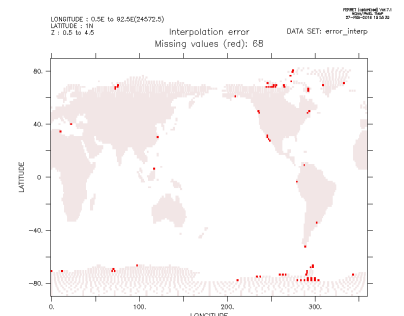
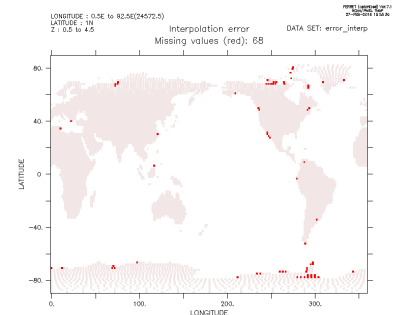
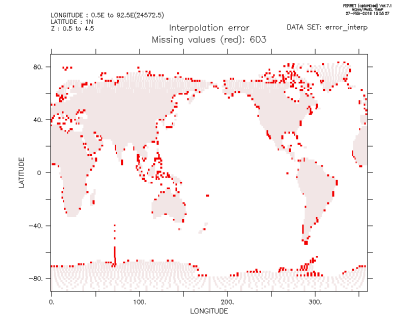
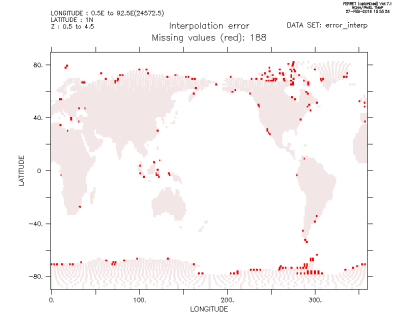
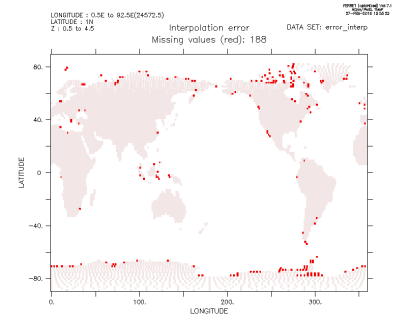
Error in [0, 1]



Error in [0, max_error]



Non-interpolation points



ssea → nogt

BILINEAR

BICUBIC

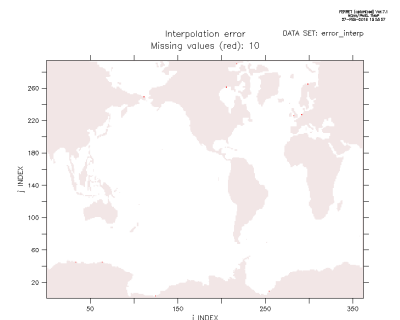
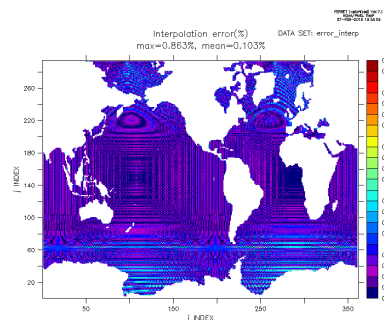
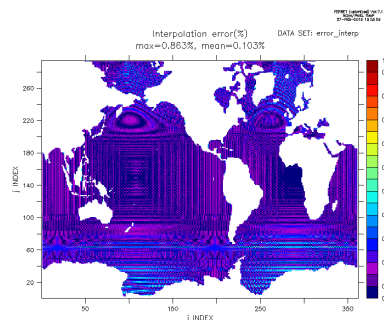
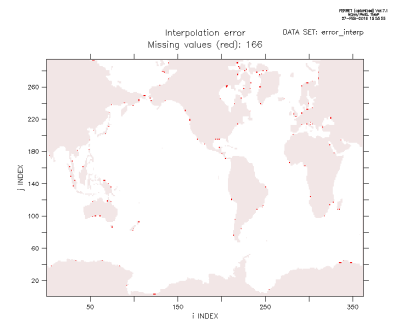
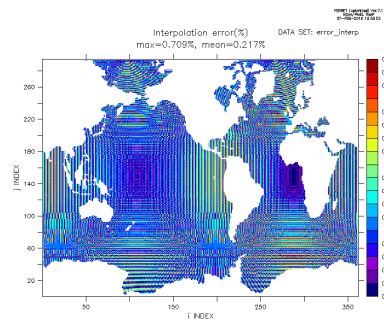
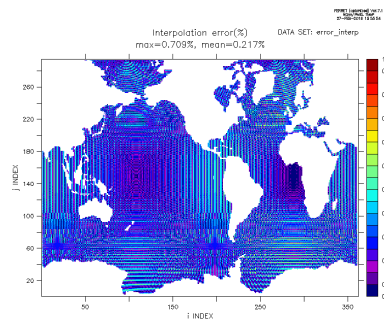
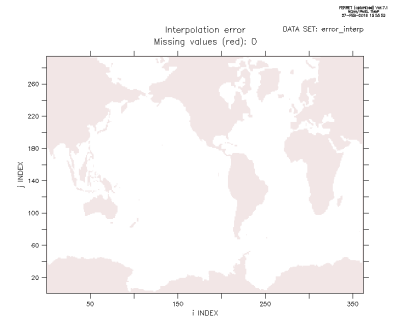
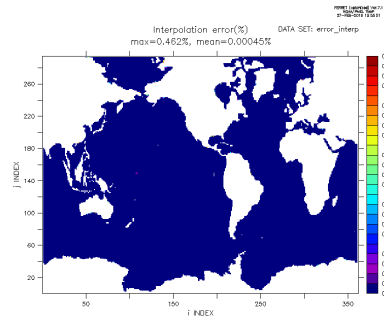
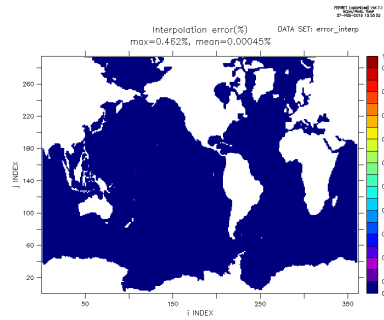
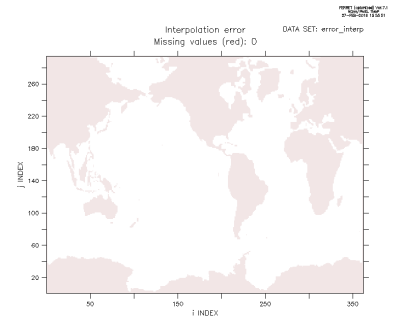
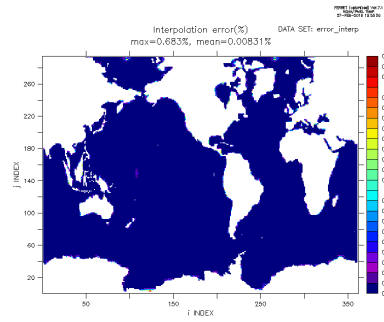
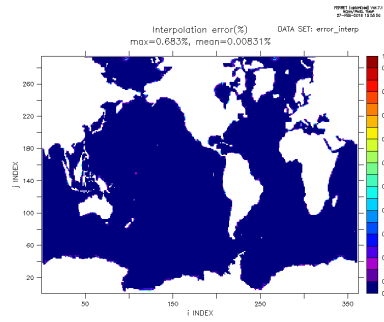
DISTWGT

CONSERV 1st order

Error in [0, 1]

Error in [0, max_error]

Non-interpolation points



nogt → bggd

BILINEAR

BICUBIC

DISTWGT

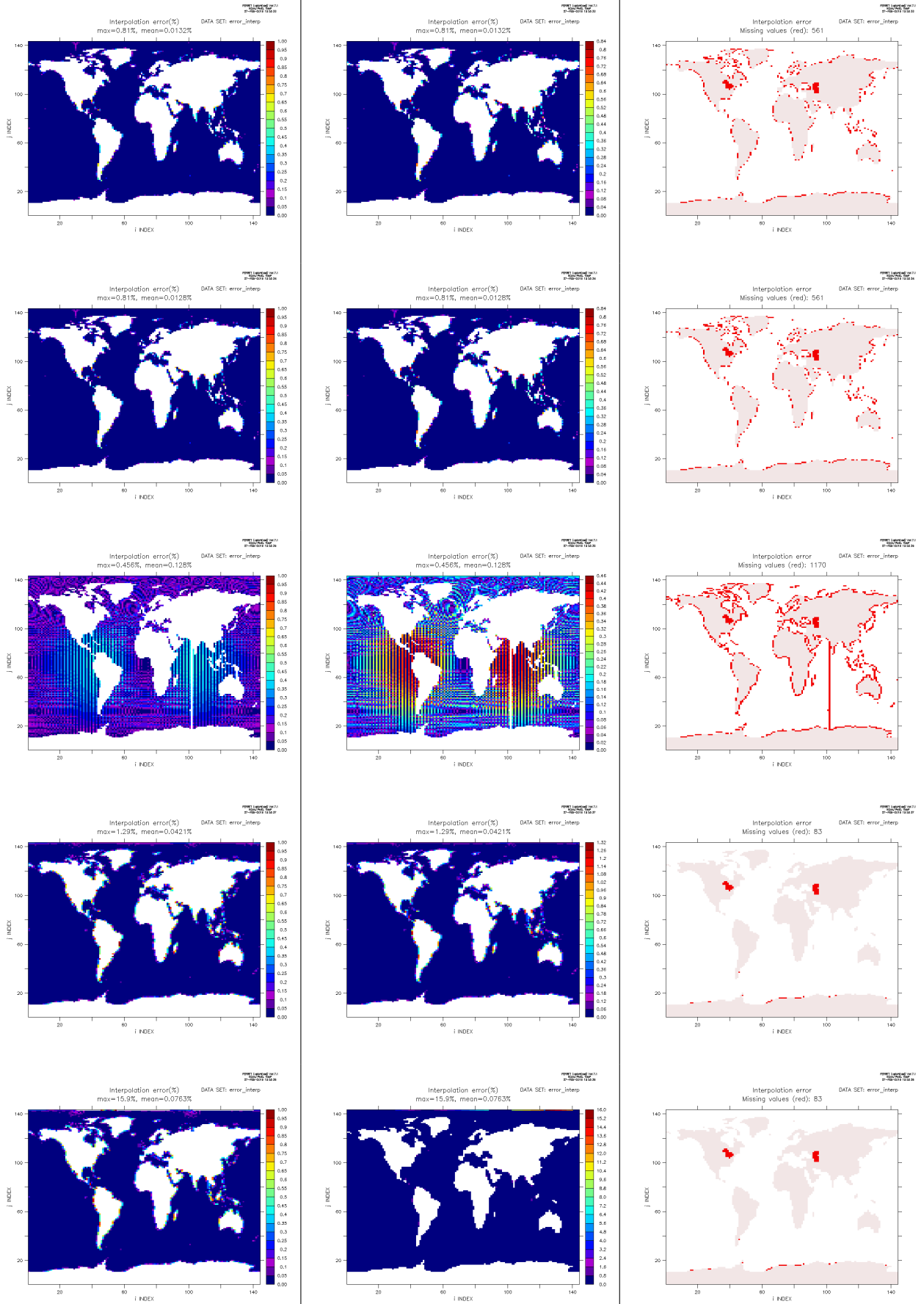
CONSERV 1st order

CONSERV 2nd order

Error in [0, 1]

