

Table 1. Submissions for ONRT course keeping in head and variable heading waves at  $Fr=0.2$ 

Institute	ABS	CSSRC	ECN CNRS	HHI	IIHR	IIHR
Code	OpenFOAM	FLUENT12	ISISCFD-AD	STAR-CCM+	CFDShip-Iowa	REX
Cases*	3.12, 3.13-C3	3.12	3.12, 3.13-C1	3.12	3.12,3.13-C1,2,3,4	3.12,3.13-C1,3
Turbulence	Two- eq.	Two- eq.	Two- eq.	Two- eq.	Two- eq.	Two- eq.
Free Surface	VOF	VOF	VOF	VOF	Level set	Level set
Propeller	Discretized	Body Force	Body Force	Discretized	Body Force	Discretized
Motions	6DOF	2DOF (heave, pitch)	6DOF	6DOF	6DOF	6DOF
Rudders	Active	Fixed	Active	Fixed	Active	Active
Discretization	Finite Vol.	Finite Vol.	Finite Vol.	Finite Vol.	Finite Dif.	Finite Dif.
Grid motion	Overset	All moving	Deforming Grid/Overset	All moving	Overset	Overset
Grid type	Unstructured	Unstructured	Unstructured	Unstructured	Structured	Structured
Grid size	6.3-6.5 M	1.15 M	6.5 M	10.7 M	23.2 M	35 M
No .CPU	16	16	48-64	32	224	270
CPU Time (CPUh)	3600	NA	14500	NA	32500	70000

\*Case 3.12 ( $\mu=0$  deg); Case 3.13-C1 ( $\mu=45$  deg); Case 3.13-C2 ( $\mu=90$  deg); Case 3.13-C3 ( $\mu=135$  deg); Case 3.13-C4 ( $\mu=180$  deg)

Table 2. Mean and SD of submission values for 0<sup>th</sup> harmonic amplitudes for ONRT course keeping at Fr=0.20

		x-vel.		Heave/A		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
$\bar{S}$	$\mu=0^\circ$		0.8307		0.0337		0.0007								
	$\mu=45^\circ$		0.8944		0.0376		-0.0174		-0.0519		-0.0485		-0.4965		
	$\mu=90^\circ$		0.9925		0.0381		-0.0091		-0.0083		0.0351		-0.0627		
	$\mu=135^\circ$		0.9699		0.0540		-0.0253		-0.0227		-0.3547		0.1500		
	$\mu=180^\circ$		0.9890		0.0626		-0.0140								
SD% $\bar{S}$	$\mu=0^\circ$		2		71		4615							<b>1563</b>	
	$\mu=45^\circ$		3		17		32		53		286		6	<b>66</b>	
	$\mu=90^\circ$														
	$\mu=135^\circ$		1		43		21		3		9		46	<b>20</b>	
	$\mu=180^\circ$														
Ave.			<b>2</b>		<b>44</b>		<b>1556</b>		<b>28</b>		<b>147</b>		<b>26</b>	<b>300</b>	

Table 3. Mean and SD of submission values for 1<sup>st</sup> harmonic amplitudes for ONRT course keeping at Fr=0.20

		$\zeta/L$		x-vel.		Heave/A		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
		Amp		Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
$\bar{S}$	$\mu=0^\circ$	0.010	0.018	-0.306	0.566	2.93	0.637	1.406									
	$\mu=45^\circ$	0.010	0.036	-1.711	0.824	-1.983	0.671	0.210	0.041	-2.05	0.272	-0.515	0.16	-1.955			
	$\mu=90^\circ$	0.010	0.002	0.696	1.04	3.935	0.031	1.706	0.107	3.91	0.713	5.089	0.027	5.307			
	$\mu=135^\circ$	0.012	0.089	3.809	0.501	2.89	0.418	3.168	0.065	2.544	2.996	2.748	0.412	3.95			
	$\mu=180^\circ$	0.010	0.055	-3.667	0.148	-0.232	0.255	-2.302									
SD% $\bar{S}$	$\mu=0^\circ$	3	6	821	11	108	4	162								<b>6</b>	<b>364</b>
	$\mu=45^\circ$	4	13	81	2	73	3	678	22	65	7	290	3	69		<b>8</b>	<b>210</b>
	$\mu=90^\circ$																
	$\mu=135^\circ$	21	26	27	7	76	6	65	10	81	26	78	13	31		<b>16</b>	<b>60</b>
	$\mu=180^\circ$																
Ave.		<b>9</b>	<b>15</b>	<b>310</b>	<b>7</b>	<b>86</b>	<b>4</b>	<b>302</b>	<b>16</b>	<b>73</b>	<b>16</b>	<b>184</b>	<b>8</b>	<b>50</b>		<b>11</b>	<b>167</b>

