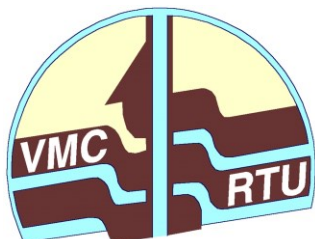


Rīgas Tehniskā universitāte



VIDES MODELĒŠANAS CENTRS

*Latvijas hidroģeoloģiskā modeļa LAMO4 piesaistīto
ezeru pazemes ūdens pieteces plūsmu katalogs*

*Valsts pētījumu programma EVIDEnT
„Latvijas hidroģeoloģiskā modeļa LAMO pilnveidošana”*

Rīga - Novembris, 2016

Katalogs „Latvijas hidroģeoloģiskā modeļa LAMO4 piesaistīto ezeru pazemes ūdens pieteces plūsmu katalogs”

LAMO pilnveidošanu RTU īsteno Valsts Pētījumu Programmas (VPP) projektā EVIDEnT. „Pilnveidot laba ūdens stāvokļa un tā ilgtspējīgai izmantošanai Latvijas hidroģeoloģisko modeli ar datiem un funkcijām, kas apraksta pazemes ūdeņu mijiedarbību ar hidroģeoloģisko tīklu (upes, ezeri)”.

Katalogs izveidots balstoties uz aprēķiniem, kuri veikti LAMO4 vidē ar Programmu GROUNDWATER VISTAS-6.

Zinātniskais vadītājs Dr.sc.ing. A. Spalviņš

VPP projekta īstenošanā piedalījās RTU darbinieki J. Šlangens, O. Aleksāns, K. Krauklis, I. Lāce, V. Škibelis, A. Mačāns, I. Tabaka, I. Eglīte

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RTU, VMC direktors
_____A.Spalviņš

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Katalogs sastāv no LAMO4 modelēto 127 ezeru galveno raksturlielumu tabulas un šo ezeru pazemes pieteču grafikiem. Tabulā ir šādi dati: ezera indekss (reach), ezera nosaukums, ar kādu LAMO slāni ir saites, laukums [km^2], ezeru līmeņi [m vjl], kalibrēšanas parametrs ezera piesaistei C , plūsma [$\text{tūkst.m}^3/\text{dnn}$], kataloga lpp., kurā skatāms ezera pazemes pietece grafiks. LAMO4 vertikālā shematizācijā doti modeļa slāņa numuri (2. att.).

Ja $C \neq 1$, ezera piesaiste ir mainīta modeli kalibrējot. Kalibrētā piesaiste = (piesaiste)/ C .

LAMO4 darbojas licenzētas programmas GROUNDWATER VISTAS-6 (GV) vidē. Ezeru pazemes pietece grafiki ir iegūti ar GV rīkiem pēc shēmas (1. att.): Plot \rightarrow Mass balance \rightarrow BC Accretion Curve \rightarrow GHB \rightarrow Number of nodes downstream \rightarrow Reach, Plot Cumulative Flow in Downstream direction. Šo opciju secība skatāma upes plūsmas aprēķinā shēmā Burtnieku ezeram, kura indekss (reach) ir 1049.

Ezera pazemes pietece plūsmas (m^3/dnn) uzkrājošais grafiks rāda kā kopīgā ezera pietece pieaug, palielinoties tā laukumam. GV sistēmā šī plūsma ir negatīva.

