

EFFECTS OF ALTIMETER CORRECTIONS ON LINEAR SEA LEVEL CHANGES AROUND TAIWAN



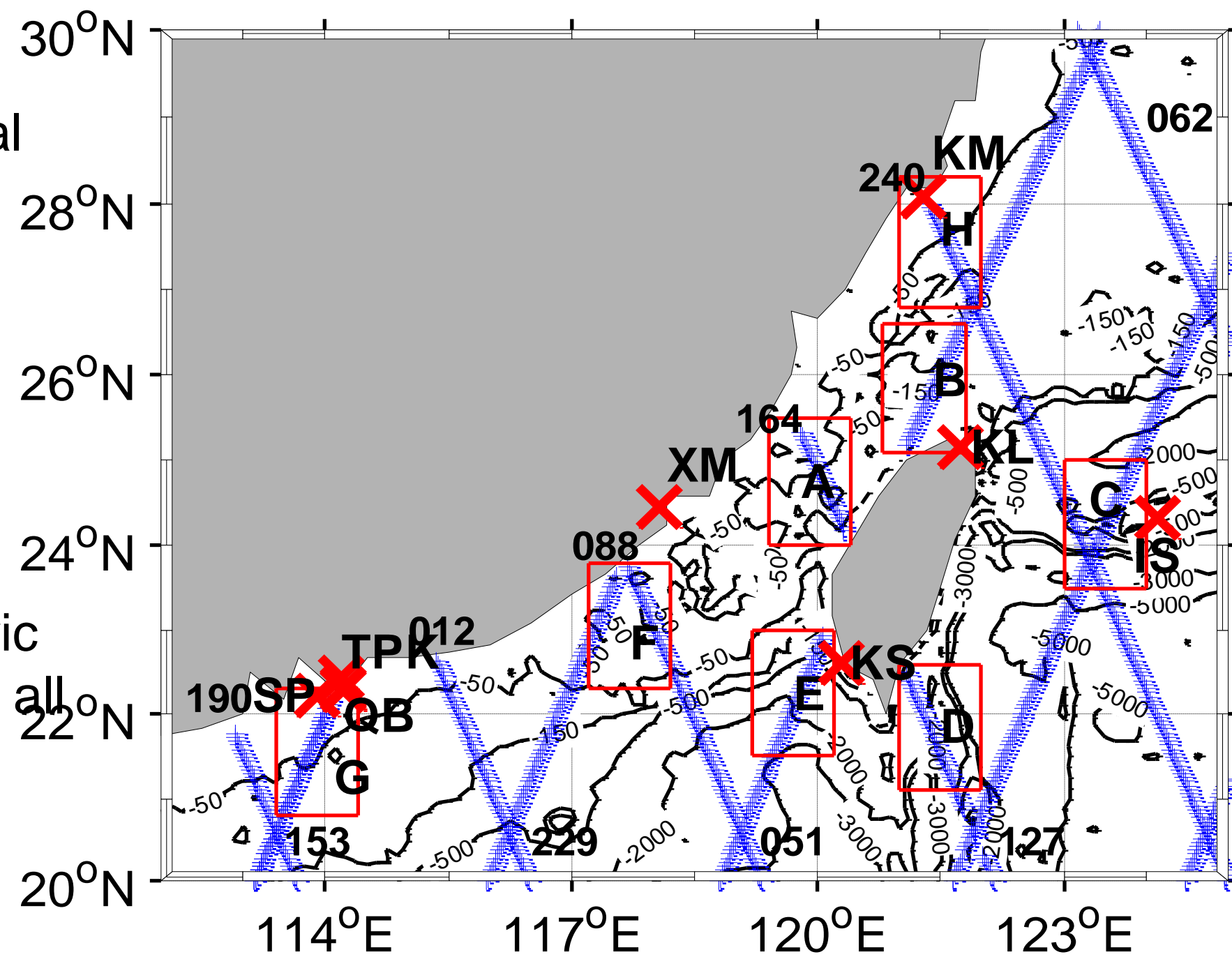
Yongcun Cheng, Ole Baltazar Andersen
 DTU Space, Juliane Maries Vej 30, Copenhagen Denmark
 cych@space.dtu.dk, oa@space.dtu.dk

Introduction

Multi-mission altimetric data from TOPEX, Jason-1 and Jason-2 satellites during the period 1993 and 2009 are used to characterize the sea level changes around Taiwan and the impacts of different geophysical and range corrections on linear sea level trend are investigated.

In this study, 8 sub regions (A-H in Figure 1) with identical size are selected in order to investigate the regional differences in linear sea level trend.