Table 4. Mean and SD of submission values for 2<sup>nd</sup> harmonic amplitudes for ONRT course keeping at Fr=0.20

		x-vel.		Heave/A		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
		Amp		Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
$\bar{S}$	$\mu=0^\circ$	0.005	-2.598	0.017	1.714	0.019	-1.270								
	$\mu=45^\circ$	0.002	2.947	0.015	0.78	0.014	-0.685	0.002	2.744	0.015	1.369	0.007	-0.123		
	$\mu=90^\circ$	0.0002	2.035	0.008	0.203	0.014	-1.959	0.005	0.553	0.007	-0.462	0.002	0.688		
	$\mu=135^\circ$	0.002	0.208	0.041	-1.51	0.029	-1.439	0.007	-1.344	0.084	-1.681	0.005	0.023		
	$\mu=180^\circ$	0.001	-1.512	0.021	-0.616	0.004	-2.361								
SD% $\bar{S}$	$\mu=0^\circ$	21	16	6	32	43	87							<b>23</b>	<b>45</b>
	$\mu=45^\circ$	12	14	34	49	46	364	47	24	1	77	1	1971	<b>23</b>	<b>417</b>
	$\mu=90^\circ$														
	$\mu=135^\circ$	27	726	24	67	17	152	15	165	30	75	34	7641	<b>25</b>	<b>1471</b>
	$\mu=180^\circ$														
Ave.		<b>20</b>	<b>252</b>	<b>21</b>	<b>49</b>	<b>35</b>	<b>201</b>	<b>31</b>	<b>95</b>	<b>15</b>	<b>76</b>	<b>17</b>	<b>4806</b>	<b>23</b>	<b>913</b>

Table 5. Average comparison error  $|E|/D$  for 0<sup>th</sup> harmonic of motions for  $\mu=0^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
1	ABS	OpenFOAM	-4	53	25				27
2	CSSRC	FLUENT12	0	69	175				81
3	ECN CNRS	ISISCFD-AD	2	18	47				23
4	HHI	STAR-CCM+	-3	115	344				154
5	IIHR	CFDShip-Iowa V4.5	-2	10	11				8
6	IIHR	REX	-2	36	15				18
<b>Ave. <math> E /D</math></b>			<b>2</b>	<b>50</b>	<b>103</b>				<b>52</b>
<b>SD <math> E /D</math></b>			<b>1</b>	<b>35</b>	<b>122</b>				<b>53</b>

Table 6. Average comparison error  $|E|/D$  for 0<sup>th</sup> harmonic of motions for  $\mu=45^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
3	ECN CNRS	ISISCFD-AD	6	84	73	-306	191	6	111
5	IIHR	CFDShip-Iowa V4.5	-1	79	39	-48	11	6	31
6	IIHR	REX	1	76	57	-43	9	18	34
<b>Ave. <math> E /D</math></b>			<b>3</b>	<b>80</b>	<b>57</b>	<b>132</b>	<b>70</b>	<b>10</b>	<b>59</b>
<b>SD <math> E /D</math></b>			<b>2</b>	<b>3</b>	<b>14</b>	<b>123</b>	<b>85</b>	<b>5</b>	<b>39</b>

Table 7. Average comparison error  $|E|/D$  for 0<sup>th</sup> harmonic of motions for  $\mu=90^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
5	IIHR	CFDShip-Iowa V4.5	0	282	64	75	62	63	91
<b>Ave. <math> E /D</math></b>			<b>0</b>	<b>282</b>	<b>64</b>	<b>75</b>	<b>62</b>	<b>63</b>	<b>91</b>
<b>SD <math> E /D</math></b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Table 8. Average comparison error  $|E|/D$  for 0<sup>th</sup> harmonic of motions for  $\mu=135^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
1	ABS	OpenFOAM	0	-541	-161	690	-185	122	283
5	IIHR	CFDShip-Iowa V4.5	1	-540	-71	648	-162	183	268
6	IIHR	REX	3	-94	-75	670	-127	160	188
<b>Ave. <math> E /D</math></b>			<b>1</b>	<b>392</b>	<b>102</b>	<b>669</b>	<b>158</b>	<b>155</b>	<b>246</b>
<b>SD <math> E /D</math></b>			<b>1</b>	<b>210</b>	<b>41</b>	<b>17</b>	<b>24</b>	<b>25</b>	<b>53</b>

Table 9. Average comparison error  $|E|/D$  for 0<sup>th</sup> harmonic of motions for  $\mu=180^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
5	IIHR	CFDShip-Iowa V4.5	0	24	-162				62
<b>Ave. <math> E /D</math></b>			<b>0</b>	<b>24</b>	<b>162</b>				<b>62</b>
<b>SD <math> E /D</math></b>			<b>0</b>	<b>0</b>	<b>0</b>				<b>0</b>

