Australian Government
Bureau of Meteorology

Severe Tropical Cyclone *Narelle*

5 – 15 January 2013

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1 Summary

A strong monsoon flow combined with a burst of the Madden-Julian Oscillation (MJO) to form a tropical low near 10.5ºS 126ºE. This tropical low initially moved west southwest and slowly developed. *Narelle* reached cyclone strength at 0000 Universal Time Coordinated (0800 AWST=UTC+8 hours) 8 January and continued to develop under favourable conditions. From 9 January *Narelle* tracked in a southwest direction and reached a 10-minute mean wind peak intensity of 105 knots (kn) (195 kilometres per hour (km/h)) at 1200 UTC 11 January when it was located around 470 kilometres (km) to the north northwest of Exmouth, Western Australia (WA). *Narelle* moved south southwest from 13 January, parallel to the WA coastline, as it weakened due to a combination of increased vertical wind shear and cooler sea surface temperatures (SSTs). *Narelle* weakened below tropical cyclone strength at 0600 UTC 14 January, finally dissipating well offshore to the west of Perth.

Though the tropical cyclone never directly affected the mainland it did cause disruption to Northwest Shelf operations. *Narelle* also produced a tidal surge which affected the WA coastline from Onslow to Busselton, the peak being 110 centimetres (cm) at Onslow and 84 cm at Exmouth on 13 January, while the surge down the west coast reached 90 cm at Busselton and 78 cm at Fremantle on 16 January. This caused elevated tides that caused some inundation of low lying areas but no major impact overall.

1.1 Intensity analysis

A tropical low became evident in an active monsoon trough around 1200 UTC 5 April with an initial Dvorak Data T-number (DT) 1.0. Conditions were favourable for development and the tropical low steadily intensified, reaching tropical cyclone strength at 0000 UTC 8 January. During 8 January curved banding improved and by 9 January an eye pattern emerged. Averaging all objective and subjective intensity guidance *Narelle* reached a 10-minute mean wind peak intensity of 105 kn (195 km/h) at 1200 UTC 11 January (refer Figure 2). Objective Advanced Dvorak Technique (ADT) failed to analyse an eye pattern so intensity estimates lagged subjective Dvorak estimates until 1200 UTC 11 January (refer Figure 3). During 12 January *Narelle* began to track south over cooler SSTs and the vertical wind shear increased. This caused Narelle to begin to weaken and as a result the eye pattern disappeared around 1000 UTC 12 January. As *Narelle* tracked south southwest parallel to the WA coastline it steadily weakened, eventually decreasing to below tropical cyclone strength at 0600 UTC 14 January over ocean to the west of Perth.

1.2 Motion

Narelle was steered by the mid-level ridge located over Australia and the tropical cyclone moved west southwest. During 9 January the ridge weakened as a mid-level trough approached from the west and *Narelle* began to move south southwest. By

0000 UTC 12 January *Narelle* had been captured by the mid-level trough and was steered south as it weakened under increased vertical wind shear.

1.3 Structure

Narelle developed under low to moderate vertical wind shear so the cloud structures were reasonably symmetric until it began to weaken. The tropical cyclone had a larger radius to gales in the southern quadrants for its lifetime. Initially radius to gales ranged from 60 to 90 nm (110 – 167 km), as the tropical cyclone developed this increased to 120 to 150 nm (120 – 278 km). The radius to maximum wind (RMW) was initially 30 nm (56 km), this decreased down to 15 nm (28 km) at peak intensity. The eye diameter ranged in size from 30 nm (56 km) down to around 10 nm (18 km) at peak intensity.

2 Impact

Narelle had no impact on mainland Australia however the Northwest Shelf offshore industries experienced some affects. As *Narelle* moved parallel to the coast an associated tidal surge was recorded from Onslow around to Busselton, the peak being 110cm at Onslow and 84cm at Exmouth on 13 January (refer Figure 4), while the surge down the west coast reached 90cm at Busselton and 78cm at Fremantle on 16 January. This caused elevated tides that caused some inundation of low lying areas but no major impact overall.