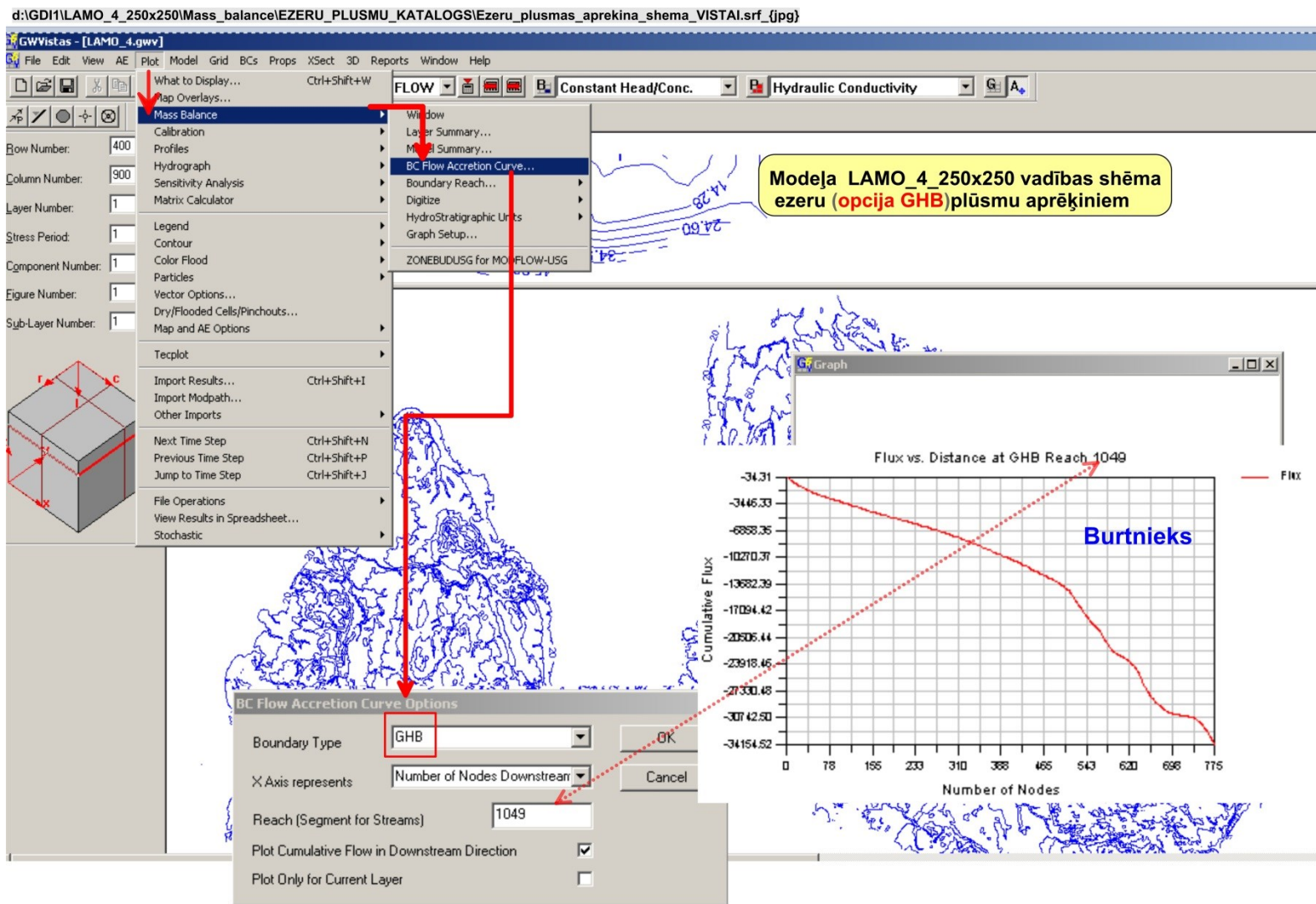
Piemētam, Burtnieku ezera kopīgā plūsma ir -35.15 tūkst. m^3/dnn , bet pirmajā ezera piesaistes mezglā -34.3 m^3/dnn . Uz grafika horizontālās ass skatāms kopīgais mezglu skaits N_i , kuros ezers piesaistīts modeļa režģim. Burtnieku ezers piesaistīts 775 mezglos. Šo mezglu skaits atbilst šī ezera vadības datnes ierakstu skaitam. Ezera laukumu L_i dod empīriskā formula $L_i \sim (0.25)^2 N_i$ [km^2], kur $(0.25)^2$ ir LAMO4 režģa šūnas laukums km^2 . Parasti L_i ir lielāks (īpaši maziem ezeriem) par ezeru faktisko laukumu. Šī novirze rodas ezera krasta līnijas aproksimācijas ietekmē. Veidojot lokālus modeļus, jānovērš iespējamie defekti ezeriem, kuri atrodas modeļa areālā.

Ir pieejams režīms "Downstream Distance", kurā uz horizontālās ass dots attālums metros no ezera pirmās šūnas, kuram šajā režīmā nav praktiska pielietojuma. Tāpēc šo režīmu nav vēlams izmantot.














Pēc ezera pazemes pietece plūsmas grafika izskata var spriest par pietece intensitāti tā laukumā, par iespējamām kļūdām ezera piesaistē modelim. Pozitīvas plūsmas ezera laukumā ne vienmēr ir kļūdas pazīme, jo daudzi ezeri daļu ūdens zaudē pazemes noteces dēļ..

Ezeru pazemes pietece grafiki atbilst LAMO4 saturam 2016. gada septembrī. Modelis tiek papildināts un tāpēc grafiki papildinātajā modelī var atšķirties no grafikiem katalogā.