Table 10. Average comparison error  $|E|/D$  for 0<sup>th</sup> harmonic of motions over five heading conditions\* for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
1	ABS	OpenFOAM	2	297	93	690	185	122	232
2	CSSRC	FLUENT12	0	69	175				81
3	ECN CNRS	ISISCFD-AD	4	51	60	306	191	6	103
4	HHI	STAR-CCM+	3	115	344				154
5	IIHR	CFDShip-Iowa V4.5	1	187	69	257	78	84	113
6	IIHR	REX	2	69	49	357	68	89	105
<b>Ave. <math> E /D</math></b>			<b>2</b>	<b>131</b>	<b>132</b>	<b>402</b>	<b>130</b>	<b>75</b>	<b>146</b>
<b>SD <math> E /D</math></b>			<b>1</b>	<b>87</b>	<b>103</b>	<b>170</b>	<b>58</b>	<b>43</b>	<b>77</b>

\* Heading conditions include  $\mu=0^\circ, 45^\circ, 90^\circ, 135^\circ, 180^\circ$

Table 11. Average comparison error  $E\%D$  for 0<sup>th</sup> harmonic of motions for  $\mu=0^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
1	ABS	OpenFOAM	-4	53	25				27
2	CSSRC	FLUENT12	0	69	175				81
3	ECN CNRS	ISISCFD-AD	2	18	47				23
4	HHI	STAR-CCM+	-3	115	344				154
5	IIHR	CFDShip-Iowa V4.5	-2	10	11				8
6	IIHR	REX	-2	36	15				18
<b>Ave. E%D</b>			<b>-1</b>	<b>50</b>	<b>103</b>				<b>51</b>
<b>SD E%D</b>			<b>2</b>	<b>35</b>	<b>122</b>				<b>53</b>

Table 12. Average comparison error  $E\%D$  for 0<sup>th</sup> harmonic of motions for  $\mu=45^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
3	ECN CNRS	ISISCFD-AD	6	84	73	-306	191	6	111
5	IIHR	CFDShip-Iowa V4.5	-1	79	39	-48	11	6	31
6	IIHR	REX	1	76	57	-43	9	18	34
<b>Ave. E%D</b>			<b>2</b>	<b>80</b>	<b>57</b>	<b>-132</b>	<b>70</b>	<b>10</b>	<b>58</b>
<b>SD E%D</b>			<b>3</b>	<b>3</b>	<b>14</b>	<b>123</b>	<b>85</b>	<b>5</b>	<b>39</b>

Table 13. Average comparison error  $E\%D$  for 0<sup>th</sup> harmonic of motions for  $\mu=90^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
5	IIHR	CFDShip-Iowa V4.5	0	282	64	75	62	63	91
<b>Ave. E%D</b>			<b>0</b>	<b>282</b>	<b>64</b>	<b>75</b>	<b>62</b>	<b>63</b>	<b>91</b>
<b>SD E%D</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Table 14. Average comparison error  $E\%D$  for 0<sup>th</sup> harmonic of motions for  $\mu=135^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
1	ABS	OpenFOAM	0	-541	-161	690	-185	122	283
5	IIHR	CFDShip-Iowa V4.5	1	-540	-71	648	-162	183	268
6	IIHR	REX	3	-94	-75	670	-127	160	188
<b>Ave. E%D</b>			<b>1</b>	<b>-392</b>	<b>-102</b>	<b>669</b>	<b>-158</b>	<b>155</b>	<b>246</b>
<b>SD E%D</b>			<b>1</b>	<b>210</b>	<b>41</b>	<b>17</b>	<b>24</b>	<b>25</b>	<b>53</b>

Table 15. Average comparison error  $E\%D$  for 0<sup>th</sup> harmonic of motions for  $\mu=180^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
5	IIHR	CFDShip-Iowa V4.5	0	24	-162				62
<b>Ave. E%D</b>			<b>0</b>	<b>24</b>	<b>-162</b>				<b>62</b>
<b>SD E%D</b>			<b>0</b>	<b>0</b>	<b>0</b>				<b>0</b>

Table 16. Average comparison error  $E\%D$  for 0<sup>th</sup> harmonic of motions over **five** heading conditions\* for ONRT course keeping submissions

No	Institute	Code	x-vel.	Heave/L	Pitch/Ak	y-vel.	Roll/Ak	Yaw/Ak	Ave.
1	ABS	OpenFOAM	-2	-244	-68	690	-185	122	219
2	CSSRC	FLUENT12	-1	-29	-24	225	-30	84	81
3	ECN CNRS	ISISCFD-AD	0	69	175				103
4	HHI	STAR-CCM+	4	51	60	-306	191	6	154
5	IIHR	CFDShip-Iowa V4.5	0	6	-1	313	-59	89	65
6	IIHR	REX	-3	115	344				78
<b>Ave. E%D</b>			<b>0</b>	<b>-5</b>	<b>81</b>	<b>231</b>	<b>-21</b>	<b>75</b>	<b>69</b>
<b>SD E%D</b>			<b>2</b>	<b>116</b>	<b>140</b>	<b>356</b>	<b>135</b>	<b>43</b>	<b>132</b>