3 Observations

Other than an associated tidal surge there were no observations recorded during the lifetime of *Narelle.*

4 Forecast Performance

The accuracy statistics obtained by comparing the forecast positions against the best track positions for *Narelle* are

Forecast Hour	**0**	**06**	**12**	**18**	**24**	**36**	**48**	**72**	**96**	**120**	**144**	**168**
Absolute error (km)	30	46	60	60	65	79	100	144	187	219	182	250
RMS error (km)	33	54	72	70	76	90	109	153	217	252	206	277

Figure 5 is a plot of the accuracy figures for *Narelle* compared to the five year mean.

TABLE 1. Best track summary for Severe Tropical Cyclone *Narelle*

Refer to the Australian Tropical Cyclone database for complete listing of parameters. AWST is UTC + 8 hours. Please note data between 0600 UTC 4 April and 0600 UTC 6 April from La Reunion RSMC.

Year	Month	Day	Hour UTC	Pos. Lat S	Pos. Long. E	Pos. Acc. n mi	Max Wind 10 min kn	Max gust kn	Cent. Press. hPa	Rad. of gales (NE/SE/SW/NW)	Rad. of storm (NE/SE/SW/NW)	RMW n mi
2013	01	05	1200	10.5	126.0	60	20	45	1005			
2013	01	05	1800	10.5	125.7	60	20	45	1003			
2013	01	06	0000	10.5	125.5	60	25	45	1000			
2013	01	06	0600	10.8	125.0	60	25	45	1001			
2013	01	06	1200	11.0	123.7	60	25	45	1002			
2013	01	06	1800	11.2	122.9	60	25	45	1002			
2013	01	07	0000	11.4	121.8	60	25	45	1001			
2013	01	07	0600	11.4	121.4	60	25	45	1001			
2013	01	07	1200	11.3	120.7	60	25	45	999			
2013	01	07	1800	11.6	119.9	45	30	45	997			
2013	01	08	0000	11.9	119.1	30	35	50	995	60/90/90/60		30
2013	01	08	0600	12.1	118.4	30	40	55	993	60/90/90/60		30
2013	01	08	1200	12.2	117.8	30	45	65	987	60/90/90/60		30
2013	01	08	1800	12.4	117.2	30	50	70	985	60/90/90/60	30/60/60/30	20
2013	01	09	0000	12.6	116.7	20	55	75	982	60/90/90/60	30/60/60/30	15

Year	Month	Day	Hour UTC	Pos. Lat S	Pos. Long. E	Pos. Acc. n mi	Max Wind 10 min kn	Max gust kn	Cent. Press. hPa	Rad. of gales (NE/SE/ SW/NW)	Rad. of storm (NE/SE/ SW/NW)	RMW n mi
2013	01	09	0600	13.0	116.4	20	60	85	978	75/110/110/75	40/70/70/40	15
2013	01	09	1200	13.4	116.1	20	65	90	972	90/120/120/90	40/70/70/40	15
2013	01	09	1800	13.8	115.9	20	65	90	972	90/120/120/90	40/70/70/40	15
2013	01	10	0000	14.4	115.7	15	70	100	967	90/120/120/90	40/70/70/40	15
2013	01	10	0600	15.6	115.2	15	75	105	964	90/120/120/90	40/70/70/40	15
2013	01	10	1200	16.3	115.0	15	85	120	952	90/120/120/90	50/70/70/50	15
2013	01	10	1800	16.6	114.4	15	90	125	949	90/120/120/90	50/70/70/50	15
2013	01	11	0000	17.0	113.8	15	95	135	943	120/150/150/120	60/80/80/60	15
2013	01	11	0600	17.6	113.2	15	100	140	938	120/150/150/120	60/80/80/60	15
2013	01	11	1200	17.9	112.7	10	105	145	930	120/150/150/120	60/80/80/60	15
2013	01	11	1800	18.3	112.3	10	105	145	930	120/150/150/120	60/80/80/60	15
2013	01	12	0000	18.6	112.0	10	105	145	932	120/150/150/120	60/80/80/60	15
2013	01	12	0600	19.3	112.0	10	100	140	936	120/150/150/120	60/80/80/60	15
2013	01	12	1200	19.9	111.6	10	95	135	941	120/150/150/120	60/80/80/60	15
2013	01	12	1800	20.5	111.3	10	85	120	950	110/120/120/90	60/80/60/40	15