Error in [0, max_error]

Non-interpolation points



bggd→nogat

BILINEAR

BICUBIC

DISTWGT

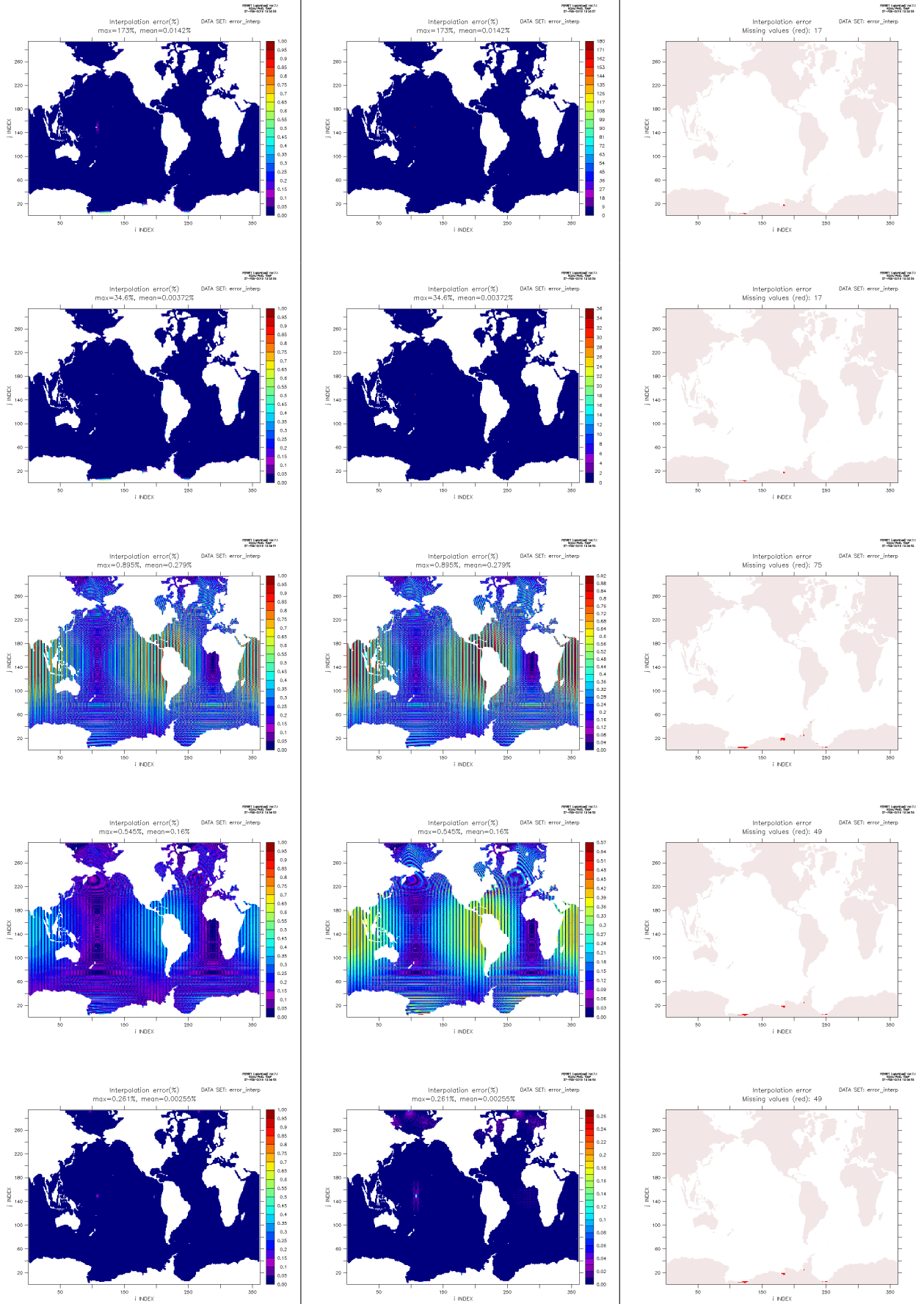
CONSERV 1st order

CONSERV 2nd order

Error in [0, 1]

Error in [0, max_error]

Non-interpolation points



nogt → icos

BILINEAR

BICUBIC

DISTWGT

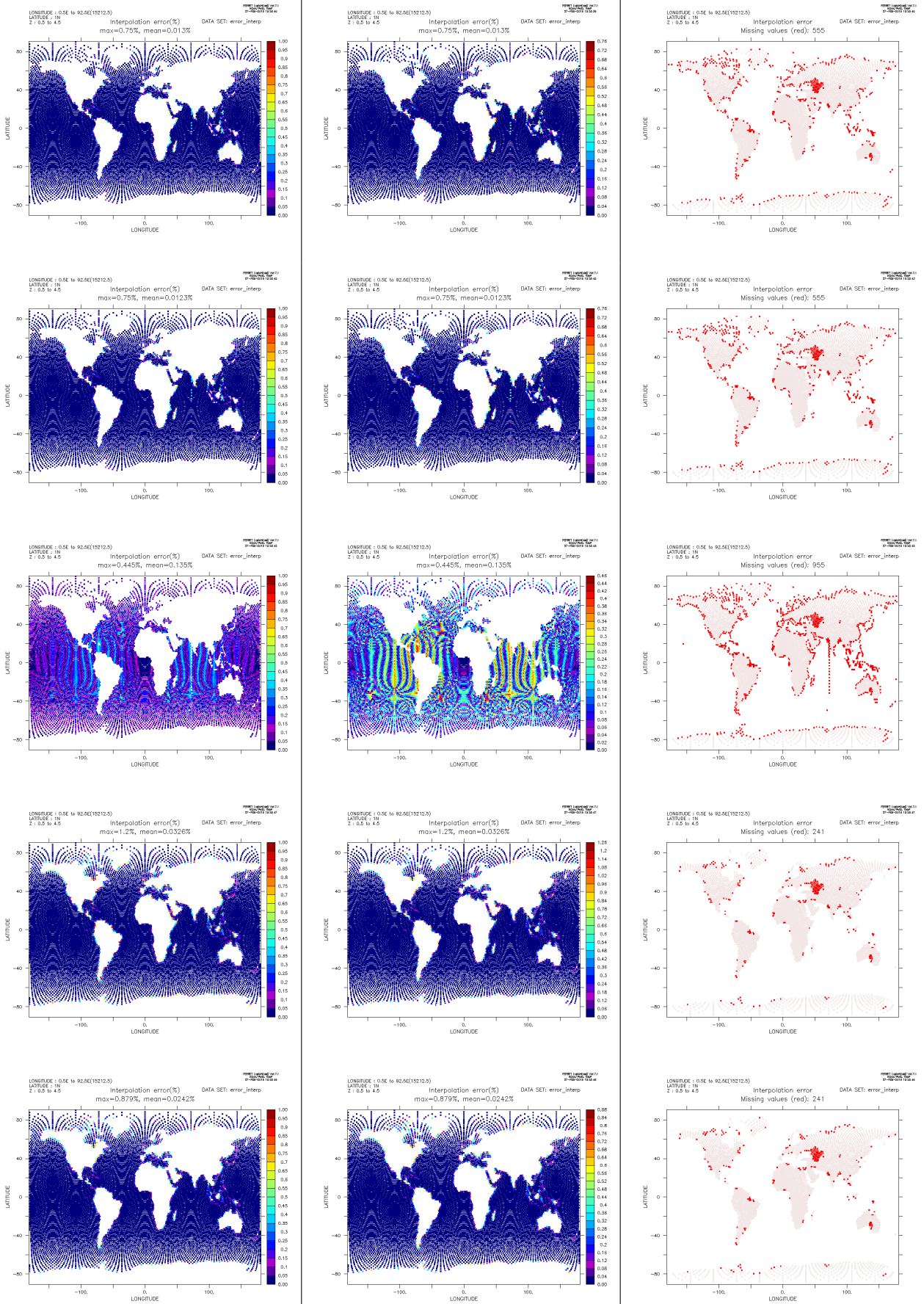
CONSERV 1st order

CONSERV 2nd order

Error in [0, 1]

Error in [0, max_error]

Non-interpolation points

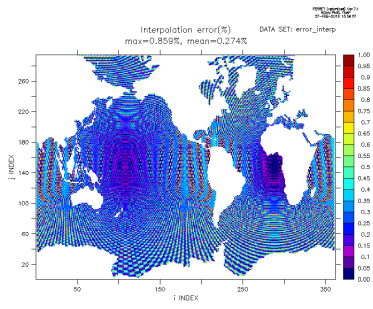


icos→nigt

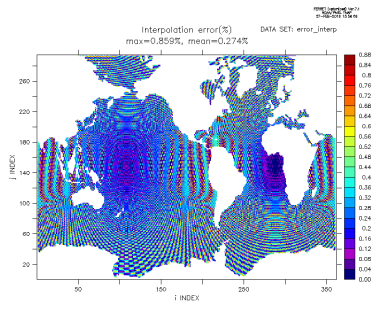
DISTWGT

CONSERV 1st order

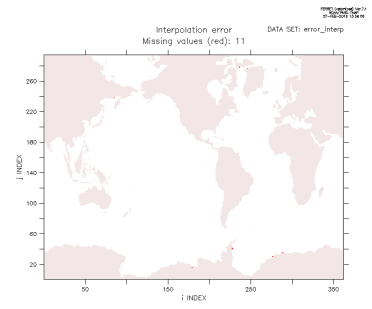
Error in [0, 1]



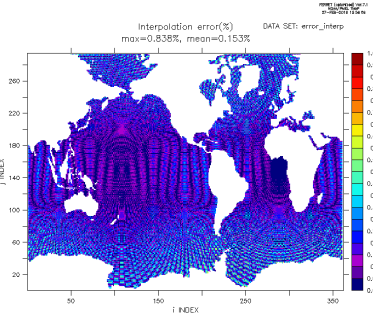
Error in [0, max_error]



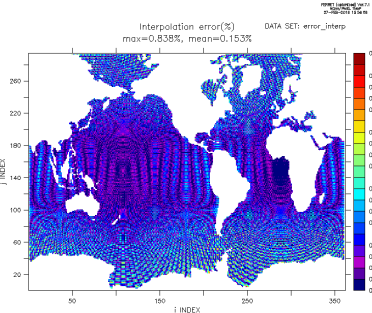
Non-interpolation points



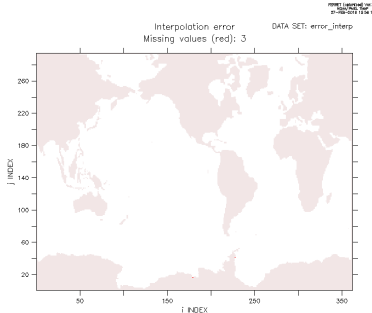
Error in [0, 1]