\* Heading conditions include  $\mu=0^\circ, 45^\circ, 90^\circ, 135^\circ, 180^\circ$

Table 17. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=0^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
1	ABS	OpenFOAM	-3	50	2	-4	-1	6	-2							16	2
2	CSSRC	FLUENT12	-3			24	3	11	8							10	5
3	ECN CNRS	ISISCFD-AD	6	44	2	0	0	5	0							14	1
4	HHI	STAR-CCM+	2	53	4	11	0	13	0							20	2
5	IIHR	CFDShip-Iowa V4.5	0	46	-2	-5	-2	1	-3							13	2
6	IIHR	REX	-1	48	2	-1	-1	4	-1							14	2
<b>Ave. <math> E \%D</math></b>			<b>2</b>	<b>40</b>	<b>2</b>	<b>8</b>	<b>1</b>	<b>7</b>	<b>2</b>							<b>14</b>	<b>2</b>
<b>SD <math> E \%D</math></b>			<b>2</b>	<b>18</b>	<b>1</b>	<b>8</b>	<b>1</b>	<b>4</b>	<b>3</b>							<b>8</b>	<b>2</b>

Table 18. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=45^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
3	ECN CNRS	ISISCFD-AD	-6	43	-45	-3	12	-3	13	19	14	36	-44	4	13	16	23
5	IIHR	CFDShip-Iowa V4.5	0	57	-2	0	-43	-4	-43	47	-42	26	47	5	-44	20	37
6	IIHR	REX	3	55	47	-5	5	-9	6	49	11	37	2	11	10	24	13
<b>Ave. <math> E \%D</math></b>			<b>3</b>	<b>52</b>	<b>31</b>	<b>3</b>	<b>20</b>	<b>5</b>	<b>20</b>	<b>38</b>	<b>22</b>	<b>33</b>	<b>31</b>	<b>7</b>	<b>22</b>	<b>20</b>	<b>25</b>
<b>SD <math> E \%D</math></b>			<b>3</b>	<b>6</b>	<b>21</b>	<b>2</b>	<b>16</b>	<b>3</b>	<b>16</b>	<b>14</b>	<b>14</b>	<b>5</b>	<b>21</b>	<b>3</b>	<b>15</b>	<b>5</b>	<b>17</b>

Table 19. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=90^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
5	IIHR	CFDShip-Iowa V4.5	2	86	-24	0	1	-34	10	46	43	42	-6	33	-12	35	16
<b>Ave. <math> E \%D</math></b>			<b>2</b>	<b>86</b>	<b>24</b>	<b>0</b>	<b>1</b>	<b>34</b>	<b>10</b>	<b>46</b>	<b>43</b>	<b>42</b>	<b>6</b>	<b>33</b>	<b>12</b>	<b>35</b>	<b>16</b>
<b>SD <math> E \%D</math></b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Table 20. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=135^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
1	ABS	OpenFOAM	1	45	11	13	-19	13	-16	28	-21	-96	-30	14	-20	30	20
5	IIHR	CFDShip-Iowa V4.5	-2	43	34	-4	5	5	7	35	3	-93	-4	17	5	28	10
6	IIHR	REX	-54	7	-48	0	22	-2	24	44	24	-5	14	37	28	22	27
<b>Ave. <math> E \%D</math></b>			<b>19</b>	<b>32</b>	<b>31</b>	<b>6</b>	<b>15</b>	<b>7</b>	<b>16</b>	<b>36</b>	<b>16</b>	<b>65</b>	<b>16</b>	<b>23</b>	<b>18</b>	<b>27</b>	<b>19</b>
<b>SD <math> E \%D</math></b>			<b>25</b>	<b>18</b>	<b>15</b>	<b>5</b>	<b>7</b>	<b>4</b>	<b>7</b>	<b>7</b>	<b>10</b>	<b>42</b>	<b>11</b>	<b>10</b>	<b>10</b>	<b>16</b>	<b>10</b>

Table 21. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=180^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
5	IIHR	CFDShip-Iowa V4.5	-6	11	-3	-14	-1	-12	1							11	2
<b>Ave. <math> E \%D</math></b>			<b>6</b>	<b>11</b>	<b>3</b>	<b>14</b>	<b>1</b>	<b>12</b>	<b>1</b>							<b>11</b>	<b>2</b>
<b>SD <math> E \%D</math></b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>							<b>0</b>	<b>0</b>