Ezeru pazemes pietece plūsmu katalogs pieejams elektroniski http://www.emc.rtu.lv/VPP/EZERU_PLUSMAS.pdf



1.att. Ezera pazemes pieteces plūsmas aprēķina shēma

HM slāņa Nr.	*	Slāņa nosaukums	HM slāņa kods	Laukums, [Tūkst.. km ²]	m_{vid} , [metri]
1		Reljefs	relh	71.29	0.02
2		Aerācijas zona	aer	71.29	0.02
3		Bezspiediena kvartārs	Q2	71.29	5.77
4		Augšējā morēna	gQ2z	71.29	22.20
5		Spiediena kvartārs	Q1#	7.4	6.13
6		Apakšējā morēna	gQ1#z	9.7	9.3
7		Ketleru	D3ktl#	5.32	61.46
8		Ketleru	D3ktlz	5.79	10.52
9		Zagares	D3zg#	7.43	42.65
10		Akmenes	D3akz	7.95	11.05
11		Kursas	D3krs#	9.34	22.34
12		Elejas	D3el#z	9.24	27.58
13		Daugavas	D3dg#	32.14	30.37
14		Salaspils	D3slp#z	35.78	12.67
15		Plavinu	D3pl	43.80	22.76
16		Amatas	D3am#z	45.14	8.97
17		Amatas	D3am	46.21	21.91
18		Upper Gauja	D3gj2z	48.80	11.62
19		Upper Gauja	D3gj2	50.92	26.34
20		Lower Gauja	D3gj1z	53.11	13.17
21		Lower Gauja	D3gj1	56.13	31.55
22		Burtnieku	D2brtz	58.09	15.41
23		Burtnieku	D2brt	68.74	45.02
24		Arikula	D2arz	68.74	15.02
25		Arikula	D2ar	68.74	40.03
26		Narva	D2nr#z	71.29	116.67
27		Pernava	D2pr	71.29	25.00