Error in [0, max_error]



Non-interpolation points



2) Interpolation error with the SCRIP library in OASIS3-MCT_4.0

The interpolation errors obtained with OASIS3-MCT_4.0 (branch "before4", revision 2324) are summarized on these figures:

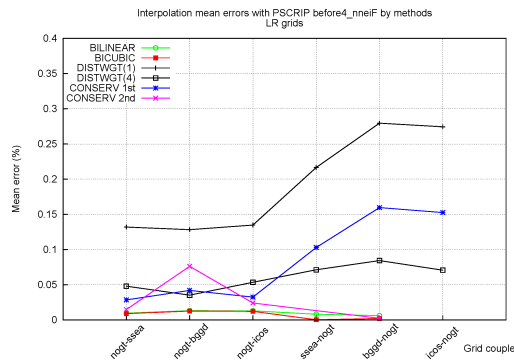
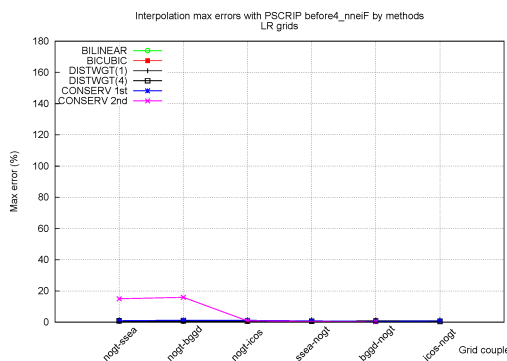
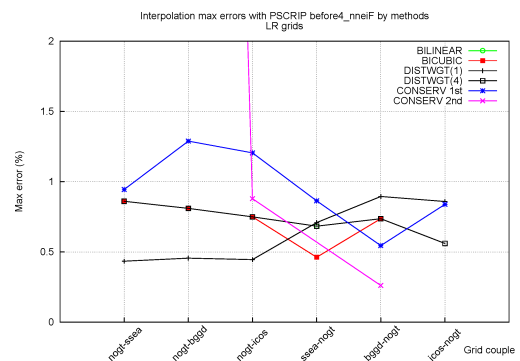


Figure 3: Mean interpolation error



(a) Y-axis upper bound is 180%



(b) Y-axis upper bound is 2%

Figure 4: Max interpolation error

The following pages show plots of geographical distribution of the interpolation errors on target grid for each couple of grids and each type of interpolation technique.

The first column shows the error between 0 and 1, the second column shows the error between 0 and the maximum case error, and the third column shows target grid points which did not received a field value because of mask considerations.

nogt → ssea

BILINEAR

BICUBIC

DISTWGT

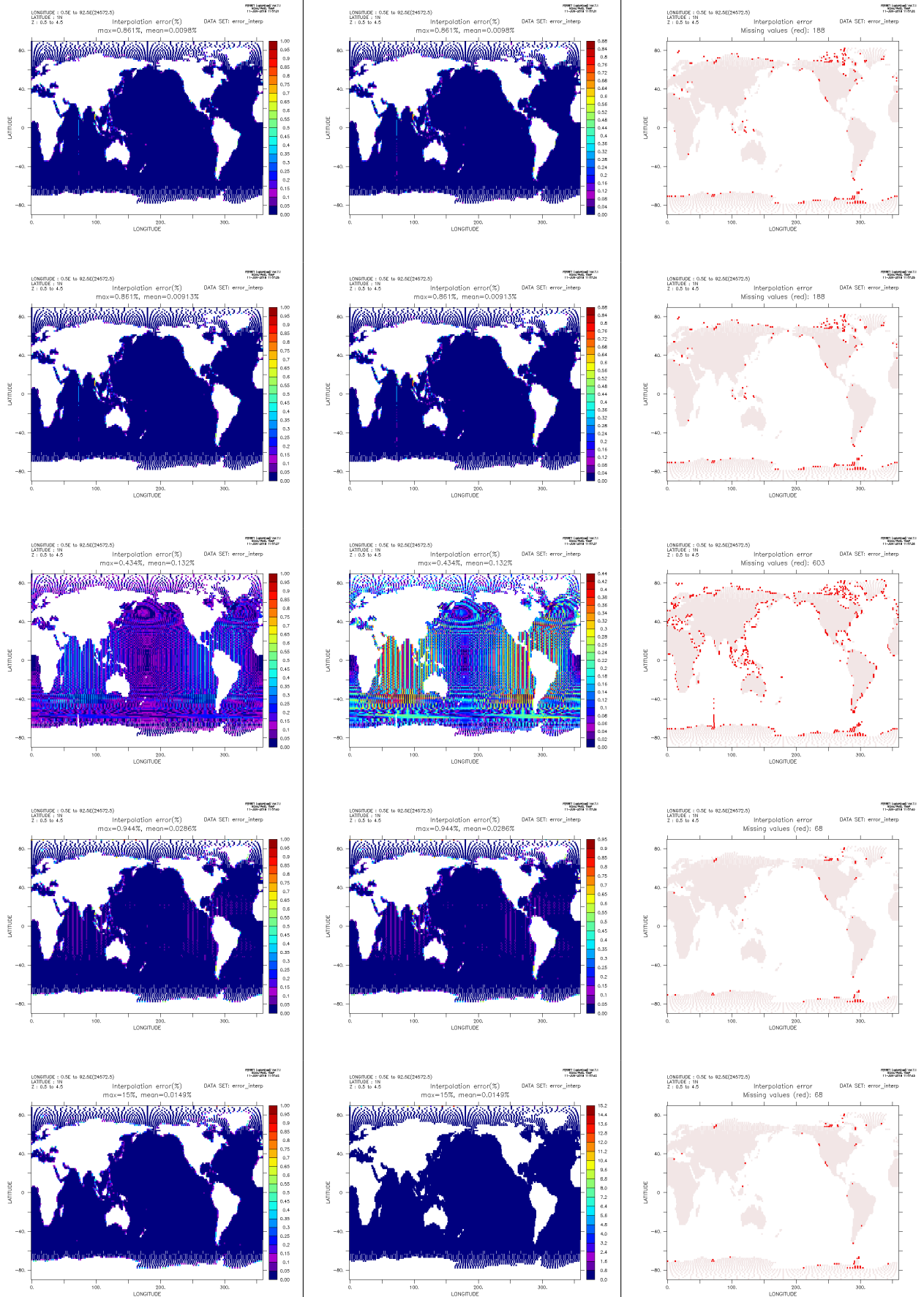
CONSERV 1st order

CONSERV 2nd order

Error in [0, 1]

Error in [0, max_error]

Non-interpolation points



ssea → nogt

BILINEAR

BICUBIC

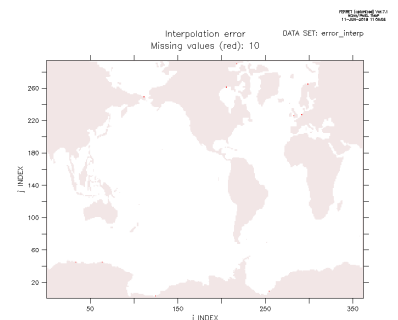
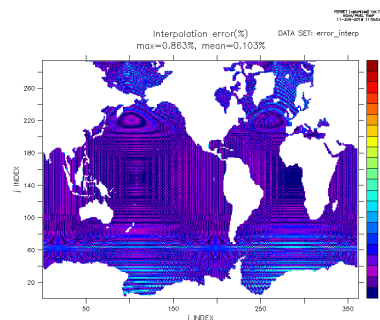
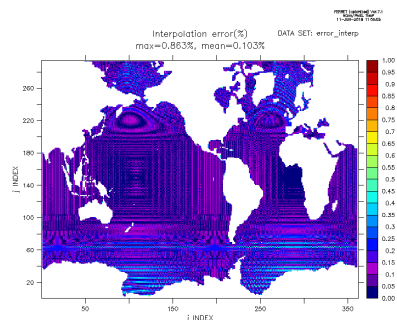
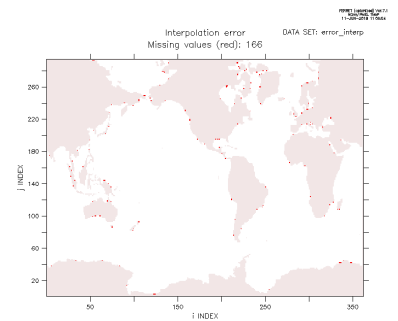
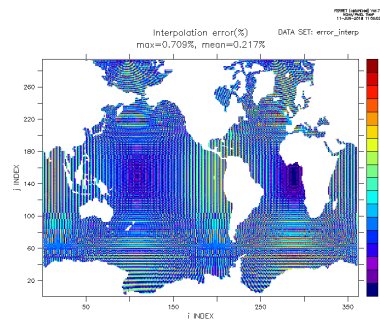
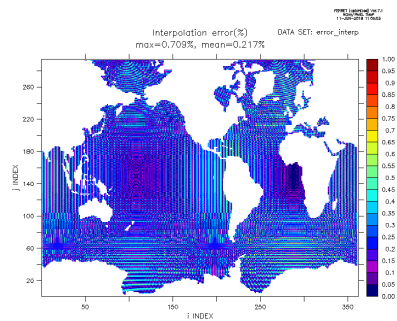
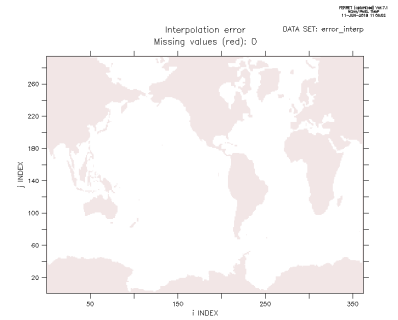
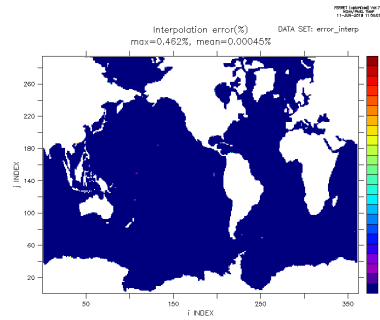
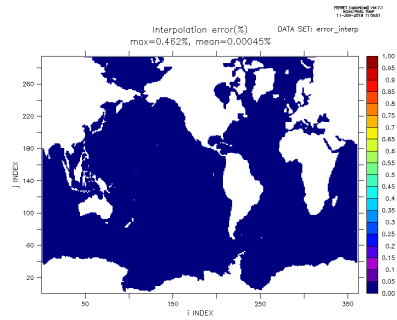
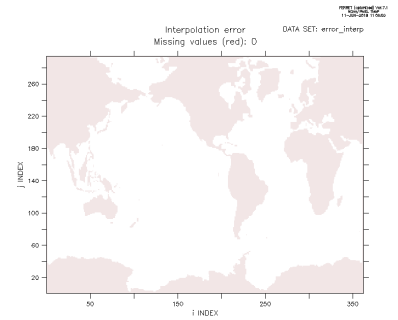
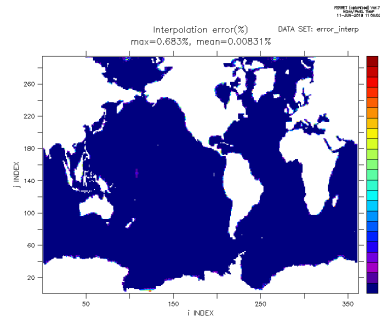
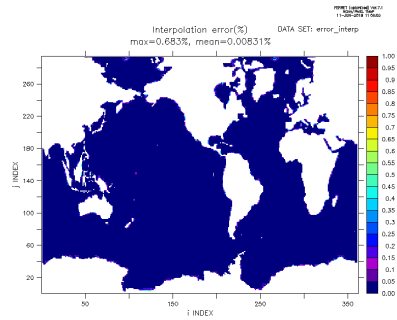
DISTWGT