Table 22. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 1<sup>st</sup> harmonic of motions over **five** heading conditions\* for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
1	ABS	OpenFOAM	2	48	6	8	10	10	9	28	21	96	30	14	20	29	16
2	CSSRC	FLUENT12	3			24	3	11	8							13	5
3	ECN CNRS	ISISCFD-AD	6	44	23	2	6	4	6	19	14	36	44	4	13	16	18
4	HHI	STAR-CCM+	2	53	4	11	0	13	0							20	2
5	IIHR	CFDShip-Iowa V4.5	2	48	13	5	10	11	13	43	29	54	19	18	20	26	17
6	IIHR	REX	19	37	33	2	9	5	11	46	18	21	8	24	19	22	16
<b>Ave. <math> E \%D</math></b>			<b>6</b>	<b>46</b>	<b>16</b>	<b>8</b>	<b>7</b>	<b>9</b>	<b>8</b>	<b>34</b>	<b>20</b>	<b>52</b>	<b>25</b>	<b>15</b>	<b>18</b>	<b>24</b>	<b>16</b>
<b>SD <math> E \%D</math></b>			<b>6</b>	<b>6</b>	<b>11</b>	<b>8</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>11</b>	<b>6</b>	<b>28</b>	<b>14</b>	<b>7</b>	<b>3</b>	<b>9</b>	<b>7</b>

\* Heading conditions include  $\mu=0^\circ, 45^\circ, 90^\circ, 135^\circ, 180^\circ$

Table 23. Average comparison error  $E\%D$  or  $E\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=0^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
1	ABS	OpenFOAM	-3	50	2	-4	-1	6	-2							16	2
2	CSSRC	FLUENT12	-3			24	3	11	8							13	5
3	ECN CNRS	ISISCFD-AD	6	44	2	0	0	5	0							14	1
4	HHI	STAR-CCM+	2	53	4	11	0	13	0							20	2
5	IIHR	CFDShip-Iowa V4.5	0	46	-2	-5	-2	1	-3							13	2
6	IIHR	REX	-1	48	2	-1	-1	4	-1							14	2
<b>Ave. E%D</b>			<b>0</b>	<b>48</b>	<b>2</b>	<b>4</b>	<b>0</b>	<b>7</b>	<b>0</b>							<b>15</b>	<b>1</b>
<b>SD E%D</b>			<b>3</b>	<b>3</b>	<b>2</b>	<b>10</b>	<b>2</b>	<b>4</b>	<b>4</b>							<b>5</b>	<b>2</b>

Table 24. Average comparison error  $E\%D$  or  $E\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=45^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
3	ECN CNRS	ISISCFD-AD	-6	43	-45	-3	12	-3	13	19	14	36	-44	4	13	16	23
5	IIHR	CFDShip-Iowa V4.5	0	57	-2	0	-43	-4	-43	47	-42	26	47	5	-44	20	37
6	IIHR	REX	3	55	47	-5	5	-9	6	49	11	37	2	11	10	24	13
<b>Ave. E%D</b>			<b>-1</b>	<b>52</b>	<b>0</b>	<b>-2</b>	<b>-8</b>	<b>-5</b>	<b>-8</b>	<b>38</b>	<b>-6</b>	<b>33</b>	<b>1</b>	<b>7</b>	<b>-7</b>	<b>20</b>	<b>5</b>
<b>SD E%D</b>			<b>4</b>	<b>6</b>	<b>38</b>	<b>2</b>	<b>24</b>	<b>3</b>	<b>25</b>	<b>14</b>	<b>26</b>	<b>5</b>	<b>37</b>	<b>3</b>	<b>26</b>	<b>5</b>	<b>29</b>

Table 25. Average comparison error  $E\%D$  or  $E\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=90^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
5	IIHR	CFDShip-Iowa V4.5	2	86	-24	0	1	-34	10	46	43	42	-6	33	-12	35	16
<b>Ave. E%D</b>			<b>2</b>	<b>86</b>	<b>-24</b>	<b>0</b>	<b>1</b>	<b>-34</b>	<b>10</b>	<b>46</b>	<b>43</b>	<b>42</b>	<b>-6</b>	<b>33</b>	<b>-12</b>	<b>35</b>	<b>16</b>
<b>SD E%D</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Table 26. Average comparison error  $E\%D$  or  $E\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=135^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
1	ABS	OpenFOAM	1	45	11	13	-19	13	-16	28	-21	-96	-30	14	-20	30	20
5	IIHR	CFDShip-Iowa V4.5	-2	43	34	-4	5	5	7	35	3	-93	-4	17	5	28	10
6	IIHR	REX	-54	7	-48	0	22	-2	24	44	24	-5	14	37	28	22	27
<b>Ave. E%D</b>			<b>-18</b>	<b>32</b>	<b>-1</b>	<b>3</b>	<b>2</b>	<b>5</b>	<b>5</b>	<b>36</b>	<b>2</b>	<b>-65</b>	<b>-7</b>	<b>23</b>	<b>4</b>	<b>26</b>	<b>4</b>
<b>SD E%D</b>			<b>25</b>	<b>18</b>	<b>35</b>	<b>7</b>	<b>17</b>	<b>6</b>	<b>17</b>	<b>7</b>	<b>19</b>	<b>42</b>	<b>18</b>	<b>10</b>	<b>20</b>	<b>16</b>	<b>21</b>