These regions are chosen to represent different oceanographic and bathymetric conditions around Taiwan and all are close to tide gauge sites.



Data and Method

Default and state of the art alternative altimeter geophysical and range corrections in RADS are used for this investigation.

Corrections in RADS	Default	Code	Alternative	Code
Tidal correction	GOT4.7	1217	FES2004 /the local tide model	1213 /1200
Geophysical corrections	Dynamic atmosphere correction	MOG2D-G+inverse barometric correction	local pressure - (1013.3 mbar)	1001
	Dry troposphere correction	ECMWF model	NCEP/NCAR model	702
Range corrections	Wet troposphere correction	radiometer measurements	ECMWF model	802
	Ionospheric correction	smoothed dual-frequency altimeter range measurements	dual-frequency range measurements	901
	Sea state bias correction	CLS non-parametric model	BM3/BM4 model	1501

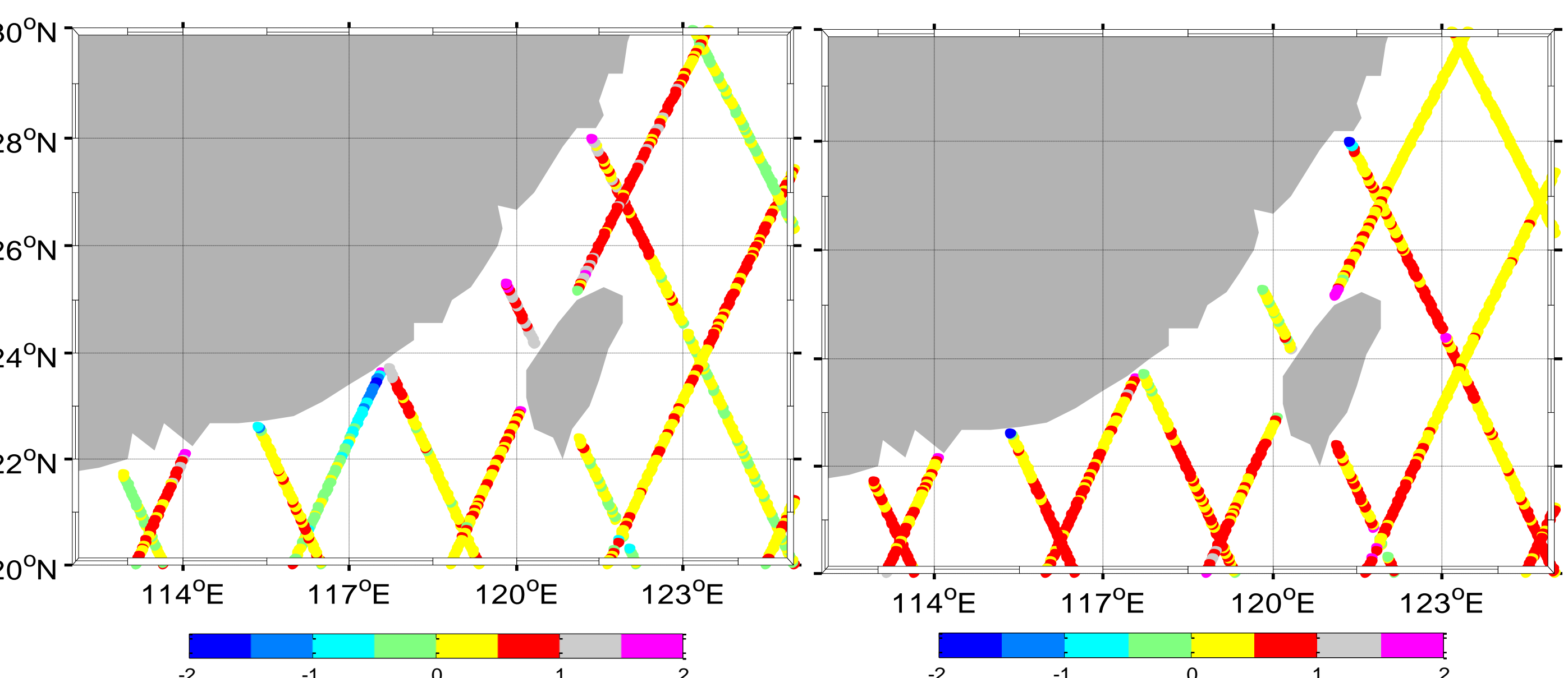
Table 1. The code 1200 stands for an alternative local tide prediction using the response method.

Effects of global ocean tide model on sea level variances.