CONSERV 1st order

Error in [0, 1]

Error in [0, max_error]

Non-interpolation points



nogt → bggd

BILINEAR

BICUBIC

DISTWGT

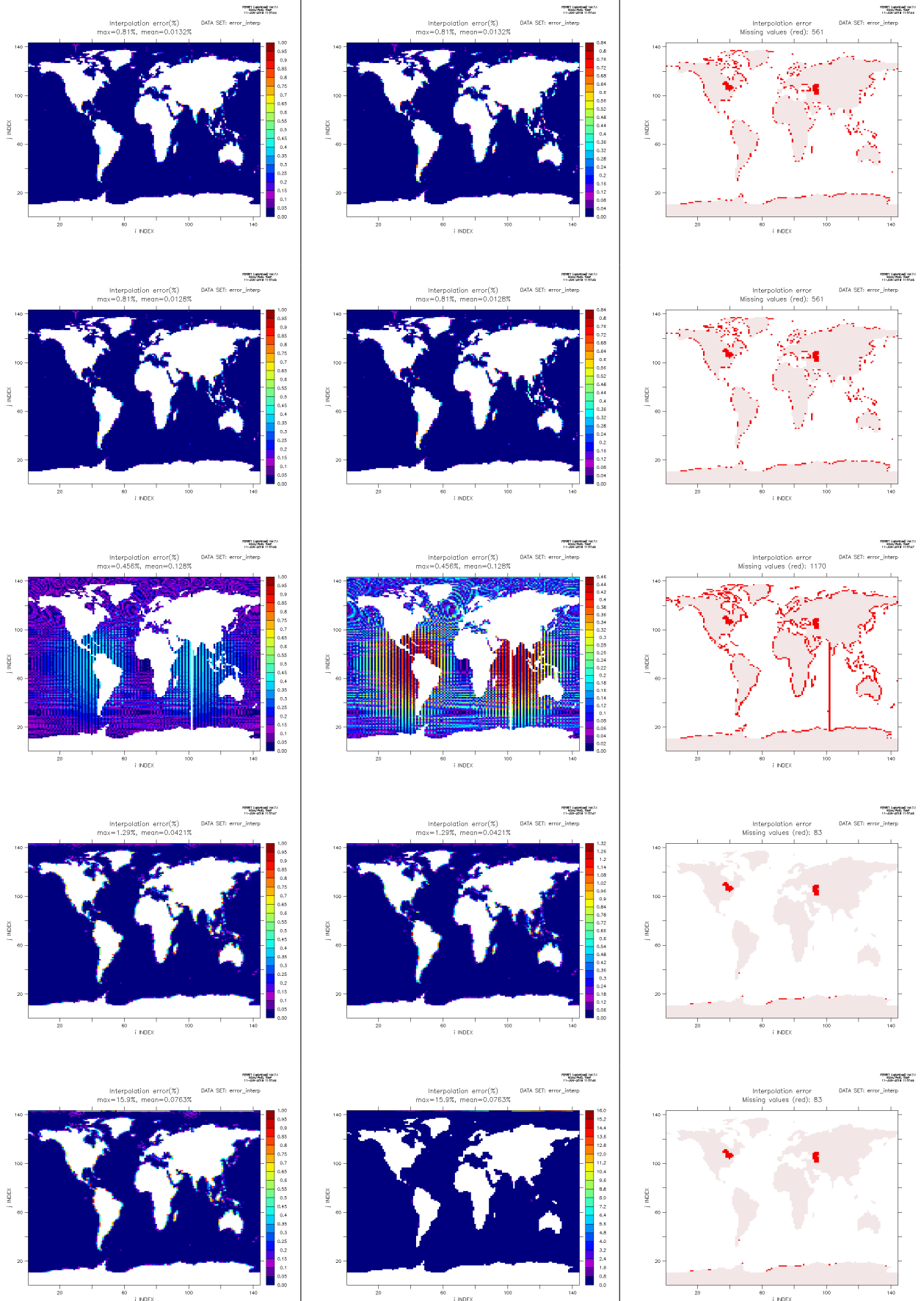
CONSERV 1st order

CONSERV 2nd order

Error in [0, 1]

Error in [0, max_error]

Non-interpolation points



bggd→nogat

BILINEAR

BICUBIC

DISTWGT

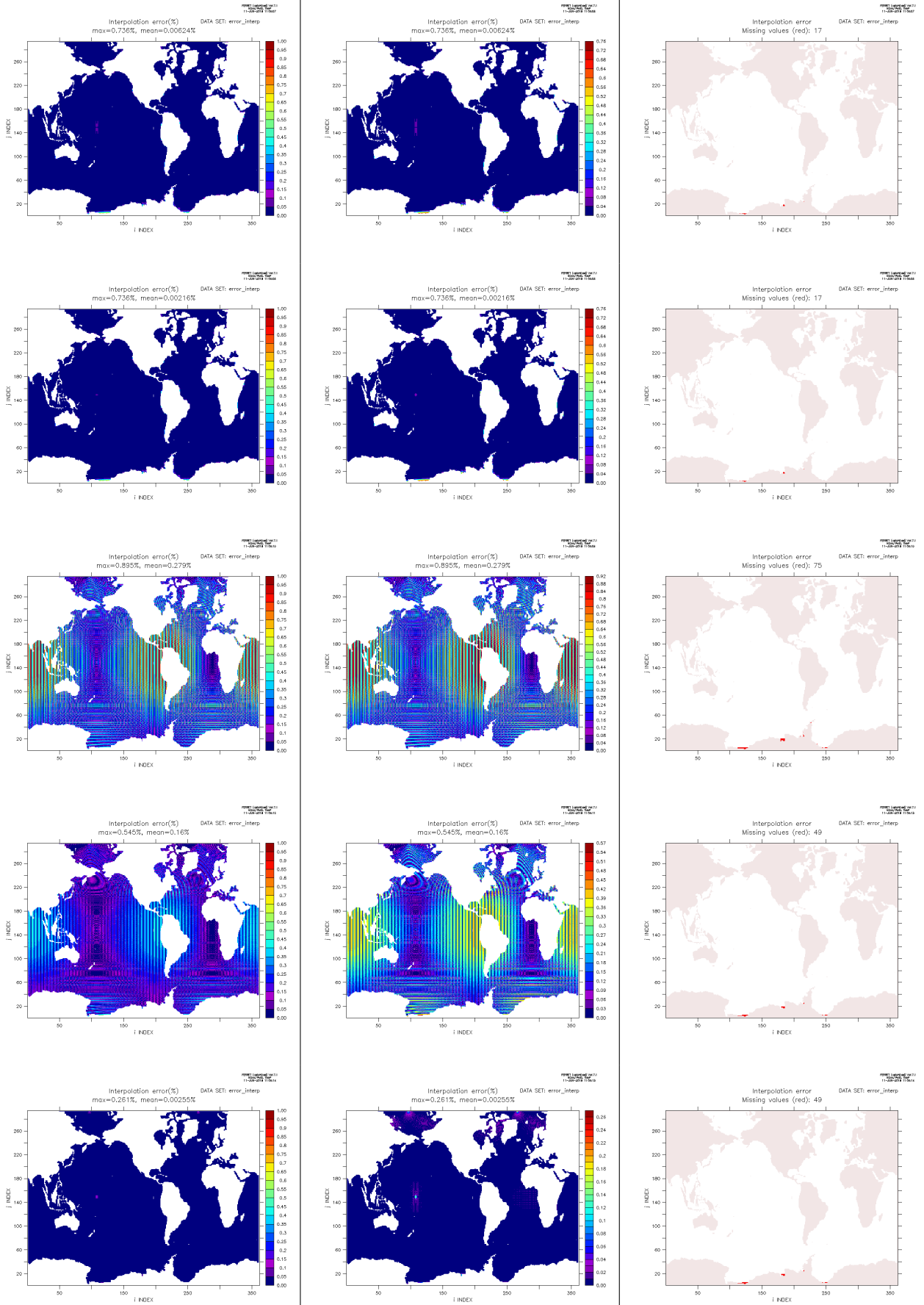
CONSERV 1st order

CONSERV 2nd order

Error in [0, 1]

Error in [0, max_error]