Year	Month	Day	Hour UTC	Pos. Lat S	Pos. Long. E	Pos. Acc. n mi	Max Wind 10 min kn	Max gust kn	Cent. Press. hPa	Rad. of gales (NE/SE/ SW/NW)	Rad. of storm (NE/SE/ SW/NW)	RMW n mi
2013	01	13	0000	21.4	110.8	10	70	100	965	90/90/90/60	60/60/30/30	15
2013	01	13	0600	22.3	110.4	10	65	90	969	90/90/110/75	60/60/30/30	20
2013	01	13	1200	23.3	110.1	15	50	70	976	90/90/120/90	60/60/30/30	20
2013	01	13	1800	24.3	110.0	20	45	65	983	60/90/90/60		20
2013	01	14	0000	25.3	109.9	20	40	55	987	60/90/90/60		25
2013	01	14	0600	26.5	109.7	20	35	50	994	0/90/0/0		25
2013	01	14	1200	27.6	109.5	30	25	45	1000			
2013	01	14	1800	28.8	109.2	30	25	45	1001			
2013	01	15	0000	30.0	109.0	20	20	45	1004			
2013	01	15	0600	31.1	109.5	30	15	45	1006			

Figure 1. Best track of *Narelle* 5-15 January 2013 (times in AWST, UTC+8).

