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*Supplement of*

## **Lead detection in Arctic sea ice from CryoSat-2: quality assessment, lead area fraction and width distribution**

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**Table 1.** Classifiers derived by (from top to bottom): Laxon et al. (2013), Röhrs et al. (2012) and Ricker et al. (2014). TL: True Leads; FL: False Leads; TI: True Ice; FI: False Ice; TLR & FLR: True & False Lead Rates [%]; eTLR & eFLR: Standard deviations of TLR & FLR within runs [%].

Feat	$\Theta$	TL	FL	TI	FI	TLR	FLR	eTLR	eFLR
PP SSD	0.18 4	59809	73003	504042	12146	83.12	12.65	1.40	0.42
MAX	$6 \times 10^{-10}$	6576	00	576811	65613	9.11	0.00	1.12	0.00
PP SSD SK PPL PPR	0.3125 4 40 40 30	43875	28599	548145	28381	60.72	4.96	1.74	0.27

**Table 2.** All tested one dimensional classifiers based on MAX, PP and LEW. Listed are the used Feature (Feat), Weight ( $w$ ), Threshold ( $\Theta$ ), the over all True and False Leads (TL & FL), as well as Ice (TI & FI) and the True and False Lead rates (TLR & FLR), with standard deviations (eTLR & eFLR). The latter four instances are displayed in percent.

Feat	$w$	$\Theta$	TL	FL	TI	FI	TLR	FLR	eTLR	eFLR
MAX	0.001	4.28e-10	10336	226	576597	61841	14.32	0.04	2.07	0.05
MAX	0.1	3.52e-10	12897	697	575781	59625	17.78	0.12	5.62	0.14
MAX	0.2	1.95e-10	22818	2342	574807	49033	31.76	0.41	5.65	0.19
MAX	0.3	1.53e-10	26770	3221	573636	45373	37.11	0.56	3.86	0.17
MAX	0.4	1.35e-10	28184	3691	573364	43761	39.17	0.64	2.94	0.16
MAX	0.5	1.22e-10	29435	4220	572634	42711	40.80	0.73	3.26	0.24
MAX	0.6	1.03e-10	31482	5573	570878	41067	43.39	0.97	5.21	0.53
MAX	0.7	7.04e-11	35774	9307	567306	36613	49.42	1.61	9.39	0.97
MAX	0.8	4.43e-11	41628	13854	562633	30885	57.41	2.40	9.90	0.98
MAX	1	2.58e-11	49204	19689	557143	22964	68.18	3.41	5.89	0.73
MAX	2	1.46e-11	57071	28722	548266	14941	79.25	4.98	1.82	0.36
MAX	5	6.4e-12	60105	42382	534546	11967	83.40	7.35	3.23	1.77
MAX	1e+01	3.37e-12	63022	56796	520007	9175	87.29	9.85	1.44	1.22
MAX	3e+01	1.44e-12	66379	102050	474821	5750	92.03	17.69	1.26	1.46
MAX	1e+02	2.98e-13	70202	328919	247755	2124	97.06	57.04	1.37	11.40
PP	0.001	0.472	2477	185	576173	70165	3.41	0.03	1.70	0.05
PP	0.1	0.47	3269	363	576264	69104	4.52	0.06	2.06	0.06
PP	0.2	0.465	5303	905	575726	67066	7.33	0.16	3.26	0.19
PP	0.3	0.455	9940	2487	574001	62572	13.71	0.43	7.70	0.37
PP	0.4	0.436	18382	5237	571660	53721	25.49	0.91	4.48	0.26
PP	0.5	0.425	22677	7728	569244	49351	31.48	1.34	8.62	0.71
PP	0.6	0.398	32600	13520	563240	39640	45.13	2.34	12.41	0.95
PP	0.7	0.378	39618	17743	558966	32673	54.80	3.08	8.10	0.71
PP	0.8	0.367	42674	19955	556792	29579	59.06	3.46	5.06	0.55
PP	1	0.35	46602	23623	553307	25468	64.66	4.09	4.94	0.66
PP	2	0.307	54551	34273	542547	17629	75.58	5.94	3.37	0.82
PP	5	0.27	58102	44567	532410	13921	80.67	7.72	2.04	1.08
PP	1e+01	0.225	60991	59890	516744	11375	84.28	10.39	1.86	1.12
PP	3e+01	0.116	65562	161561	415295	6582	90.88	28.01	2.59	7.40
PP	1e+02	0.0311	71308	524865	51839	988	98.63	91.01	2.46	19.74
LEW	0.001	1.44	257	169	576717	71857	0.36	0.03	0.73	0.05
LEW	0.1	1.4	252	160	576924	71664	0.35	0.03	0.77	0.05
LEW	0.2	1.57	885	464	576415	71236	1.23	0.08	2.00	0.12
LEW	0.3	1.85	5131	2120	574746	67003	7.11	0.37	9.23	0.48
LEW	0.4	2.17	21108	7760	569288	50844	29.34	1.34	10.92	0.52
LEW	0.5	2.23	26495	9675	566983	45847	36.62	1.68	4.86	0.33
LEW	0.6	2.25	29488	11559	565147	42806	40.79	2.00	6.50	0.61
LEW	0.7	2.28	34638	15122	561781	37459	48.04	2.62	8.42	0.76
LEW	0.8	2.32	39468	18524	558153	32855	54.57	3.21	7.27	0.74
LEW	1	2.36	44114	22683	554220	27983	61.19	3.93	5.04	0.69
LEW	2	2.51	53473	34035	542525	18967	73.82	5.90	2.84	0.57
LEW	5	2.74	58714	50710	526025	13551	81.25	8.79	2.10	0.80
LEW	1e+01	2.94	60905	64495	511853	11747	83.83	11.19	1.91	1.34
LEW	3e+01	4.41	65443	181176	395601	6780	90.61	31.41	3.20	7.70
LEW	1e+02	11.2	71073	487835	88875	1217	98.32	84.59	1.49	12.18