*  - sprosts slānis m_{vid} – vidējais biezums

2.att. LAMO4 vertikālā shematizācija

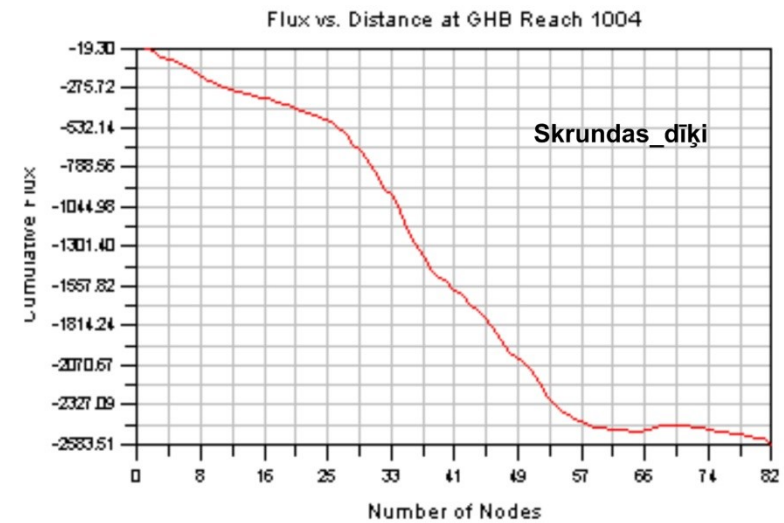
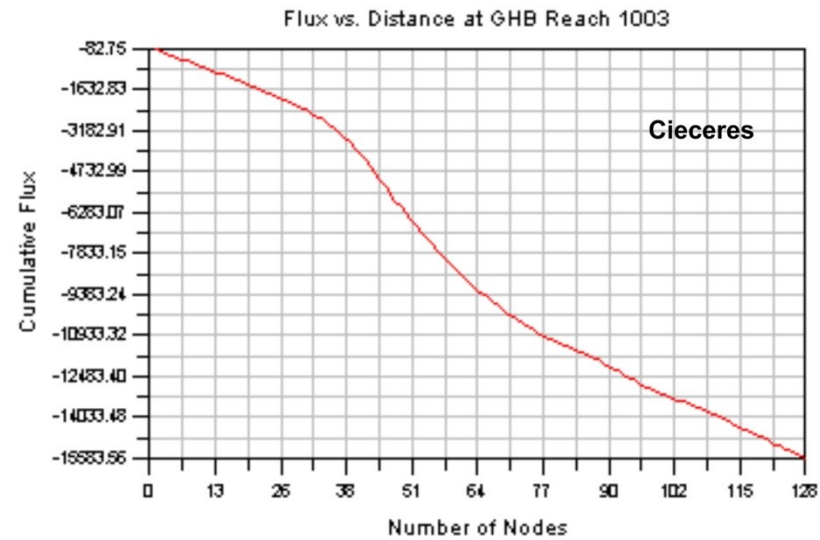
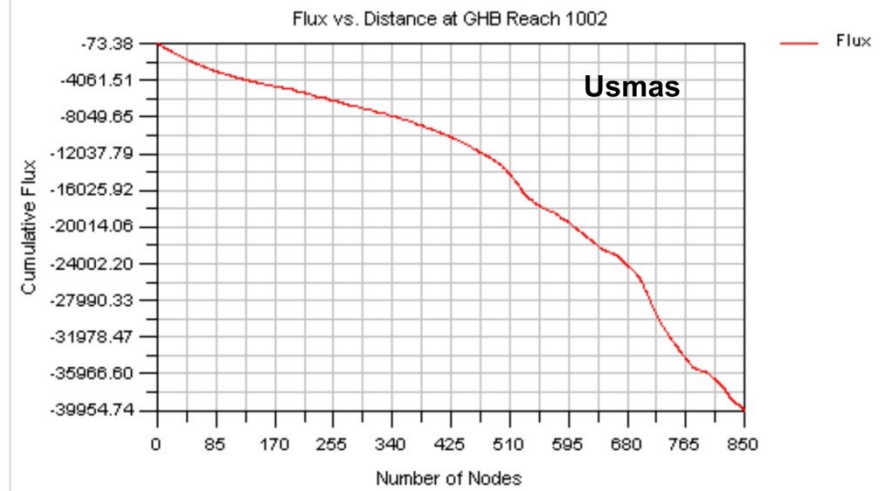
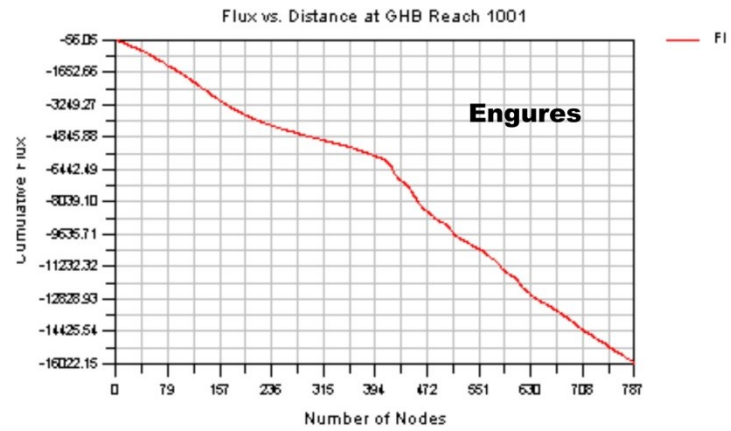
LAMO ezeru saraksts