Table 27. Average comparison error  $E\%D$  or  $E\%2\pi$  for 1<sup>st</sup> harmonic of motions for  $\mu=180^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
5	IIHR	CFDShip-Iowa V4.5	-6	11	-3	-14	-1	-12	1							11	2
<b>Ave. E%D</b>			<b>-6</b>	<b>11</b>	<b>-3</b>	<b>-14</b>	<b>-1</b>	<b>-12</b>	<b>1</b>							<b>11</b>	<b>2</b>
<b>SD E%D</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>							<b>0</b>	<b>0</b>

Table 28. Average comparison error  $E\%D$  or  $E\%2\pi$  for 1<sup>st</sup> harmonic of motions over five heading conditions\* for ONRT course keeping submissions

No	Institute	Code	$\zeta/L$ Amp	x-vel. Amp Phase		Heave/L Amp Phase		Pitch/Ak Amp Phase		y-vel. Amp Phase		Roll/Ak Amp Phase		Yaw/Ak Amp Phase		Ave. Amp Phase	
1	ABS	OpenFOAM	-1	48	6	4	-10	10	-9	28	-21	-96	-30	14	-20	29	16
2	CSSRC	FLUENT12	-3			24	3	11	8							13	5
3	ECN CNRS	ISISCFD-AD	0	44	-21	-2	6	1	6	19	14	36	-44	4	13	15	17
4	HHI	STAR-CCM+	2	53	4	11	0	13	0							20	2
5	IIHR	CFDShip-Iowa V4.5	-1	48	1	-5	-8	-9	-6	43	1	-8	13	18	-17	19	7
6	IIHR	REX	-17	37	1	-2	9	-2	10	46	18	16	8	24	19	21	11
<b>Ave. E%D</b>			<b>-4</b>	<b>46</b>	<b>-2</b>	<b>5</b>	<b>0</b>	<b>4</b>	<b>1</b>	<b>34</b>	<b>3</b>	<b>-13</b>	<b>-14</b>	<b>15</b>	<b>-1</b>	<b>17</b>	<b>4</b>
<b>SD E%D</b>			<b>6</b>	<b>6</b>	<b>10</b>	<b>5</b>	<b>7</b>	<b>8</b>	<b>7</b>	<b>11</b>	<b>15</b>	<b>50</b>	<b>24</b>	<b>7</b>	<b>17</b>	<b>14</b>	<b>13</b>

\* Heading conditions include  $\mu=0^\circ, 45^\circ, 90^\circ, 135^\circ, 180^\circ$

Table 29. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=0^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
1	ABS	OpenFOAM	20	4	25	21	73	-1							39	9
2	CSSRC	FLUENT12			19	32	-56	-38							38	35
3	ECN CNRS	ISISCFD-AD	23	0	19	6	29	2							23	3
4	HHI	STAR-CCM+	6	19	9	21	3	17							6	19
5	IIHR	CFDShip-Iowa V4.5	-28	5	12	8	9	2							16	5
6	IIHR	REX	22	10	15	15	8	12							15	13
<b>Ave. <math> E \%D</math></b>			<b>16</b>	<b>6</b>	<b>17</b>	<b>17</b>	<b>30</b>	<b>12</b>							<b>21</b>	<b>12</b>
<b>SD <math> E \%D</math></b>			<b>10</b>	<b>6</b>	<b>5</b>	<b>9</b>	<b>27</b>	<b>13</b>							<b>14</b>	<b>9</b>

Table 30. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=45^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
3	ECN CNRS	ISISCFD-AD	66	-2	70	-22	82	-33	37	-29	23	10	31	-8	52	17
5	IIHR	CFDShip-Iowa V4.5	61	-18	49	-7	62	-12	83	48	23	19	33	-45	52	25
6	IIHR	REX	71	-5	77	-13	86	-23	59	-31	22	49	32	-16	58	23
<b>Ave. <math> E \%D</math></b>			<b>66</b>	<b>8</b>	<b>65</b>	<b>14</b>	<b>77</b>	<b>23</b>	<b>60</b>	<b>36</b>	<b>23</b>	<b>26</b>	<b>32</b>	<b>23</b>	<b>54</b>	<b>22</b>
<b>SD <math> E \%D</math></b>			<b>4</b>	<b>7</b>	<b>12</b>	<b>6</b>	<b>11</b>	<b>8</b>	<b>19</b>	<b>8</b>	<b>1</b>	<b>17</b>	<b>1</b>	<b>16</b>	<b>8</b>	<b>10</b>