Mean standard deviation (STD) of non tidal sea level variation over the Taiwan area are listed. The default and state of the art alternative corrections (stars) listed in Table 1 are applied. The underlined bold value denote the smallest STD of non tidal sea level variation.

Corrections		Standard deviations (cm)	
		GOT4.7 (1217)	Local tide Model (1200*)
Dry troposphere correction	701	12.45	11.89
	702*	12.46	11.89
Wet troposphere correction	801	12.45	11.89
	802*	12.58	11.99
Ionospheric correction	901*	12.44	<u>11.87</u>
	903	12.45	11.89
Sea state bias correction	1502	12.45	11.89
	1501*	12.25	10.80
Dynamic atmosphere correction	1001*	13.01	12.45
	1004	12.45	11.89
	DAC not applied	14.80	14.31

The smallest STD of non tidal sea level time series can be interpreted as the most accurate non tidal sea level time series. This is obtained if the default ionospheric and tidal corrections in RADS are substituted by their alternatives, respectively.



The difference of linear sea level trends (mm/yr) between without DAC and with DAC applied.

The difference of linear sea level trends (mm/yr) between applied GOT4.7 and the local tide prediction to sea level detiding.

Results

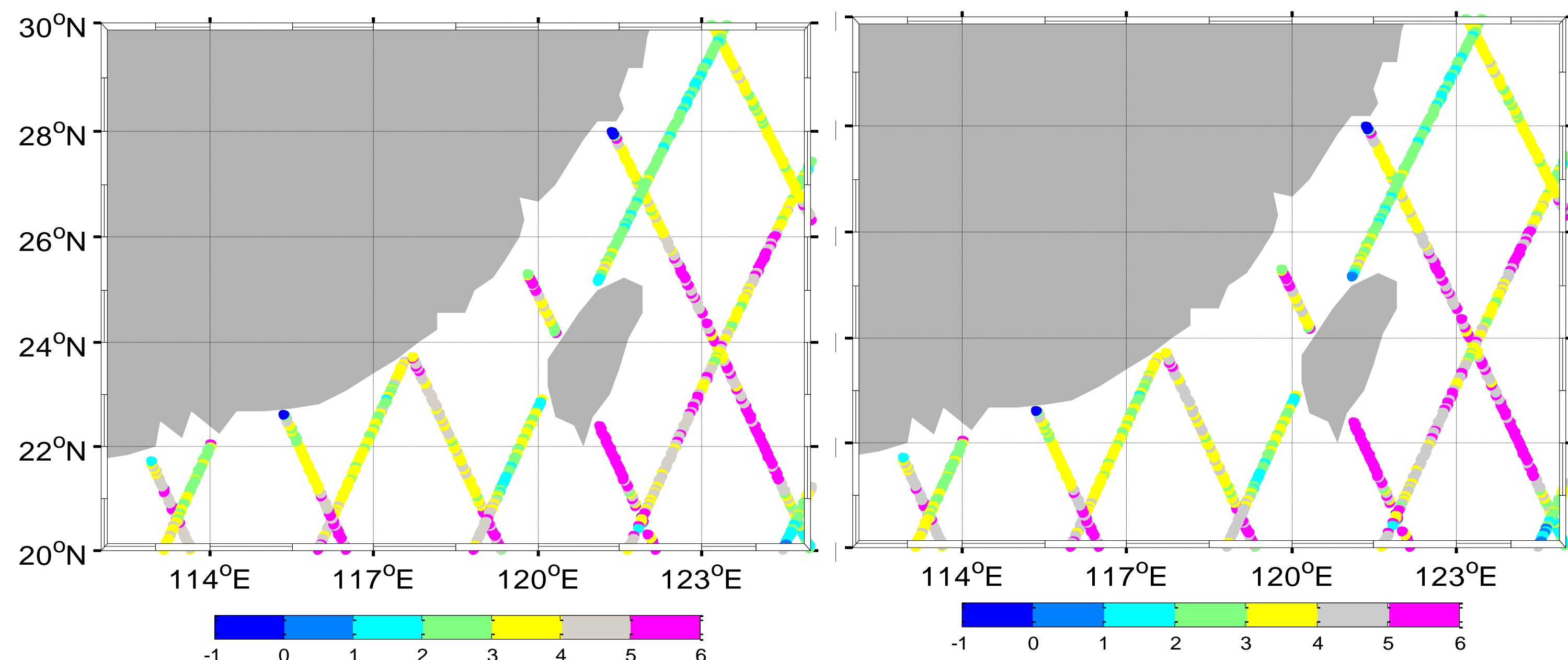
The results show that the wet tropospheric correction, the dynamic atmospheric correction (DAC) and the tidal correction have significant impacts on the determination of the linear sea level trend from altimeter measurements around Taiwan.