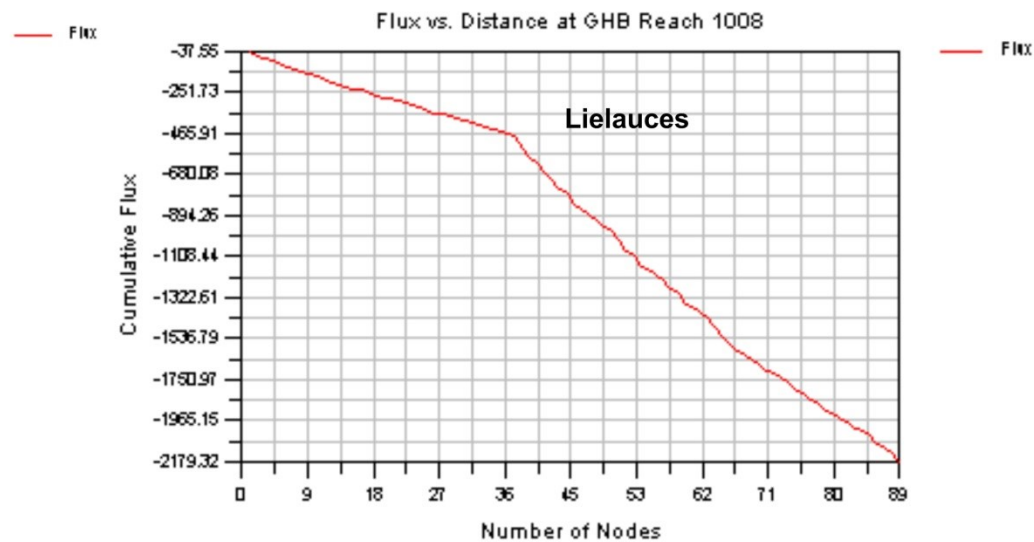
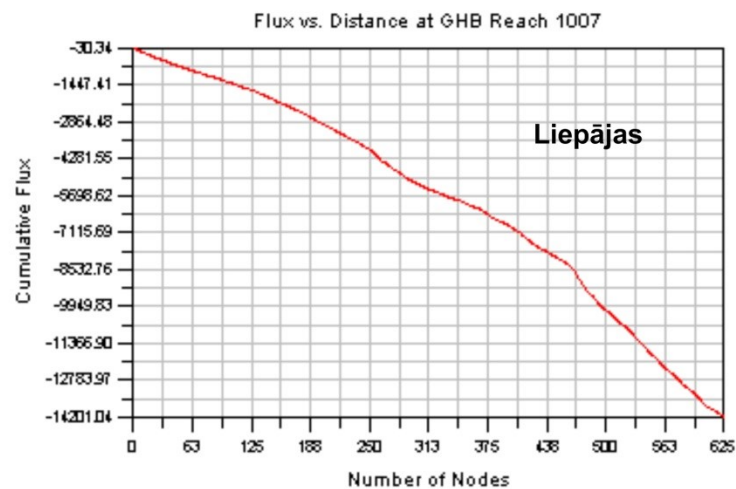
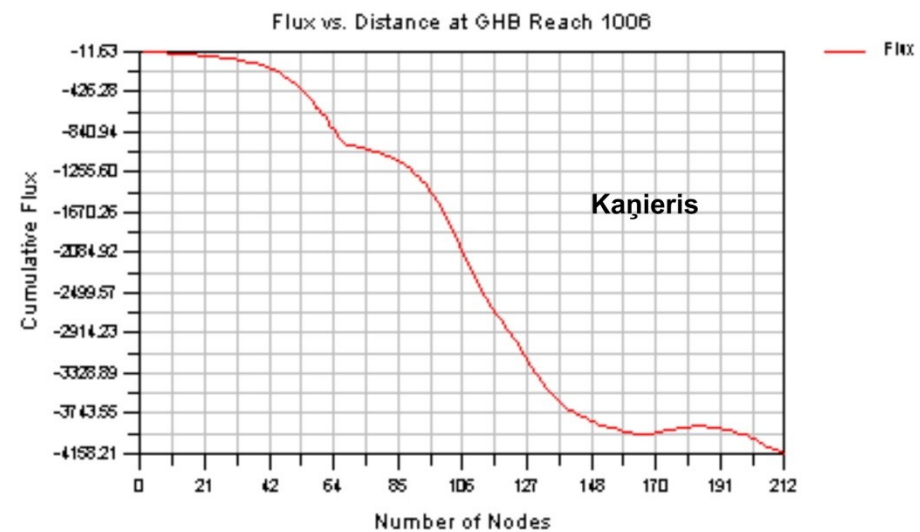
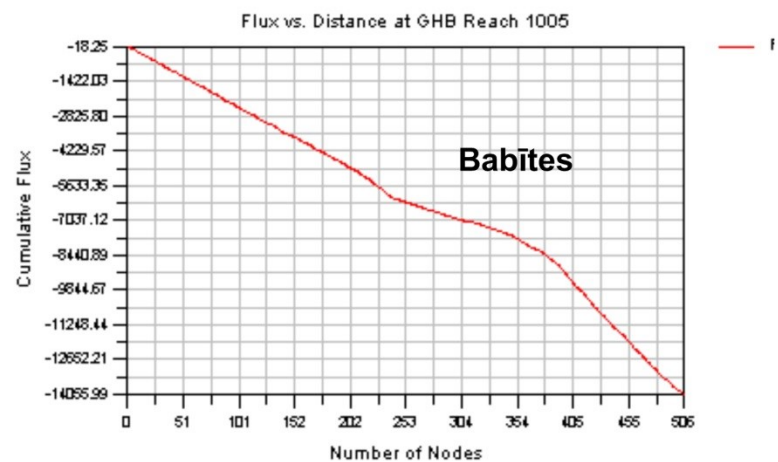
Nr.p. k.	Indekss	Nosaukums	Ar kādiem slāņiem saistīta	Laukums [km ²]	Līmenis [m vjl]	C	Plūsma [tūkst. m ³ /dnn]	Lpp.
1	1001	Engures	3	36.60	0.75	1	-16.0	1
2	1002	Usmas	3	42.93	20.70	1	-40.0	1
3	1003	Cieceres	7	2.75	100.30	1	-15.6	1
4	1004	Skrundas dīķi	3	3.20	30.70	1	-2.6	1
5	1005	Babītes	3	23.04	0.20	1	-14.1	2
6	1006	Kaņieris	3,15	8.01	2.20	1	-4.2	2
7	1007	Liepājas	3	26.61	0.20	1	-14.2	2
8	1008	Lielauces	3	3.76	100.80	1	-2.2	2
9	1009	Zebus	3	4.19	86.50	1	-4.8	3
10	1010	Durbes	3	5.88	23.20	1	-6.2	3
11	1011	Puzes	23,3	4.81	12.30	1	-10.8	3
12	1012	Būšnieku	3	3.36	9.2	1	-2.0	3
13	1013	Papes	3	6.46	0.10	1	-6.9	4
14	1014	Ludza	3	2.87	124.50	1	-2.2	4
15	1015	Balvu	13,3	3.81	101.30	1	-21.6	4
16	1016	Alauksts	3	7.66	202.30	1	-3.8	4
17	1017	Inesis	3	5.22	194.00	1	-4.7	5
18	1018	Lobes	3	4.26	81.00	1	-2.6	5
19	1019	Kālezers	3	4.01	187.80	1	-8.5	5
20	1020	Ķīšezers	3	16.08	0.1	1	-13.5	5
21	1021	Juglas	3	5.27	0.10	1	-8.9	6
22	1022	Lubāns	3	80.96	90.7	1	-24.7	6
23	1023	Odzes	3	2.58	82.10	1	-12.2	6
24	1024	Liels un Mazais Ludzas	3	8.73	133.00	1	-5.4	6
25	1025	Pildas	3	3.10	138.40	1	-3.5	7
26	1026	Cirma	3	12.64	137.80	1	-3.2	7
27	1027	Saukas	3	7.10	78.70	1	5.0	7
28	1028	Rāznas	3	57.11	163.3	1	-23.4	7
29	1029	Nierzas	3	5.58	155.90	1	-7.0	8
30	1030	Peiteļa	3	3.64	107.8	1	-0.6	8
31	1031	Feimaņu	3	6.29	153.9	3.3	-6.0	8
32	1032	Cirišs	3	6.53	143.5	3.3	-5.0	9
33	1033	Jašas un Bic	3	2.52	149.2	1	-2.5	9
34	1034	Sivers	3	17.60	159.60	3.3	-4.6	9
35	1035	Cārmins un	3	3.80	158.6	1	-3.2	9