Non-interpolation points



nogt → icos

BILINEAR

BICUBIC

DISTWGT

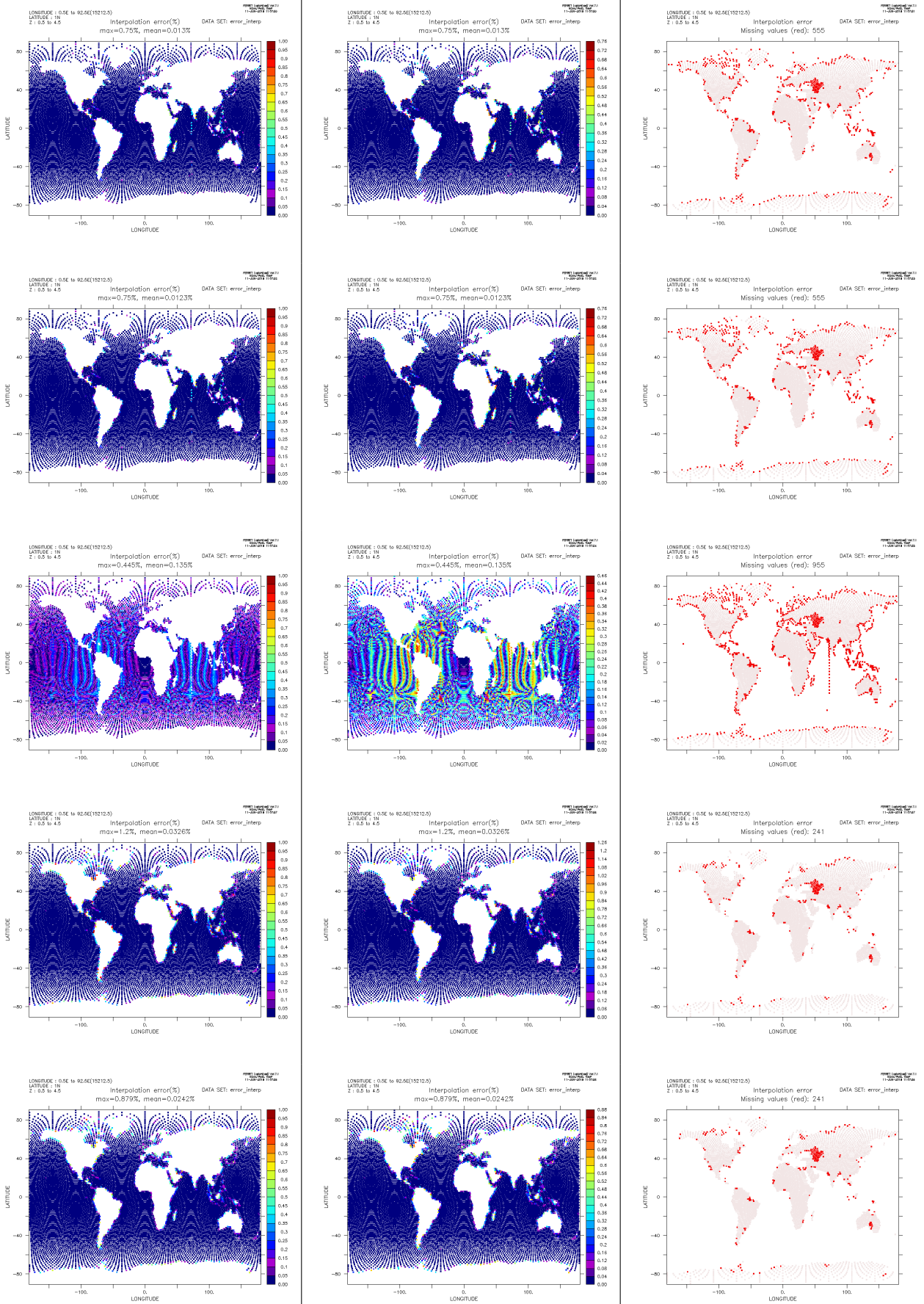
CONSERV 1st order

CONSERV 2nd order

Error in [0, 1]

Error in [0, max_error]

Non-interpolation points

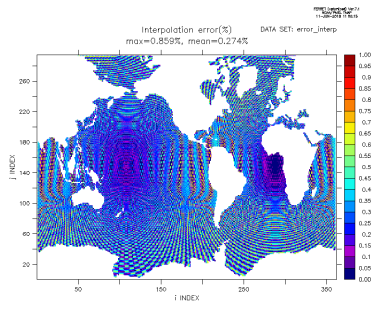


icos→nigt

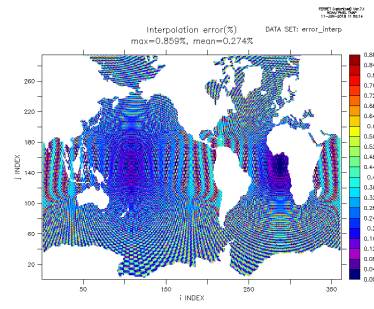
DISTWGT

CONSERV 1st order

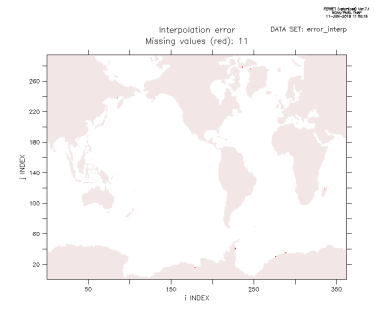
Error in [0, 1]



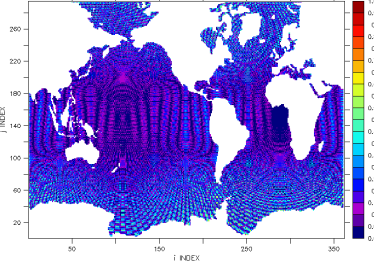
Error in [0, max_error]



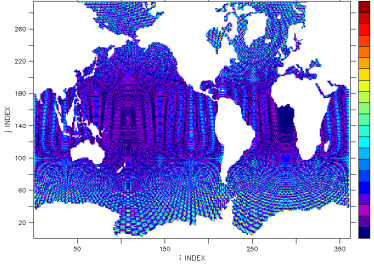
Non-interpolation points



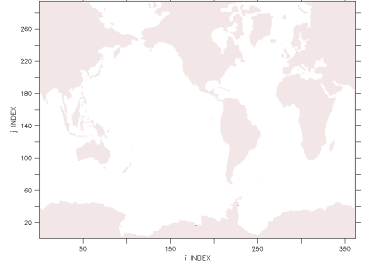
Error in [0, 1]



Error in [0, max_error]



Non-interpolation points



3) Impact of Lambert projection near the poles

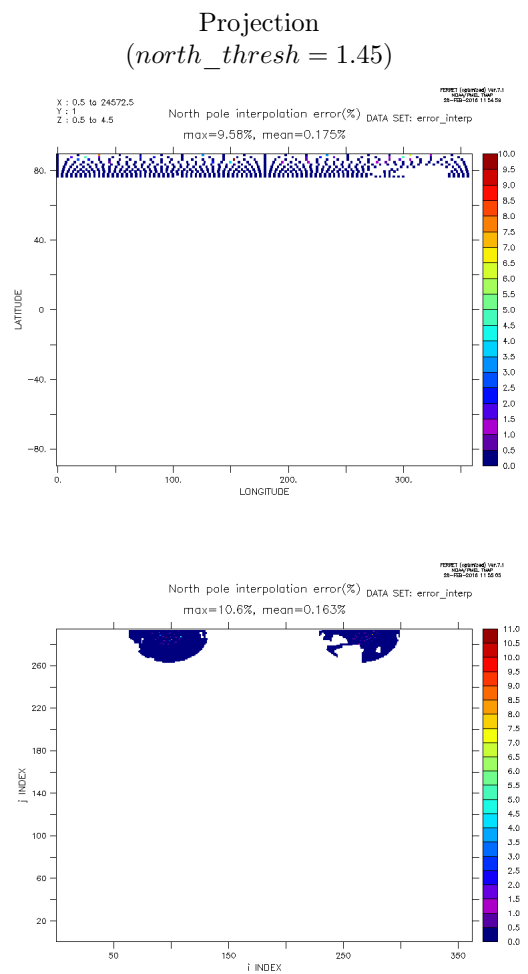
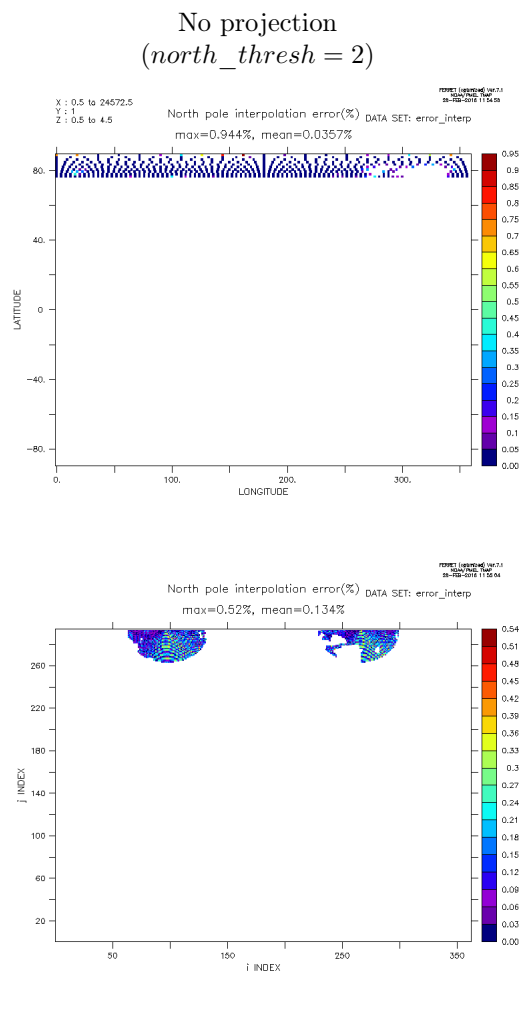
This paragraph shows a focus on interpolation errors at poles (obtained with OASIS3-MCT_3.0) to analyze the impact of Lambert projection.

For the north pole, the first column shows the interpolation error without Lambert projection (north latitude threshold = 2 rad), the second column shows the interpolation error with Lambert projection (north latitude threshold = 1.45 rad)

3.1 Interpolation errors at north pole

Coupled grids

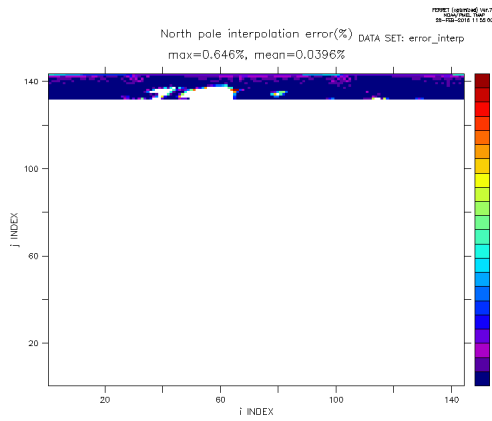
nogt → ssea



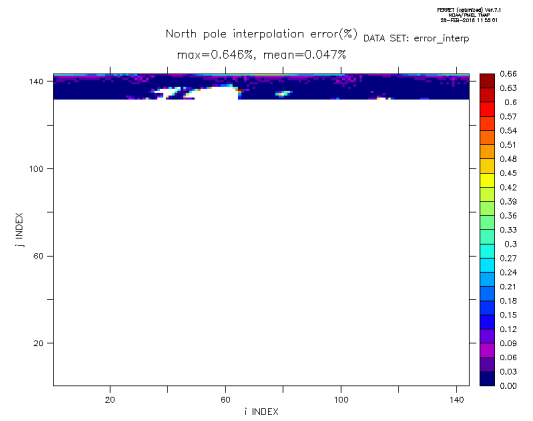
Coupled grids

nigt→bggd

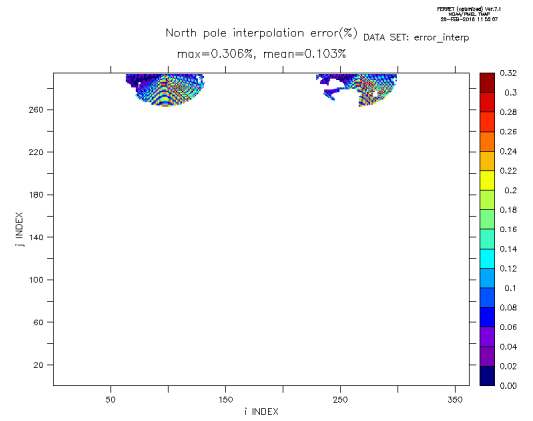
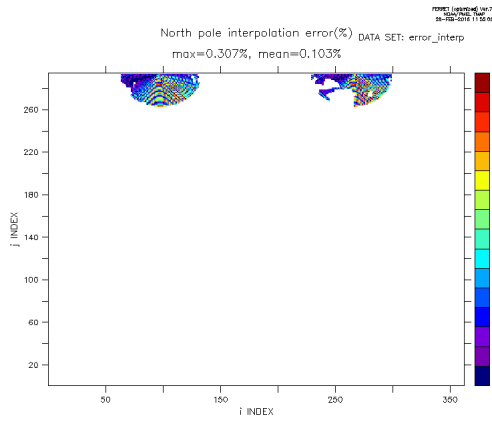
No projection
(north_thresh = 2)