**Table 3.** As Table 2 but for classifiers based on TEW, SSD and SK.

Feat	$w$	$\Theta$	TL	FL	TI	FI	TLR	FLR	eTLR	eFLR
TEW	0.001	4.02	344	173	576408	72075	0.48	0.03	0.41	0.04
TEW	0.1	4.3	330	170	576763	71737	0.46	0.03	0.45	0.04
TEW	0.2	4.33	412	260	576287	72041	0.57	0.05	0.71	0.08
TEW	0.3	4.42	900	573	576481	71046	1.25	0.10	2.22	0.19
TEW	0.4	4.35	3603	2030	575093	68274	5.01	0.35	5.48	0.39
TEW	0.5	4.67	9428	5060	571591	62921	13.03	0.88	9.60	0.68
TEW	0.6	4.95	17226	9244	567753	54777	23.92	1.60	8.50	0.66
TEW	0.7	5.07	22407	12463	564400	49730	31.06	2.16	6.05	0.62
TEW	0.8	5.15	25592	15067	561971	46370	35.56	2.61	6.10	0.70
TEW	1	5.31	30633	19801	557246	41320	42.57	3.43	6.99	1.01
TEW	2	6	45625	37191	539744	26440	63.31	6.45	3.23	0.91
TEW	5	7.67	57842	71473	505330	14355	80.12	12.39	2.19	0.96
TEW	1e+01	8.57	60437	89789	486880	11894	83.56	15.57	2.03	1.47
TEW	3e+01	13.2	64126	167830	409210	7834	89.11	29.08	2.20	5.12
TEW	1e+02	9.6e+03	72226	563429	12984	361	99.50	97.75	1.21	7.59
SSD	0.001	0.31	00	163	576519	72318	0.00	0.03	0.00	0.04
SSD	0.1	0.31	00	172	576474	72354	0.00	0.03	0.00	0.04
SSD	0.2	0.31	00	154	576605	72241	0.00	0.03	0.00	0.04
SSD	0.3	0.31	00	155	576852	71993	0.00	0.03	0.00	0.04
SSD	0.4	0.306	00	145	576599	72256	0.00	0.03	0.00	0.04
SSD	0.5	0.303	01	179	576444	72376	0.00	0.03	0.02	0.04
SSD	0.6	0.303	14	201	576605	72180	0.02	0.03	0.16	0.07
SSD	0.7	0.308	47	319	576343	72291	0.06	0.06	0.36	0.14
SSD	0.8	0.314	166	515	576312	72007	0.23	0.09	1.06	0.25
SSD	1	0.368	849	1651	575327	71173	1.18	0.29	2.28	0.49
SSD	2	3.04	55936	83674	493195	16195	77.55	14.50	3.81	0.94
SSD	5	3.62	61093	96405	480466	11036	84.70	16.71	1.63	0.63
SSD	1e+01	4.65	62809	116237	460879	9075	87.38	20.14	2.74	2.61
SSD	3e+01	8.49	67117	172489	404014	5380	92.58	29.92	1.38	3.69
SSD	1e+02	22.5	71031	386776	190063	1130	98.43	67.05	1.14	8.42
SK	0.001	733	02	23	576638	72337	0.00	0.00	0.03	0.03
SK	0.1	746	00	00	576810	72190	0.00	0.00	0.00	0.00
SK	0.2	733	03	22	576941	72034	0.00	0.00	0.04	0.03
SK	0.3	737	05	23	576887	72085	0.01	0.00	0.08	0.04
SK	0.4	741	05	18	576826	72151	0.01	0.00	0.10	0.04
SK	0.5	747	00	00	576632	72368	0.00	0.00	0.00	0.00
SK	0.6	737	02	17	576910	72071	0.00	0.00	0.04	0.03
SK	0.7	667	91	247	576410	72252	0.13	0.04	0.46	0.15
SK	0.8	609	194	454	576601	71751	0.27	0.08	0.80	0.21
SK	1	493	766	1429	575377	71428	1.06	0.25	2.06	0.46
SK	2	40.2	52528	86699	490026	19747	72.68	15.03	6.88	1.58
SK	5	30	61064	108188	468498	11250	84.44	18.76	1.79	0.72
SK	1e+01	24.3	62549	124185	452809	9457	86.87	21.52	2.29	2.53
SK	3e+01	12.5	66867	180874	395729	5530	92.36	31.37	1.28	2.61
SK	1e+02	1.94	71170	405289	171447	1094	98.49	70.27	1.06	7.35