Table 31. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=90^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
5	IIHR	CFDShip-Iowa V4.5	96	-21	86	-2	3	-4	35	47	36	23	55	-41	52	23
<b>Ave. <math> E \%D</math></b>			<b>96</b>	<b>21</b>	<b>86</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>35</b>	<b>47</b>	<b>36</b>	<b>23</b>	<b>55</b>	<b>41</b>	<b>52</b>	<b>23</b>
<b>SD <math> E \%D</math></b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Table 32. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=135^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
1	ABS	OpenFOAM	42	-34	74	11	44	-27	24	-6	-210	-35	93	3	81	19
5	IIHR	CFDShip-Iowa V4.5	71	2	54	-29	61	27	-7	46	-42	18	88	-41	54	27
6	IIHR	REX	44	44	68	-9	42	-43	18	-21	-161	-45	84	-1	69	27
<b>Ave. <math> E \%D</math></b>			<b>53</b>	<b>27</b>	<b>65</b>	<b>16</b>	<b>49</b>	<b>32</b>	<b>16</b>	<b>24</b>	<b>138</b>	<b>33</b>	<b>89</b>	<b>15</b>	<b>68</b>	<b>25</b>
<b>SD <math> E \%D</math></b>			<b>13</b>	<b>18</b>	<b>8</b>	<b>9</b>	<b>9</b>	<b>7</b>	<b>7</b>	<b>17</b>	<b>71</b>	<b>11</b>	<b>4</b>	<b>18</b>	<b>19</b>	<b>13</b>

Table 33. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=180^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
5	IIHR	CFDShip-Iowa V4.5	-24	-33	-6	8	78	-12							36	18
<b>Ave. <math> E \%D</math></b>			<b>24</b>	<b>33</b>	<b>6</b>	<b>8</b>	<b>78</b>	<b>12</b>							<b>36</b>	<b>18</b>
<b>SD <math> E \%D</math></b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>							<b>0</b>	<b>0</b>

Table 34. Average comparison error  $|E|\%D$  or  $|E|\%2\pi$  for 2<sup>nd</sup> harmonic of motions over five heading conditions\* for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
1	ABS	OpenFOAM	31	19	49	16	59	14	24	6	210	35	93	3	78	16
2	CSSRC	FLUENT12			19	32	56	38							38	35
3	ECN CNRS	ISISCFD-AD	44	1	44	14	55	17	37	29	23	10	31	8	39	13
4	HHI	STAR-CCM+	6	19	9	21	3	17							6	19
5	IIHR	CFDShip-Iowa V4.5	56	16	41	11	43	11	42	47	34	20	59	42	46	25
6	IIHR	REX	46	20	53	12	45	26	38	26	91	47	58	8	55	23
<b>Ave. <math> E \%D</math></b>			<b>37</b>	<b>15</b>	<b>36</b>	<b>18</b>	<b>43</b>	<b>21</b>	<b>35</b>	<b>27</b>	<b>90</b>	<b>28</b>	<b>60</b>	<b>15</b>	<b>50</b>	<b>21</b>
<b>SD <math> E \%D</math></b>			<b>17</b>	<b>7</b>	<b>16</b>	<b>7</b>	<b>19</b>	<b>9</b>	<b>7</b>	<b>14</b>	<b>74</b>	<b>14</b>	<b>22</b>	<b>16</b>	<b>26</b>	<b>11</b>

\* Heading conditions include  $\mu=0^\circ, 45^\circ, 90^\circ, 135^\circ, 180^\circ$

Table 35. Average comparison error  $E\%D$  or  $E\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=0^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
1	ABS	OpenFOAM	20	4	25	21	73	-1							39	9
2	CSSRC	FLUENT12			19	32	-56	-38							38	35
3	ECN CNRS	ISISCFD-AD	23	0	19	6	29	2							23	3
4	HHI	STAR-CCM+	6	19	9	21	3	17							6	19
5	IIHR	CFDShip-Iowa V4.5	-28	5	12	8	9	2							16	5
6	IIHR	REX	22	10	15	15	8	12							15	13
<b>Ave. E%D</b>			<b>9</b>	<b>8</b>	<b>17</b>	<b>17</b>	<b>11</b>	<b>-1</b>							<b>12</b>	<b>9</b>
<b>SD E%D</b>			<b>19</b>	<b>6</b>	<b>5</b>	<b>9</b>	<b>38</b>	<b>18</b>							<b>21</b>	<b>11</b>