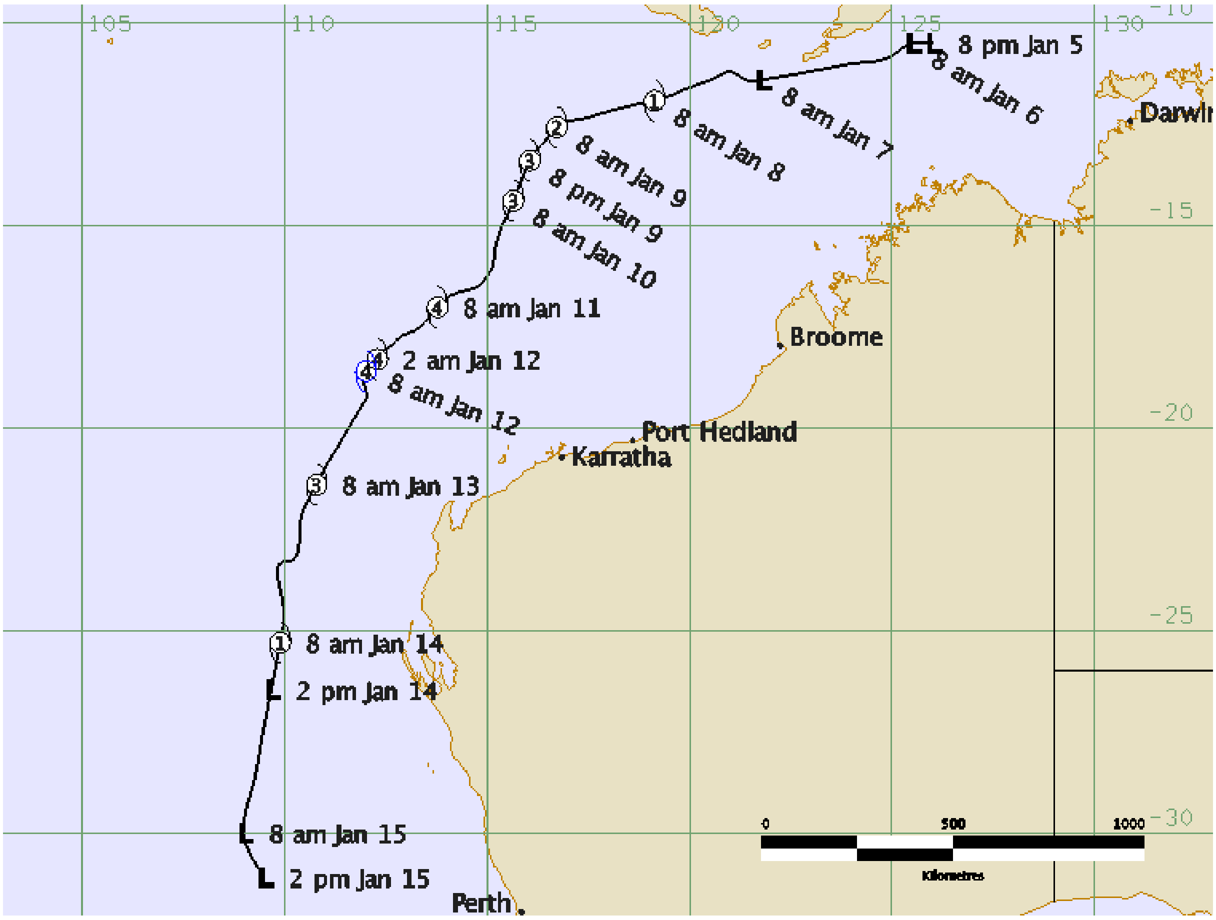

Figure 2. SSMIS microwave image at 1002 UTC 11 January 2013 around peak intensity.

(image courtesy of NOAA NRL: http://www.nrlmry.navy.mil/)

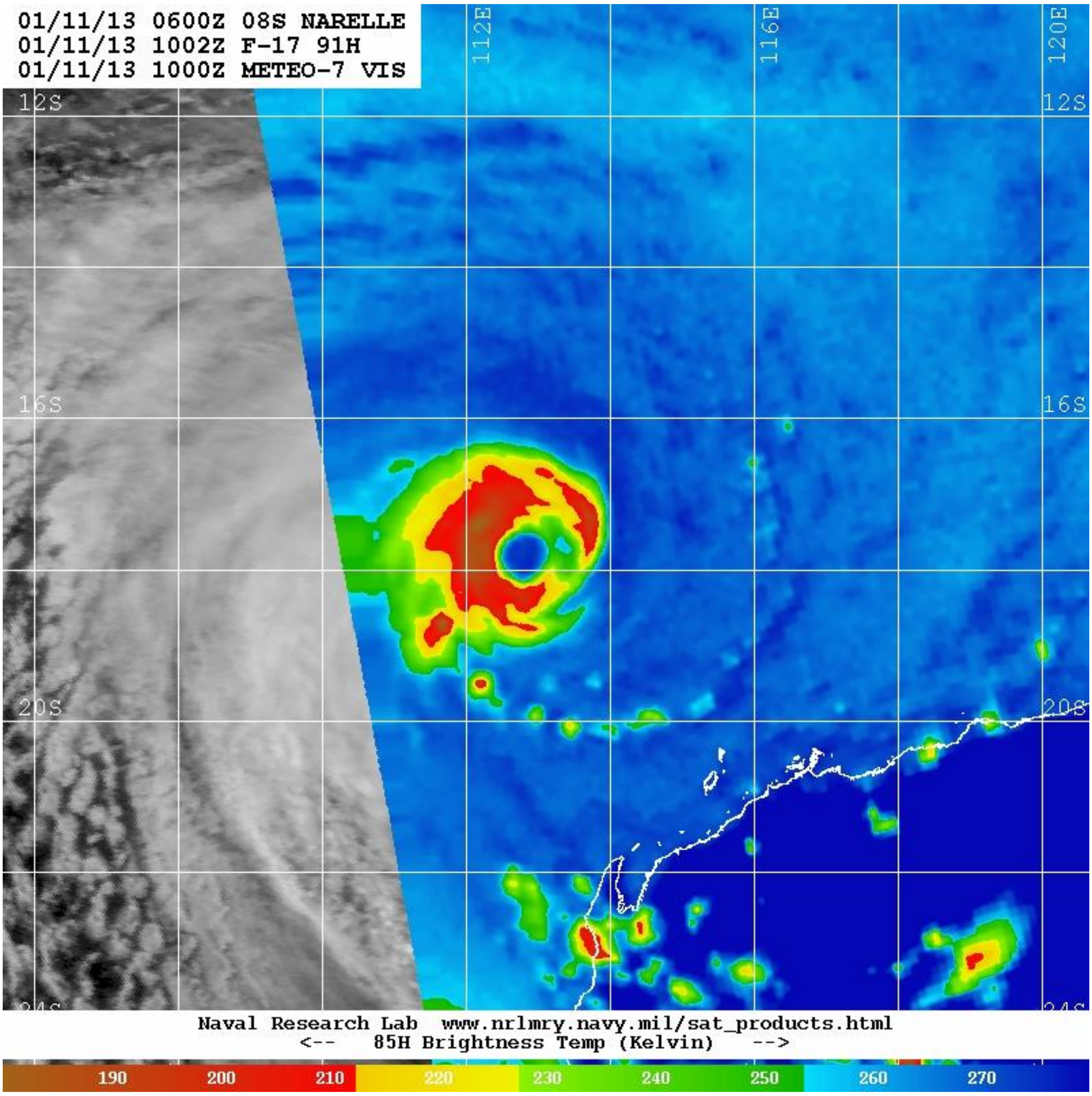

Figure 3. Comparison of objective and subjective intensity estimates for *Narelle*.