**Table 4.** Tested two dimensional classifiers part one (see Table 5 for second part) using ‘and’ criteria (both thresholds have to be reached to detect a lead). See Table 2 for further description.

Feat	$w$	$\Theta$	TL	FL	TI	FI	TLR	FLR	eTLR	eFLR
MAX PP	0.001	4.33e-10 0.0684	10151	196	576476	62177	14.03	0.03	1.83	0.05
MAX PP	0.5	1.16e-10 0.0841	30013	4584	572202	42201	41.56	0.79	3.20	0.29
MAX PP	1	2.59e-11 0.116	49039	19510	557341	23110	67.97	3.38	4.92	0.68
MAX LEW	0.001	4.23e-10 15.6	10141	223	576418	62218	14.01	0.04	2.14	0.06
MAX LEW	0.5	1.13e-10 5.51	30059	4611	572136	42194	41.60	0.80	2.84	0.28
MAX LEW	1	2.5e-11 11	49579	20175	556452	22794	68.50	3.50	5.66	0.76
MAX TEW	0.001	4.36e-10 2.72e+03	9959	195	576686	62160	13.81	0.03	2.11	0.06
MAX TEW	0.5	1.18e-10 697	29679	4265	572609	42447	41.15	0.74	2.93	0.25
MAX TEW	1	2.55e-11 200	48808	19580	557305	23307	67.68	3.39	5.61	0.72
MAX SSD	0.001	4.29e-10 15.7	10292	216	576388	62104	14.22	0.04	2.16	0.05
MAX SSD	0.5	1.19e-10 12.9	29682	4445	572484	42389	41.18	0.77	3.39	0.28
MAX SSD	1	2.59e-11 9.89	49010	19519	557533	22938	68.12	3.38	5.08	0.67
MAX SK	0.001	4.33e-10 0.446	10141	203	576579	62077	14.04	0.04	2.00	0.05
MAX SK	0.5	1.22e-10 0.911	29394	4149	572914	42543	40.86	0.72	2.55	0.17
MAX SK	1	2.59e-11 5.99	49347	19836	556802	23015	68.19	3.44	5.38	0.74
PP LEW	0.001	0.444 17.5	2526	312	576343	69819	3.49	0.05	1.72	0.06
PP LEW	0.5	0.386 4.39	23413	8180	568674	48733	32.45	1.42	7.22	0.51
PP LEW	1	0.344 5.9	45806	23061	553615	26518	63.33	4.00	4.99	0.61
PP TEW	0.001	0.465 7.31e+03	2439	214	576589	69758	3.38	0.04	1.72	0.05
PP TEW	0.5	0.425 796	21637	7086	569839	50438	30.02	1.23	7.64	0.65
PP TEW	1	0.35 82.3	46067	23232	553611	26090	63.84	4.03	5.05	0.62