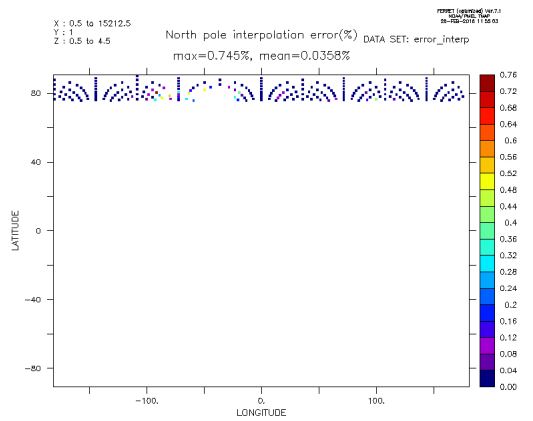
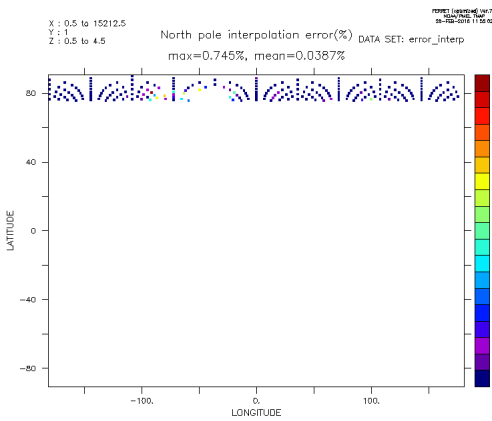
Projection
(north_thresh = 1.45)



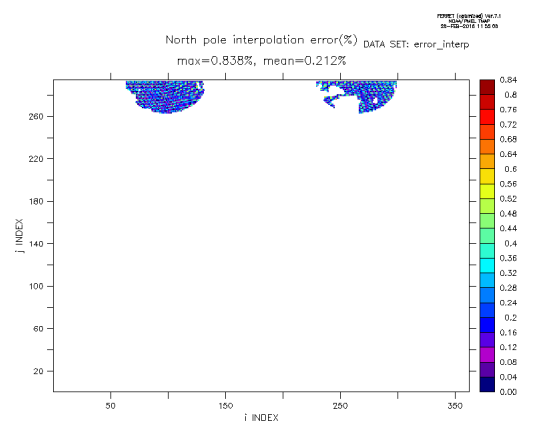
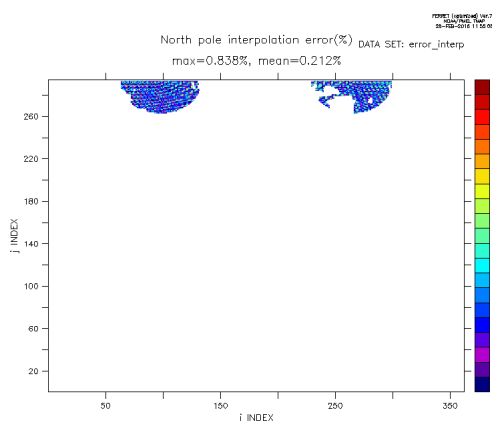
bggd→nigt



nigt→icos



icos→nigt

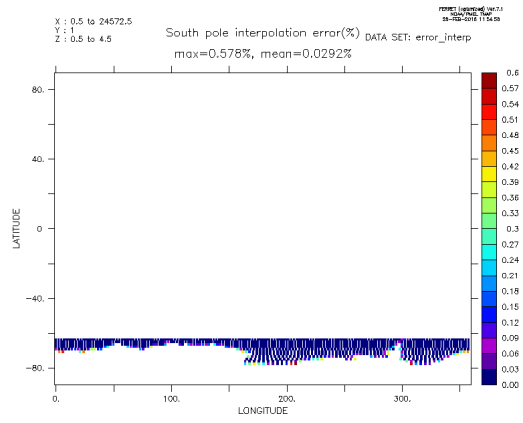


3.2 Interpolation errors at south pole

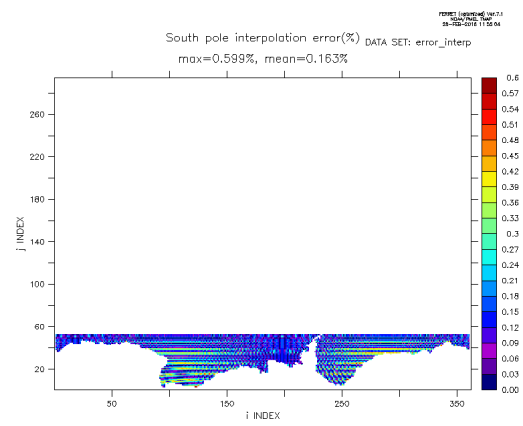
Coupled grids

noqt → ssea

No projection
(*south_thresh* = -2)



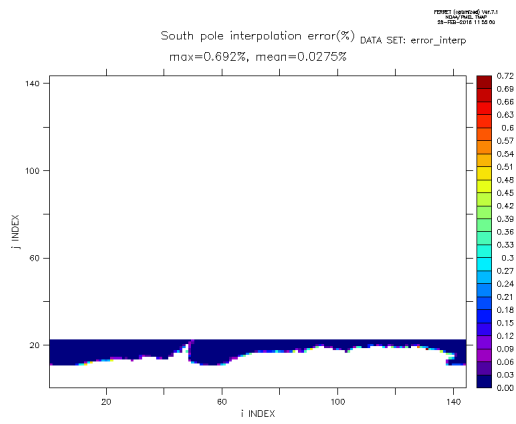
ssea → noqt



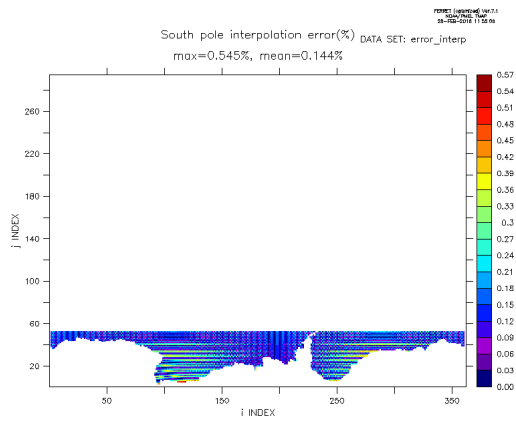
Coupled grids

No projection
(*south_thresh* = -2)

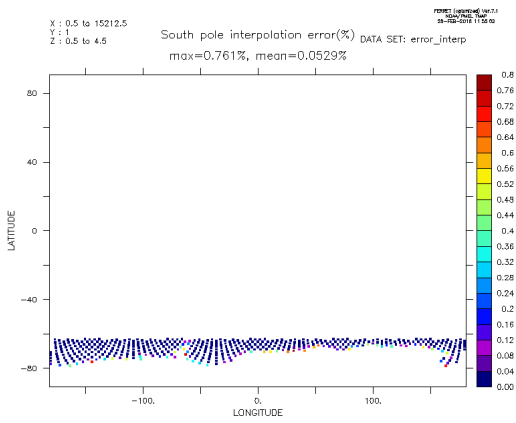
nogt → bggd



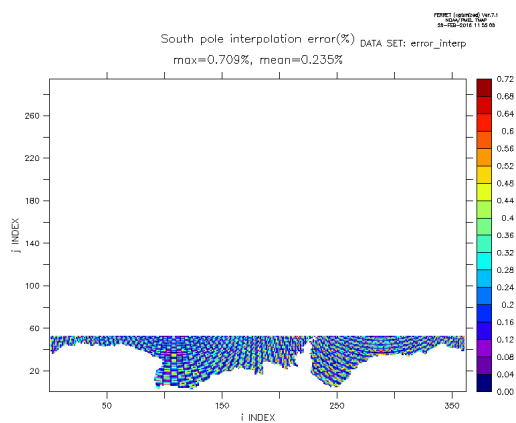
bggd → nogt



nogt → icos



icos → nogt



4) Review of weights generated for the CONSERV FRACAREA remapping

This paragraph is a review of weights generated for the CONSERV FRACAREA remapping with or without Lambert projection near the north pole in OASIS3-MCT_3.0.