Table 36. Average comparison error  $E\%D$  or  $E\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=45^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
3	ECN CNRS	ISISCFD-AD	66	-2	70	-22	82	-33	37	-29	23	10	31	-8	52	17
5	IIHR	CFDShip-Iowa V4.5	61	-18	49	-7	62	-12	83	48	23	19	33	-45	52	25
6	IIHR	REX	71	-5	77	-13	86	-23	59	-31	22	49	32	-16	58	23
<b>Ave. E%D</b>			<b>66</b>	<b>-8</b>	<b>65</b>	<b>-14</b>	<b>77</b>	<b>-23</b>	<b>60</b>	<b>-4</b>	<b>23</b>	<b>26</b>	<b>32</b>	<b>-23</b>	<b>54</b>	<b>16</b>
<b>SD E%D</b>			<b>4</b>	<b>7</b>	<b>12</b>	<b>6</b>	<b>11</b>	<b>8</b>	<b>19</b>	<b>37</b>	<b>1</b>	<b>17</b>	<b>1</b>	<b>16</b>	<b>8</b>	<b>15</b>

Table 37. Average comparison error  $E\%D$  or  $E\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=90^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
5	IIHR	CFDShip-Iowa V4.5	96	-21	86	-2	3	-4	35	47	36	23	55	-41	52	23
<b>Ave. E%D</b>			<b>96</b>	<b>-21</b>	<b>86</b>	<b>-2</b>	<b>3</b>	<b>-4</b>	<b>35</b>	<b>47</b>	<b>36</b>	<b>23</b>	<b>55</b>	<b>-41</b>	<b>52</b>	<b>23</b>
<b>SD E%D</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Table 38. Average comparison error  $E\%D$  or  $E\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=135^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
1	ABS	OpenFOAM	42	-34	74	11	44	-27	24	-6	-210	-35	93	3	81	19
5	IIHR	CFDShip-Iowa V4.5	71	2	54	-29	61	27	-7	46	-42	18	88	-41	54	27
6	IIHR	REX	44	44	68	-9	42	-43	18	-21	-161	-45	84	-1	69	27
<b>Ave. E%D</b>			<b>53</b>	<b>4</b>	<b>65</b>	<b>-9</b>	<b>49</b>	<b>-14</b>	<b>12</b>	<b>6</b>	<b>-138</b>	<b>-21</b>	<b>89</b>	<b>-13</b>	<b>67</b>	<b>11</b>
<b>SD E%D</b>			<b>13</b>	<b>32</b>	<b>8</b>	<b>16</b>	<b>9</b>	<b>30</b>	<b>13</b>	<b>29</b>	<b>71</b>	<b>28</b>	<b>4</b>	<b>20</b>	<b>20</b>	<b>26</b>

Table 39. Average comparison error  $E\%D$  or  $E\%2\pi$  for 2<sup>nd</sup> harmonic of motions for  $\mu=180^\circ$  heading condition for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
5	IIHR	CFDShip-Iowa V4.5	-24	-33	-6	8	78	-12							36	18
<b>Ave. E%D</b>			<b>-24</b>	<b>-33</b>	<b>-6</b>	<b>8</b>	<b>78</b>	<b>-12</b>							<b>36</b>	<b>18</b>
<b>SD E%D</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>							<b>0</b>	<b>0</b>

Table 40. Average comparison error  $E\%D$  or  $E\%2\pi$  for 2<sup>nd</sup> harmonic of motions over five heading conditions\* for ONRT course keeping submissions

No	Institute	Code	x-vel.		Heave/L		Pitch/Ak		y-vel.		Roll/Ak		Yaw/Ak		Ave.	
			Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase	Amp	Phase
1	ABS	OpenFOAM	31	-15	49	16	59	-14	24	-6	-210	-35	93	3	78	15
2	CSSRC	FLUENT12			19	32	-56	-38							38	35
3	ECN CNRS	ISISCFD-AD	44	-1	44	-8	55	-15	37	-29	23	10	31	-8	39	12
4	HHI	STAR-CCM+	6	19	9	21	3	17							6	19
5	IIHR	CFDShip-Iowa V4.5	35	-13	39	-4	43	0	37	47	6	20	59	-42	36	21
6	IIHR	REX	46	16	53	-2	45	-18	38	-26	-69	2	58	-8	52	12
<b>Ave. E%D</b>			<b>32</b>	<b>1</b>	<b>36</b>	<b>9</b>	<b>25</b>	<b>-11</b>	<b>34</b>	<b>-3</b>	<b>-63</b>	<b>-1</b>	<b>60</b>	<b>-14</b>	<b>42</b>	<b>7</b>
<b>SD E%D</b>			<b>14</b>	<b>14</b>	<b>16</b>	<b>15</b>	<b>41</b>	<b>17</b>	<b>6</b>	<b>30</b>	<b>92</b>	<b>21</b>	<b>22</b>	<b>17</b>	<b>32</b>	<b>19</b>

\* Heading conditions include  $\mu=0^\circ, 45^\circ, 90^\circ, 135^\circ, 180^\circ$