**Table 5.** As Table 4, second part.

Feat	$w$	$\Theta$	TL	FL	TI	FI	TLR	FLR	eTLR	eFLR
PP SSD	0.001	0.472 20.6	2478	199	576443	69880	3.42	0.03	1.63	0.05
PP SSD	0.5	0.425 12.8	22191	7557	568970	50282	30.62	1.31	9.13	0.74
PP SSD	1	0.352 19.3	46345	23074	553708	25873	64.17	4.00	5.02	0.65
PP SK	0.001	0.472 0.298	2511	209	576471	69809	3.47	0.04	1.59	0.06
PP SK	0.5	0.427 1.02	21600	7021	569748	50631	29.90	1.22	6.91	0.56
PP SK	1	0.351 0.431	46948	23575	552994	25483	64.82	4.09	4.14	0.58
LEW TEW	0.001	7.06 13.5	758	207	576511	71524	1.05	0.04	0.97	0.05
LEW TEW	0.5	2.24 13.8	24120	8395	568596	47889	33.50	1.45	5.71	0.44
LEW TEW	1	2.37 125	43291	22570	554400	28739	60.10	3.91	5.38	0.71
LEW SSD	0.001	8.32 2.25	259	267	576753	71721	0.36	0.05	0.63	0.06
LEW SSD	0.5	2.24 6.87	26501	9617	567173	45709	36.70	1.67	3.77	0.33
LEW SSD	1	2.37 10.5	43994	22828	554030	28148	60.98	3.96	5.60	0.74
LEW SK	0.001	2.84 2.64	325	291	576709	71675	0.45	0.05	0.71	0.07
LEW SK	0.5	2.24 7.56	26498	9638	567250	45614	36.75	1.67	3.87	0.33
LEW SK	1	2.37 4.83	44264	22946	553935	27855	61.38	3.98	5.21	0.75
TEW SSD	0.001	6.67 4.31	302	326	576393	71979	0.42	0.06	0.45	0.06
TEW SSD	0.5	4.83 15.9	9330	5078	571440	63152	12.87	0.88	8.82	0.64
TEW SSD	1	5.35 14.6	31983	21020	555562	40435	44.16	3.65	8.70	1.18
TEW SK	0.001	5.27 5.43	429	370	576479	71722	0.59	0.06	0.53	0.07
TEW SK	0.5	4.97 0.542	8936	4903	571629	63532	12.33	0.85	9.17	0.65
TEW SK	1	5.33 2.2	31467	20593	556064	40876	43.50	3.57	7.86	1.15
SSD SK	0.001	0.904 1.61	00	175	576905	71920	0.00	0.03	0.00	0.03
SSD SK	0.5	1.02 1.87	10	195	576729	72066	0.01	0.03	0.11	0.06
SSD SK	1	1.73 7.58	949	1857	575022	71172	1.32	0.32	2.28	0.49

**Table 6.** As Table 4, but using ‘inclusive or’ criteria (reaching one threshold is sufficient to detect a lead) part one. See Table 7 for second part.