4.1 nogt \rightarrow ssea

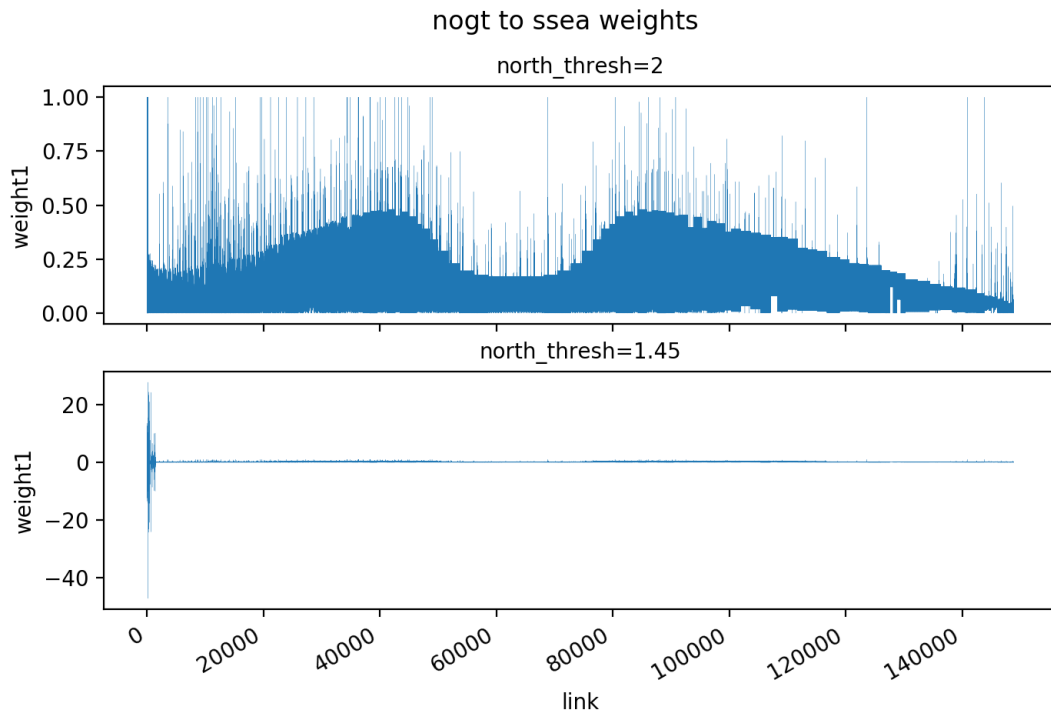


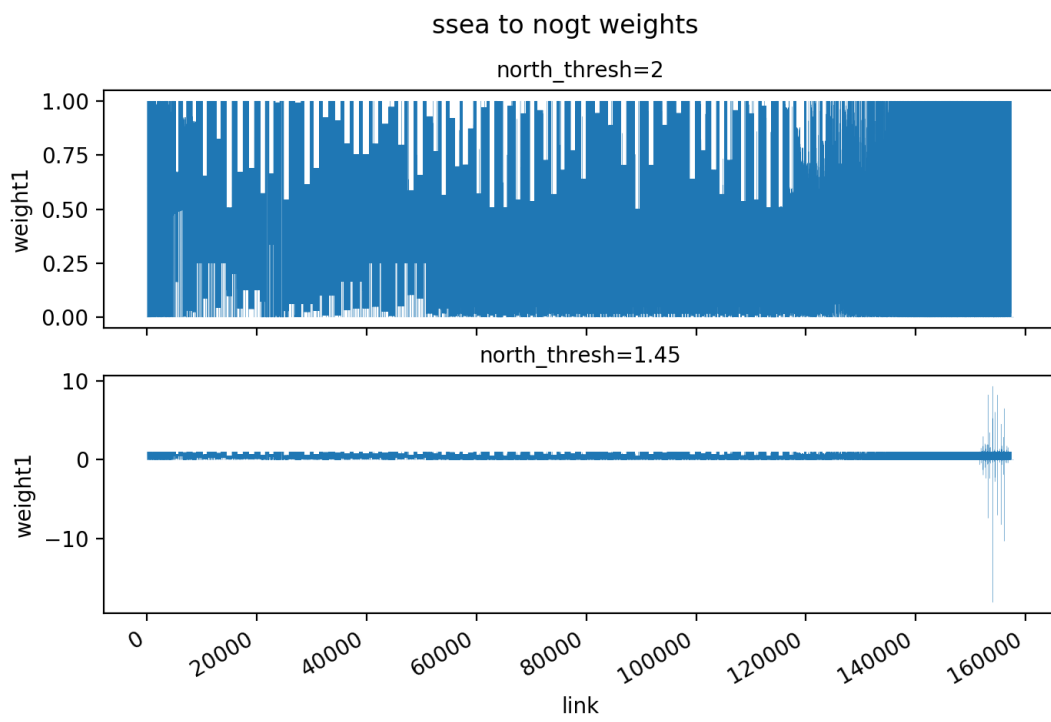
Figure 5: nogt to ssea weights with $north_thresh = 2$ rad (up) and $north_thresh = 1.45$ rad (down)

Weights where $weight \notin [0, 1]$ with $north_thresh = 2$ rad :

link	weight1	src address	dst address	src lon	src lat	dst lon	dst lat
1	-0.000009663962664	104523	1	350.91	88.09	0.00	88.93
2	-0.000000472185752	104524	1	3.29	87.98	0.00	88.93
3	-0.000119722167877	104885	1	353.43	88.52	0.00	88.93
4	-0.000078469956120	104886	1	8.79	88.37	0.00	88.93
5	-0.000133884780160	105247	1	357.79	88.93	0.00	88.93
6	-0.000012279337362	105248	1	17.46	88.74	0.00	88.93
7	-0.000000000725380	105608	1	328.19	89.37	0.00	88.93
8	-0.000088525397711	105609	1	7.15	89.33	0.00	88.93
9	1.000454232680565	105970	1	304.56	89.74	0.00	88.93
10	-0.000011214167539	105971	1	36.76	89.66	0.00	88.93
...
186	1.000439310026988	105970	19	304.56	89.74	324.00	88.93
187	-0.000026508145349	104522	20	337.69	88.11	342.00	88.93
188	-0.000014630080952	104523	20	350.91	88.09	342.00	88.93
189	-0.000127514317754	104884	20	336.36	88.54	342.00	88.93
190	-0.000064818909737	104885	20	353.43	88.52	342.00	88.93
191	-0.000097366447742	105246	20	333.90	88.96	342.00	88.93
192	-0.000037019371922	105247	20	357.79	88.93	342.00	88.93
193	-0.000069129305313	105608	20	328.19	89.37	342.00	88.93
194	-0.000009473001398	105609	20	7.15	89.33	342.00	88.93
195	1.000446459580169	105970	20	304.56	89.74	342.00	88.93

Weights where $weight \notin [0, 1]$ with $north_thresh = 1.45$ rad = 83.07° :

link	weight1	src address	dst address	src lon	src lat	dst lon	dst lat
19	-12.390052261128423	104887	3	21.00	88.14	36.00	88.93
21	12.658624585832627	105249	3	30.90	88.45	36.00	88.93
22	-13.509690622013945	105250	3	39.76	88.10	36.00	88.93
26	13.577820531077020	105612	3	51.73	88.29	36.00	88.93
56	-0.000000183576723	105970	6	304.56	89.74	90.00	88.93
68	-9.863198787419288	104712	8	125.00	88.14	126.00	88.93
70	10.065636615715917	105074	8	115.10	88.45	126.00	88.93
87	-0.000030113960281	105970	9	304.56	89.74	144.00	88.93
108	-0.000005504828397	105970	11	304.56	89.74	180.00	88.93
109	1.541324200231972	104716	12	185.70	88.43	198.00	88.93
...
1412	-2.539689683275232	103424	129	282.48	83.82	285.00	84.74
1416	2.548544982393447	103786	129	278.98	84.04	285.00	84.74
1424	-1.051921803912782	102702	130	293.90	83.95	292.50	84.74
1425	1.161377723567112	102703	130	296.86	84.26	292.50	84.74
1448	-0.402672866588780	101980	132	305.59	83.81	307.50	84.74
1462	-1.700586522446139	101981	133	309.04	84.04	315.00	84.74
1463	1.869116897233037	101982	133	312.76	84.26	315.00	84.74
1472	-0.005824190721256	101621	134	318.54	84.01	322.50	84.74
1484	-0.604469288027527	101262	135	331.80	83.88	330.00	84.74
1519	-0.116102111657484	101630	138	357.92	84.18	352.50	84.74

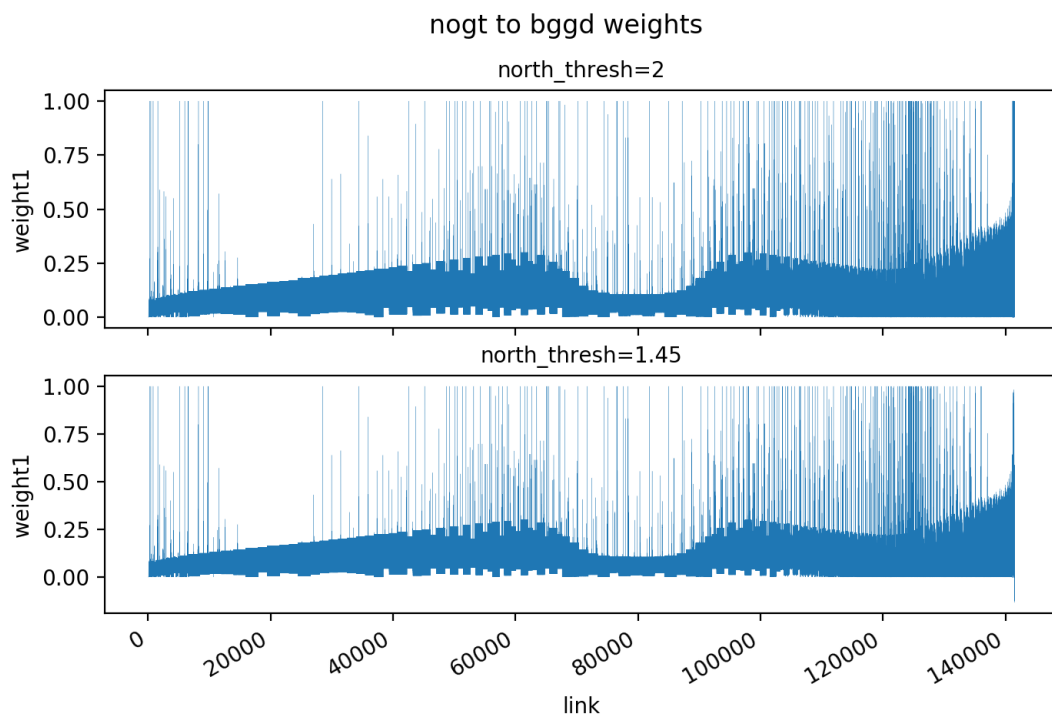
4.2 ssea \rightarrow nogtFigure 6: ssea to nogt weights with $north_thresh = 2$ rad (up) and $north_thresh = 1.45$ rad (down)

Weights where $weight \notin [0, 1]$ with $north_thresh = 2$ rad :

link	weight1	src address	dst address	src lon	src lat	dst lon	dst lat
157255	-0.000000620109969	3	105970	36.00	88.93	304.56	89.74
157256	-0.000000268148311	4	105970	54.00	88.93	304.56	89.74
157257	-0.000000072558043	5	105970	72.00	88.93	304.56	89.74
157263	-0.000000788586218	11	105970	180.00	88.93	304.56	89.74
157264	-0.000001003961634	12	105970	198.00	88.93	304.56	89.74
157265	-0.000001245403859	13	105970	216.00	88.93	304.56	89.74
157266	-0.000001512912816	14	105970	234.00	88.93	304.56	89.74
157267	-0.000001840829243	15	105970	252.00	88.93	304.56	89.74

Weights where $weight \notin [0, 1]$ with $north_thresh = 1.45$ rad = 83.07° :

link	weight1	src address	dst address	src lon	src lat	dst lon	dst lat
151659	1.023876713457825	111	101092	150.00	84.74	153.37	83.81
151660	-0.000554762248690	112	101092	157.50	84.74	153.37	83.81
151661	-0.023321951209138	162	101092	153.33	83.34	153.37	83.81
151671	-0.635403343211977	113	101096	165.00	84.74	170.06	83.93
151874	1.461680538834039	135	101262	330.00	84.74	331.80	83.88
151875	-0.027248537903124	188	101262	326.67	83.34	331.80	83.88
151876	-0.434432000930962	189	101262	333.33	83.34	331.80	83.88
152041	1.039993076882199	109	101451	135.00	84.74	140.04	83.86
152042	-0.003691982371407	110	101451	142.50	84.74	140.04	83.86
152043	-0.036301094510791	160	101451	140.00	83.34	140.04	83.86
...
156826	1.536646954137487	59	105619	72.00	86.14	65.37	85.25
156827	-0.098833422061276	99	105619	60.00	84.74	65.37	85.25
156828	-0.410940991533134	100	105619	67.50	84.74	65.37	85.25
157002	-0.002669357345755	59	105793	72.00	86.14	76.52	86.63
157003	-0.002780997980151	60	105793	81.00	86.14	76.52	86.63
157251	-0.000000432649258	6	105970	90.00	88.93	304.56	89.74
157254	-0.000070936729357	9	105970	144.00	88.93	304.56	89.74
157256	-0.000012928313265	11	105970	180.00	88.93	304.56	89.74
157257	-0.000009248480345	12	105970	198.00	88.93	304.56	89.74
157258	-0.000008535393287	13	105970	216.00	88.93	304.56	89.74