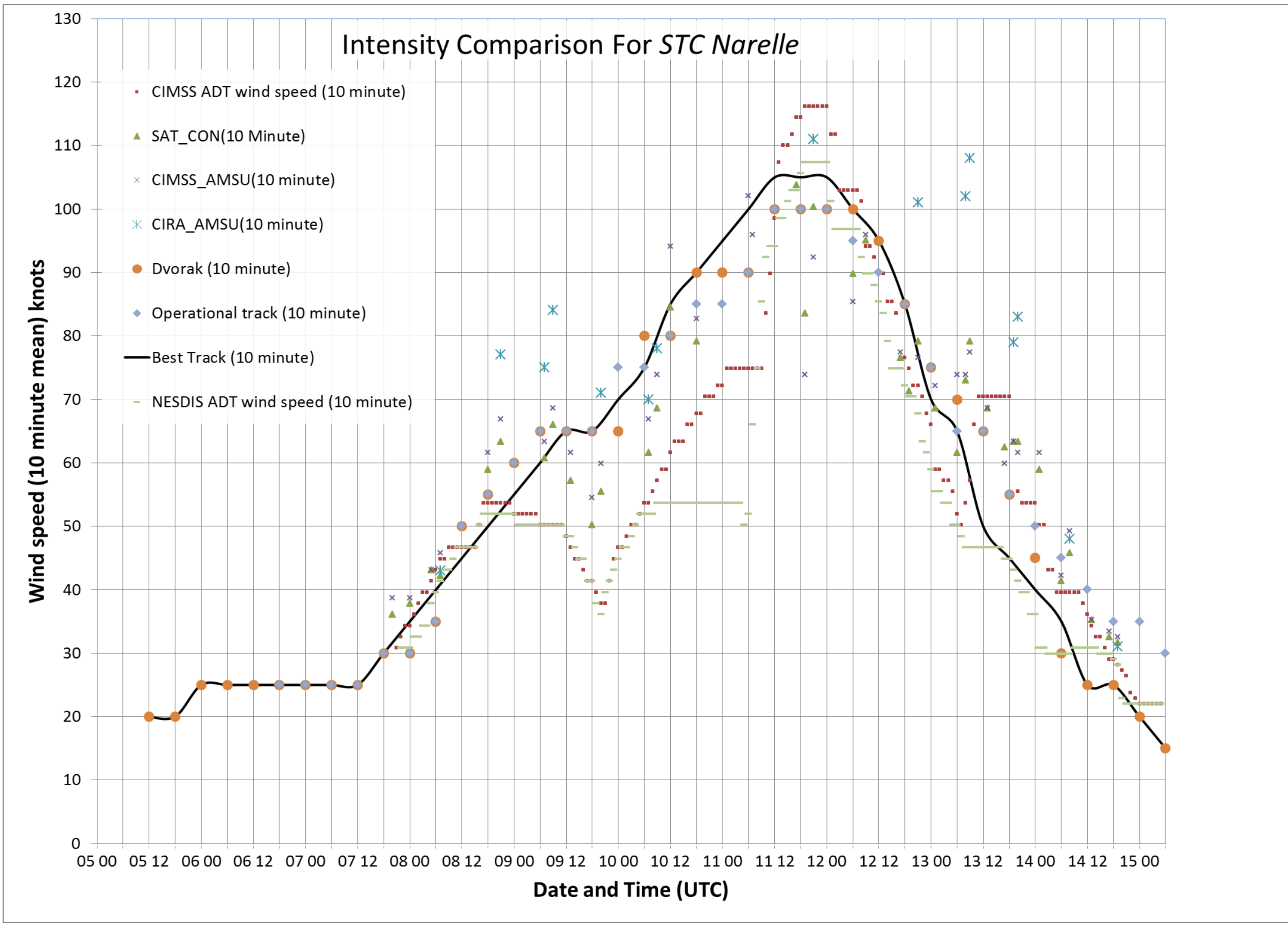

Figure 4. Comparison of storm surge associated with *Narelle*.