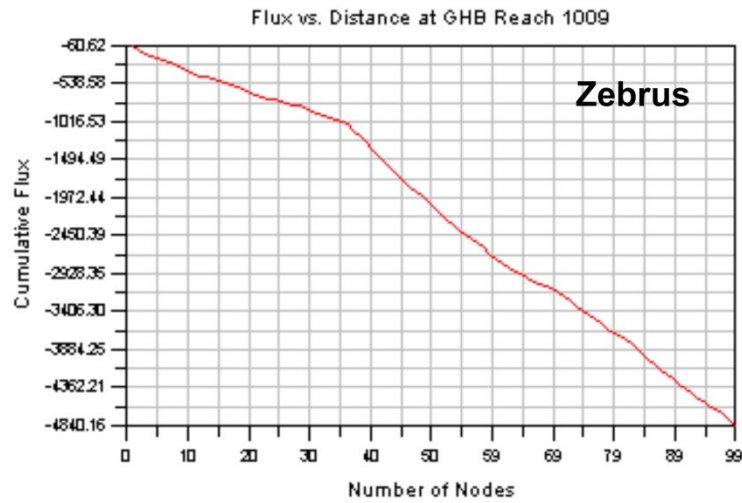
36	1036	Užuņu	3	2.71	159.9	1	-9.1	10
37	1037	Gerāņimovas	3	3.16	150.6	1	-11.7	10
38	1038	Rušons	3	24.25	149.8	3.3	-8.9	10
39	1039	Zolvas_Ribac	3	4.97	149.8	1	-12.7	10
40	1040	Luknas_un_V	3	7.63	100	1	-22.4	11
41	1041	Meduma	3	2.71	135.90	1	-1.2	11
42	1042	Sventes	3	7.03	137.00	1	-3.5	11
43	1043	Skaunas	3	2.50	147.80	1	-3.0	11
44	1044	Plisūns	3	4.71	150.1	1	-0.5	12
45	1045	Dagdas	3	4.87	158.60	1	-12.7	12
46	1046	Eša	3	11.36	169.4	1	-11.0	12
47	1047	Sila	3	2.55	146.30	1	-1.9	12
48	1048	Riču	3	13.07	146.2	1	-2.1	13
49	1049	Burtnieku	3	39.63	39.50	1	-34.2	13
50	1050	Stropu	3	4.10	110.00	1	0.2	13
51	1051	Dreidzs	3	7.72	159.20	3.3	-7.7	13
52	1052	Augstrozes_L ielezers	3	4.06	77.30	1	-3.1	14
53	1053	Limbažu_Liel ezers	3	2.51	49.6	1	-7.8	14
54	1054	Lādes	3	2.69	47.7	1	-7.6	14
55	1055	Aijažu	3	3.07	59.5	1	-1.3	14
56	1056	Ungurs	3	3.95	68	1	-1.4	15
57	1057	Alūksnes	3	16.14	183.3	1	-4.4	15
58	1058	Dūņezers	3	2.69	0.7	1	-6.7	15
59	1059	Baltezers	3	7.81	0.10	1	-13.7	15
60	1060	Istras	3	1.58	145.80	1	-2.0	16
61	1061	Kvāpānu_dīķi	3	5.54	93.8	1	-0.4	16
62	1062	Īdeņas_dīķi	3	6.31	93.8	1	-0.4	16
63	1063	Vaidavas	21	0.88	48.00	1	-5.9	16
64	1064	Viļakas	3	1.38	87.7	1	-5.5	17
65	1065	Rīgas_HES	3,13	36.18	17.50	1	-40.0	17
66	1066	Pļaviņu_HES	3,15	13.51	71.50	1	-12.4	17
67	1067	PuĒsas	3	2.16	158.90	1	-3.4	17
68	1068	Bižas	3	1.49	172.30	1	-2.5	18
69	1069	Pārtovas	3	0.94	180.80	1	-4.1	18
70	1070	Ušura	3	1.38	112.50	1	-1.0	18
71	1071	Lielais_Ilgas	3	1.32	135.80	1	-1.2	18
72	1072	Biržkalna	3	2.03	149.80	1	-3.4	19
73	1073	Vilgāles	3	2.35	62.20	1	-5.3	19
74	1075	Slokas	3	2.49	1.40	1	-1.2	19