The difference of linear sea level trend with and without DAC is up to 2 mm/yr to the north of Taiwan, in the Taiwan Strait and in the coastal regions. Applying the selected optimal geophysical and range corrections (i.e., the default ionospheric and tidal corrections in RADS are substituted by their alternatives, respectively) to altimeter measurements, the linear sea level trend for the period 1993-2009 without DAC applied is 3.63 mm/yr, which is higher than the global average of 3 mm/yr. With the DAC applied the regional linear sea level trend is 3.31 mm/yr. Moreover, significant differences in linear sea level trend are found in all 8 selected regions around Taiwan.

Corrections	Linear sea level trends in sub regions								
	A	B	C	D	E	F	G	H	ALL
Default	4.25	2.25	3.92	6.08	2.74	3.99	3.09	3.24	3.77
1200*	3.95	1.69	3.48	5.55	2.22	3.60	2.62	2.87	3.31
702*	4.38	2.30	3.93	5.98	2.73	3.95	3.07	3.26	3.77
702*, 1200*	4.08	1.73	3.48	<u>5.45</u>	<u>2.21</u>	3.56	2.61	2.89	3.31
802*	5.26	2.75	4.73	6.83	3.85	4.44	3.97	3.94	4.44
802*, 1200*	4.97	2.19	4.28	6.31	3.35	4.09	3.55	3.58	3.98
901*	4.02	2.17	3.94	6.04	2.77	3.94	2.82	3.25	3.77
901*, 1200*	<u>3.83</u>	<u>1.63</u>	<u>3.48</u>	5.51	2.25	<u>3.56</u>	<u>2.37</u>	<u>2.87</u>	<u>3.31</u>
1001*	4.66	3.14	4.07	6.32	2.94	4.14	3.58	4.08	4.02
1001*, 1200*	4.36	2.54	3.61	5.79	2.41	3.71	3.12	3.70	3.53

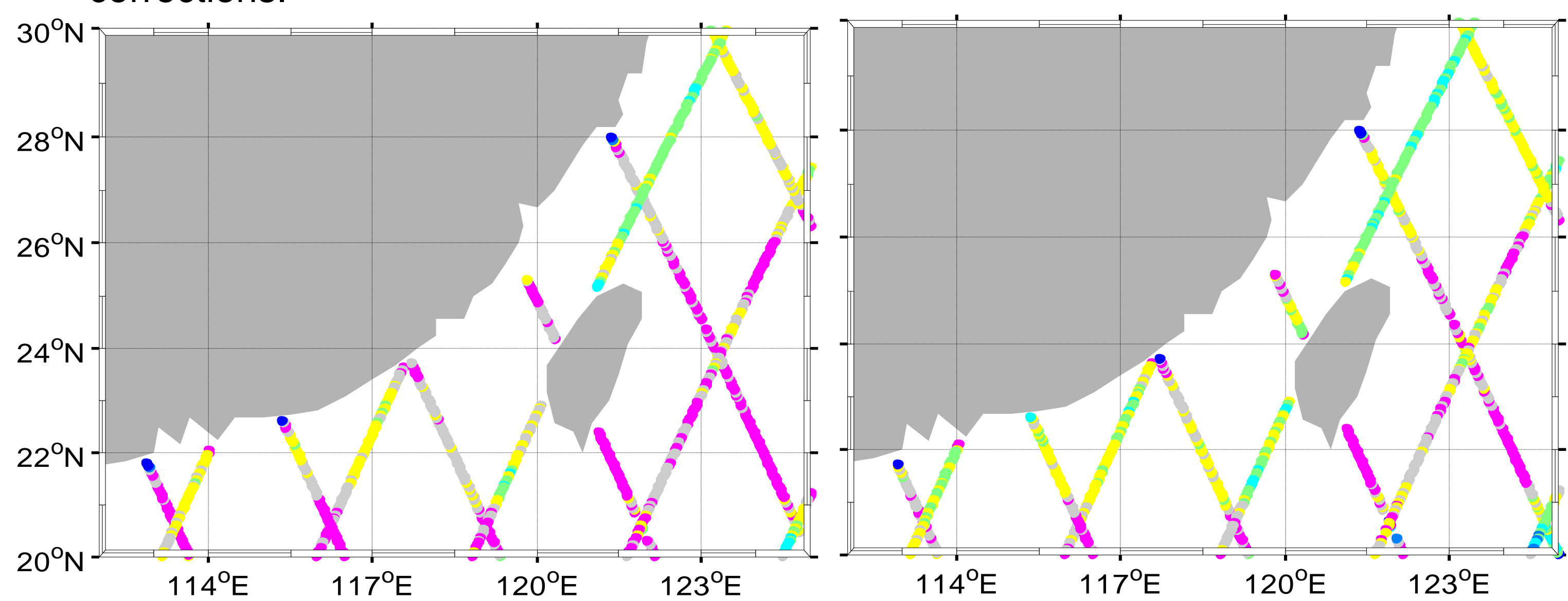
The determined linear sea level trends (mm/yr) when applying corrections listed in Table 1 to along-track altimeter measurements in selected regions around Taiwan.