Image courtesy of Western Australian Department of Transport http://www.transport.wa.gov.au/imarine/storm-surge-comparison-chart.asp

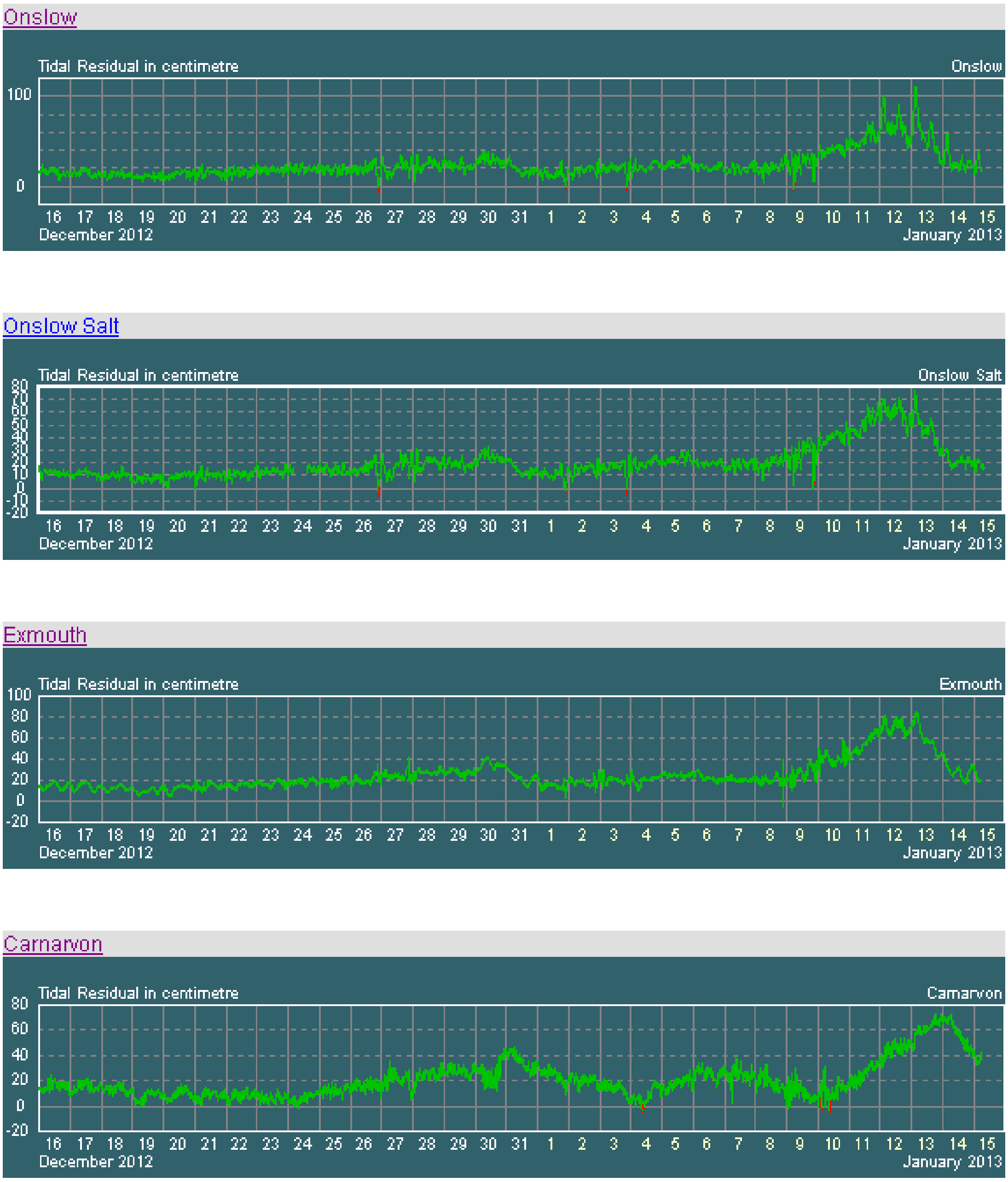

Figure 5. Accuracy statistics for *Narelle*