Feat	$w$	$\Theta$	TL	FL	TI	FI	TLR	FLR	eTLR	eFLR
MAX PP	0.001	4.28e-10 0.472	11694	418	576325	60563	16.18	0.07	2.21	0.07
MAX PP	0.5	1.2e-10 0.801	29672	4413	572344	42571	41.07	0.77	2.59	0.22
MAX PP	1	2.55e-11 0.608	49449	20453	556645	22453	68.77	3.54	5.24	0.74
MAX LEW	0.001	4.32e-10 0.953	10148	362	576655	61835	14.10	0.06	1.95	0.07
MAX LEW	0.5	1.2e-10 0.96	29836	4395	572217	42552	41.22	0.76	3.16	0.26
MAX LEW	1	2.66e-11 1.81	49565	20085	556621	22729	68.56	3.48	4.85	0.64
MAX TEW	0.001	4.33e-10 0.705	10235	276	576718	61771	14.21	0.05	1.99	0.06
MAX TEW	0.5	1.2e-10 0.83	29542	4354	572594	42510	41.00	0.75	2.94	0.22
MAX TEW	1	2.59e-11 2.67	49461	19916	556922	22701	68.54	3.45	4.93	0.65
MAX SSD	0.001	4.4e-10 0.19	10046	172	576326	62456	13.86	0.03	1.81	0.04
MAX SSD	0.5	1.19e-10 0.234	29589	4296	572462	42653	40.96	0.74	2.73	0.20
MAX SSD	1	2.53e-11 0.284	49499	20308	556655	22538	68.71	3.52	6.17	0.84
MAX SK	0.001	4.3e-10 7.23e+03	10177	229	576644	61950	14.11	0.04	2.09	0.07
MAX SK	0.5	1.2e-10 2.4e+03	29455	4273	572864	42408	40.99	0.74	2.49	0.21
MAX SK	1	2.61e-11 636	49198	19911	556992	22899	68.24	3.45	5.32	0.74
PP LEW	0.001	0.474 1.36	2685	321	576561	69433	3.72	0.06	1.86	0.06
PP LEW	0.5	0.445 2.14	24027	7863	569158	47952	33.38	1.36	4.98	0.44
PP LEW	1	0.357 1.71	46267	23785	552896	26052	63.98	4.12	4.94	0.66
PP TEW	0.001	0.475 0.913	2388	215	576668	69729	3.31	0.04	1.64	0.05
PP TEW	0.5	0.43 3.01	22903	7848	568944	49305	31.72	1.36	7.06	0.57
PP TEW	1	0.354 1.93	46676	23387	553268	25669	64.52	4.06	4.11	0.56

**Table 7.** As Table 6, second part.

Feat	$w$	$\Theta$	TL	FL	TI	FI	TLR	FLR	eTLR	eFLR
PP SSD	0.001	0.472 0.142	2530	188	576563	69719	3.50	0.03	1.62	0.04
PP SSD	0.5	0.425 0.21	22325	7433	569272	49970	30.88	1.29	8.48	0.71
PP SSD	1	0.351 0.382	46716	23536	553424	25324	64.85	4.08	4.22	0.61
PP SK	0.001	0.472 1.44e+03	2483	198	576726	69593	3.44	0.03	1.84	0.05
PP SK	0.5	0.426 1.37e+03	22283	7540	569374	49803	30.91	1.31	8.76	0.73
PP SK	1	0.351 502	47052	24040	552724	25184	65.14	4.17	4.05	0.61
LEW TEW	0.001	1.01 2.65	506	282	576617	71595	0.70	0.05	0.76	0.06
LEW TEW	0.5	2.24 0.583	27018	9781	567143	45058	37.49	1.70	3.65	0.34
LEW TEW	1	2.36 1.02	44092	22894	553735	28279	60.92	3.97	5.52	0.72
LEW SSD	0.001	0.297 0.282	242	298	576033	72427	0.33	0.05	0.80	0.06
LEW SSD	0.5	2.24 0.243	26802	9846	566925	45427	37.11	1.71	5.10	0.42
LEW SSD	1	2.37 0.412	44671	23583	553197	27549	61.85	4.09	5.38	0.76
LEW SK	0.001	0.00422 664	286	196	576605	71913	0.40	0.03	0.82	0.06
LEW SK	0.5	2.24 747	27001	9877	566551	45571	37.21	1.71	4.23	0.36
LEW SK	1	2.37 343	44487	23457	553532	27524	61.78	4.07	5.25	0.73
TEW SSD	0.001	2.17 0.347	338	310	576399	71953	0.47	0.05	0.42	0.05
TEW SSD	0.5	4.53 0.251	10507	5719	571107	61667	14.56	0.99	8.45	0.63
TEW SSD	1	5.32 0.473	32349	21939	555150	39562	44.98	3.80	7.33	1.02
TEW SK	0.001	0.145 517	318	247	576663	71772	0.44	0.04	0.57	0.07
TEW SK	0.5	4.07 520	9574	5216	571637	62573	13.27	0.90	8.64	0.63
TEW SK	1	5.31 286	31759	21346	555523	40372	44.03	3.70	7.39	1.05
SSD SK	0.001	0.00415 2.48e+04	02	08	576677	72313	0.00	0.00	0.04	0.02
SSD SK	0.5	0.00186 2.55e+04	03	20	576493	72484	0.00	0.00	0.06	0.04
SSD SK	1	0.00443 4.85e+03	1052	1905	575038	71005	1.46	0.33	2.49	0.54