Linear sea level trends (mm/yr) applying alternative geophysical or range corrections.



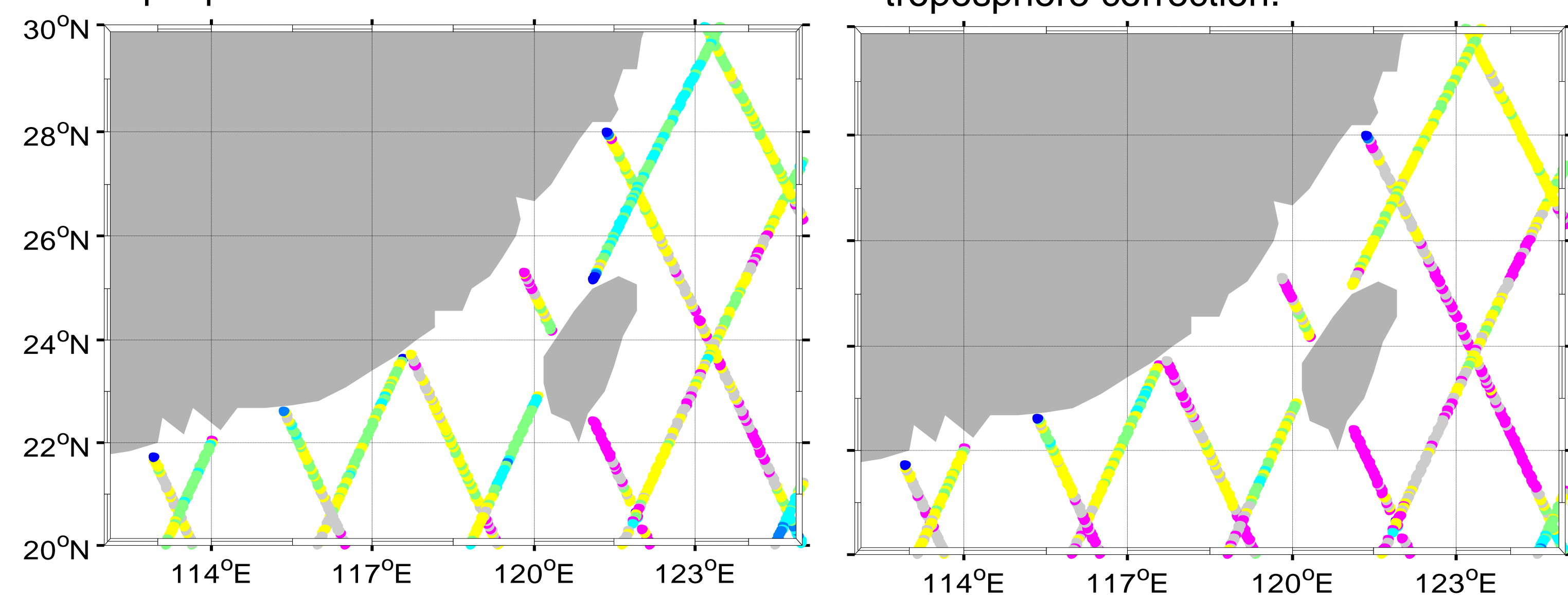
All corrections from default settings in RADS, i.e. applying 701, 801, 903, 1004, 1217 and 1502 for range and geophysical corrections.

All corrections from default settings except 701 replaced by 702 for dry troposphere correction.



All corrections from default settings except 801 replaced by 802 for wet troposphere correction.

All corrections from default settings except 903 replaced by 901 for wet troposphere correction.



All corrections from default settings except 1017 replaced by 1200 for wet troposphere correction.

All corrections from default settings except 1004 replaced by 1001 for wet troposphere correction.