75	1076	Spāres	3	1.85	26.80	1	-2.8	20
76	1077	Liezēris	3	0.92	185.10	1	-3.1	20
77	1078	Saimejs	3	1.00	148.80	1	-2.1	20
78	1079	Piksteres	3	2.38	91.50	1	-1.9	20
79	1080	Talejas	3	0.81	235.90	1	-1.0	21
80	1081	Juveris	3	0.79	199.90	1	-2.2	21
81	1082	Dziļais	3	1.44	145.50	1	-1.7	21
82	1083	Bižas	3	1.70	172.20	1	-2.4	21
83	1084	Viraudas	3	1.22	164.00	1	-2.5	22
84	1085	Solojs	3	1.70	163.90	1	-6.5	22
85	1086	Jazinks	3	2.58	155.70	1	-4.9	22
86	1087	Laidzes	3	1.35	42.30	1	-5.1	22
87	1088	Niedres dīķi	3,9	1.47	32.40	1	-4.1	23
88	1089	Grebūtnieku dīķis	3	1.06	83.10	1	-0.8	23
89	1090	Liekna	3,7	3.08	83.10	1	-4.3	23
90	1091	Tosmares	3,9	1.23	1.00	1	-1.9	23
91	1092	Lubezers	3	1.27	37.90	1	-2.4	24
92	1093	Kalnis	3	1.07	102.80	1	-0.4	24
93	1094	Lazdags	3	1.30	98.90	1	-0.6	24
94	1095	Pečora	3	1.09	91.50	1	-0.4	24
95	1096	Viešūrs	3	1.72	221.60	1	-2.6	25
96	1097	Jumurdas	3	1.74	186.60	1	-0.7	25
97	1098	Baļotes	3	1.74	98.20	1	-1.8	25
98	1099	Viesotes	3	1.63	96.20	1	-2.6	25
99	1100	Zviergzdīnes	3	1.32	133.60	1	-1.2	26
100	1101	Kurjanovas	3	1.26	111.00	1	-2.6	26
101	1102	Meirānu	3	1.12	138.30	1	-0.5	26
102	1103	Bižu	3	1.38	142.30	1	-1.5	26
103	1104	Adamovas	3	1.99	147.60	1	-2.2	27
104	1105	Tiskadu	3	1.91	129.90	1	-2.5	27
105	1106	Ismeru	3	1.46	167.30	1	-1.2	27
106	1107	Zilezers	3	2.17	104.60	1	-0.9	27
107	1108	Veirūgnes	3	1.26	100.00	1	-5.9	28
108	1109	Ārdavs	3	2.25	158.70	1	-2.7	28
109	1110	Lielais_Kustaru	3	1.42	155.60	1	-6.1	28
110	1111	Cierps	3	1.34	163.60	1	-1.9	28
111	1112	Černostes	3	2.19	163.60	1	-1.0	29
112	1113	Olovecs	3	1.60	175.80	1	-1.4	29
113	1114	Zosnas	3	1.50	163.50	1	-1.1	29
114	1115	Svātovas	3	1.33	164.20	1	3.0	29
115	1116	Brīgenes	3	1.43	147.90	1	-0.8	30