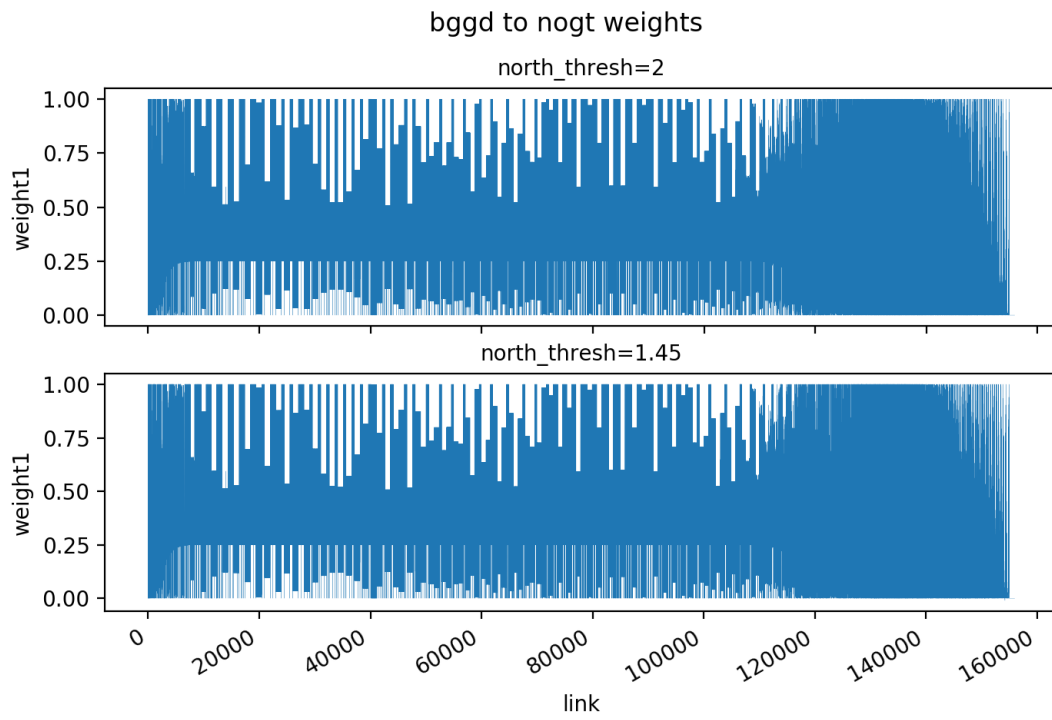
4.3 nogt \rightarrow bggdFigure 7: nogt to bggd weights with $north_thresh = 2$ rad (up) and $north_thresh = 1.45$ rad (down)

Weights where $weight \notin [0, 1]$ with $north_thresh = 2$ rad :

link	weight1	src address	dst address	src lon	src lat	dst lon	dst lat
141166	-0.000038460786319	105969	20479	271.65	89.37	255.00	90.00
141167	1.000038460786319	105970	20479	304.56	89.74	255.00	90.00
141168	-0.000037339117366	105969	20480	271.65	89.37	257.50	90.00
141169	1.000037339117366	105970	20480	304.56	89.74	257.50	90.00
141170	-0.000036190426503	105969	20481	271.65	89.37	260.00	90.00
141171	1.000036190426502	105970	20481	304.56	89.74	260.00	90.00
141172	-0.000035014713760	105969	20482	271.65	89.37	262.50	90.00
141173	1.000035014713760	105970	20482	304.56	89.74	262.50	90.00
141174	-0.000033811979171	105969	20483	271.65	89.37	265.00	90.00
141175	1.000033811979171	105970	20483	304.56	89.74	265.00	90.00
...
141492	1.000054266322716	105970	20585	304.56	89.74	160.00	90.00
141493	-0.000032692773812	105439	20586	177.81	89.37	162.50	90.00
141494	-0.000021281557241	105801	20586	201.44	89.74	162.50	90.00
141495	1.000053974331053	105970	20586	304.56	89.74	162.50	90.00
141496	-0.000031756225807	105439	20587	177.81	89.37	165.00	90.00
141497	-0.000021920079394	105801	20587	201.44	89.74	165.00	90.00
141498	1.000053676305201	105970	20587	304.56	89.74	165.00	90.00
141499	-0.000030804533382	105439	20588	177.81	89.37	167.50	90.00
141500	-0.000022567711739	105801	20588	201.44	89.74	167.50	90.00
141501	1.000053372245120	105970	20588	304.56	89.74	167.50	90.00

Weights where $weight \notin [0, 1]$ with $north_thresh = 1.45$ rad = 83.07° :

link	weight1	src address	dst address	src lon	src lat	dst lon	dst lat
141118	-0.002567846755709	105970	20464	304.56	89.74	217.50	90.00
141124	-0.000740385145948	105970	20466	304.56	89.74	222.50	90.00
141136	-0.000430335312153	105970	20470	304.56	89.74	232.50	90.00
141142	-0.001959276900932	105970	20472	304.56	89.74	237.50	90.00
141148	-0.000124019065377	105970	20474	304.56	89.74	242.50	90.00
141157	-0.000217160344451	105970	20477	304.56	89.74	250.00	90.00
141367	-0.000031279639811	105970	20554	304.56	89.74	82.50	90.00
141371	-0.000081437902869	105970	20555	304.56	89.74	85.00	90.00
141387	-0.000361088374503	105970	20559	304.56	89.74	95.00	90.00
141395	-0.000959357512995	105970	20561	304.56	89.74	100.00	90.00
141403	-0.000939804754203	105970	20563	304.56	89.74	105.00	90.00
141416	-0.001191880014630	105970	20566	304.56	89.74	112.50	90.00
141432	-0.003396077959864	105970	20570	304.56	89.74	122.50	90.00
141444	-0.001338378891131	105970	20573	304.56	89.74	130.00	90.00
141448	-0.001863739500943	105970	20574	304.56	89.74	132.50	90.00
141455	-0.132944405923236	105801	20576	201.44	89.74	137.50	90.00
141459	-0.125362777590441	105801	20577	201.44	89.74	140.00	90.00
141463	-0.106340400083420	105801	20578	201.44	89.74	142.50	90.00
141467	-0.089511009789654	105801	20579	201.44	89.74	145.00	90.00
141471	-0.058785425169976	105801	20580	201.44	89.74	147.50	90.00
141475	-0.010307904502948	105801	20581	201.44	89.74	150.00	90.00

4.4 bggd \rightarrow nogtFigure 8: bggd to nogt weights with $north_thresh = 2$ rad (up) and $north_thresh = 1.45$ rad (down)

Weights where $weight \notin [0, 1]$ with $north_thresh = 2$ rad :

link	weight1	src address	dst address	src lon	src lat	dst lon	dst lat
154566	-0.000000098173566	20449	105970	180.00	90.00	304.56	89.74
154567	-0.000000101717866	20450	105970	182.50	90.00	304.56	89.74
154568	-0.000000105325019	20451	105970	185.00	90.00	304.56	89.74
154569	-0.000000108995026	20452	105970	187.50	90.00	304.56	89.74
154570	-0.000000112727887	20453	105970	190.00	90.00	304.56	89.74
154571	-0.000000116523601	20454	105970	192.50	90.00	304.56	89.74
154572	-0.000000120382170	20455	105970	195.00	90.00	304.56	89.74
154573	-0.000000124303593	20456	105970	197.50	90.00	304.56	89.74
154574	-0.000000128287869	20457	105970	200.00	90.00	304.56	89.74
154575	-0.000000132334999	20458	105970	202.50	90.00	304.56	89.74
...
154662	-0.000000020753443	20545	105970	60.00	90.00	304.56	89.74
154663	-0.000000017034146	20546	105970	62.50	90.00	304.56	89.74
154664	-0.000000013682717	20547	105970	65.00	90.00	304.56	89.74
154665	-0.000000010699155	20548	105970	67.50	90.00	304.56	89.74
154666	-0.000000008083461	20549	105970	70.00	90.00	304.56	89.74
154667	-0.000000005940849	20550	105970	72.50	90.00	304.56	89.74
154706	-0.000000084624910	20589	105970	170.00	90.00	304.56	89.74
154707	-0.000000087917793	20590	105970	172.50	90.00	304.56	89.74
154708	-0.000000091273530	20591	105970	175.00	90.00	304.56	89.74
154709	-0.000000094692121	20592	105970	177.50	90.00	304.56	89.74

Weights where $weight \notin [0, 1]$ with $north_thresh = 1.45$ rad = 83.07° :

link	weight1	src address	dst address	src lon	src lat	dst lon	dst lat
154181	-0.010069622285335	20576	105801	137.50	90.00	201.44	89.74
154182	-0.009495366203713	20577	105801	140.00	90.00	201.44	89.74
154183	-0.008054552239902	20578	105801	142.50	90.00	201.44	89.74
154184	-0.006779841939955	20579	105801	145.00	90.00	201.44	89.74
154185	-0.004452590714395	20580	105801	147.50	90.00	201.44	89.74
154186	-0.000780752707701	20581	105801	150.00	90.00	201.44	89.74
154581	-0.000093778868787	20464	105970	217.50	90.00	304.56	89.74
154583	-0.000027039184211	20466	105970	222.50	90.00	304.56	89.74
154587	-0.000015716030794	20470	105970	232.50	90.00	304.56	89.74
154589	-0.000071553635738	20472	105970	237.50	90.00	304.56	89.74
154591	-0.000004529229722	20474	105970	242.50	90.00	304.56	89.74
154594	-0.000007930789266	20477	105970	250.00	90.00	304.56	89.74
154671	-0.000001142345909	20554	105970	82.50	90.00	304.56	89.74
154672	-0.000002974147266	20555	105970	85.00	90.00	304.56	89.74
154676	-0.000013187102859	20559	105970	95.00	90.00	304.56	89.74
154678	-0.000035036149307	20561	105970	100.00	90.00	304.56	89.74
154680	-0.000034322074140	20563	105970	105.00	90.00	304.56	89.74
154683	-0.000043518015059	20566	105970	112.50	90.00	304.56	89.74
154687	-0.000124026228856	20570	105970	122.50	90.00	304.56	89.74
154690	-0.000048878173177	20573	105970	130.00	90.00	304.56	89.74
154691	-0.000068064568777	20574	105970	132.50	90.00	304.56	89.74