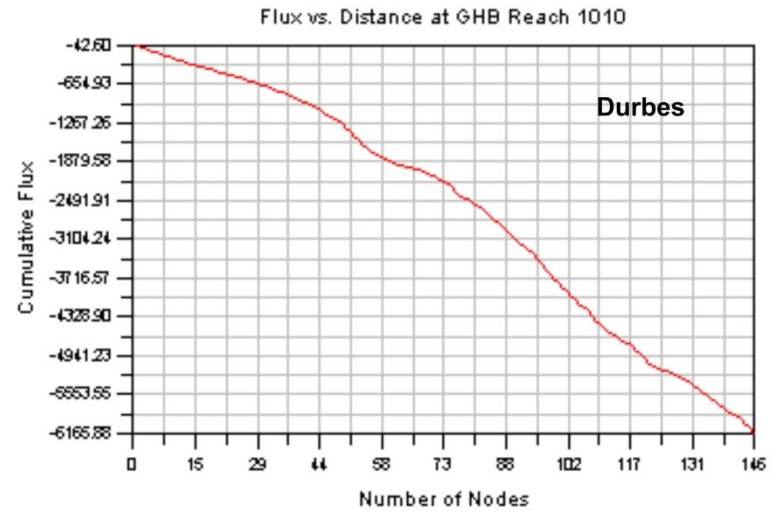
116	1117	Stirns	3	1.51	144.20	1	-2.7	30
117	1118	Ots	3	1.24	159.00	1	-0.8	30
118	1119	Indezers	3	1.49	168.30	1	-0.8	30
119	1120	Gusena	3	1.24	160.60	1	-0.3	31
120	1121	Lilastes	3	1.71	0.50	1	-3.8	31
121	1122	Dzirnezers	3	1.70	0.60	1	-2.7	31
122	1123	Aģes	3	1.09	51.40	1	-0.8	31
123	1124	Ramatas_Liel ezers	3	1.63	58.80	1	1.0	32
124	1125	Kodajezers	3	1.01	50.40	1	-0.1	32
125	1126	Lielais_Līderi s	3	0.97	193.90	1	-0.4	32
126	1127	Pulgosnis	3	0.90	172.80	1	-1.6	32
127	1665	Ķeguma_HES	3,13,15	24.35	31.80	1	-116.6	33



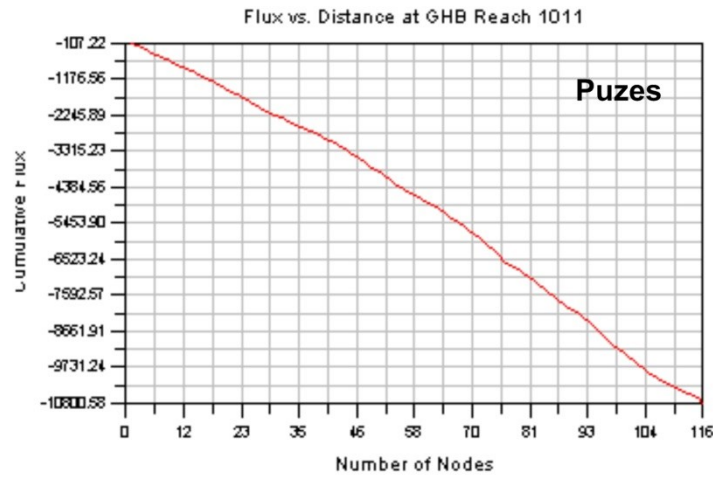




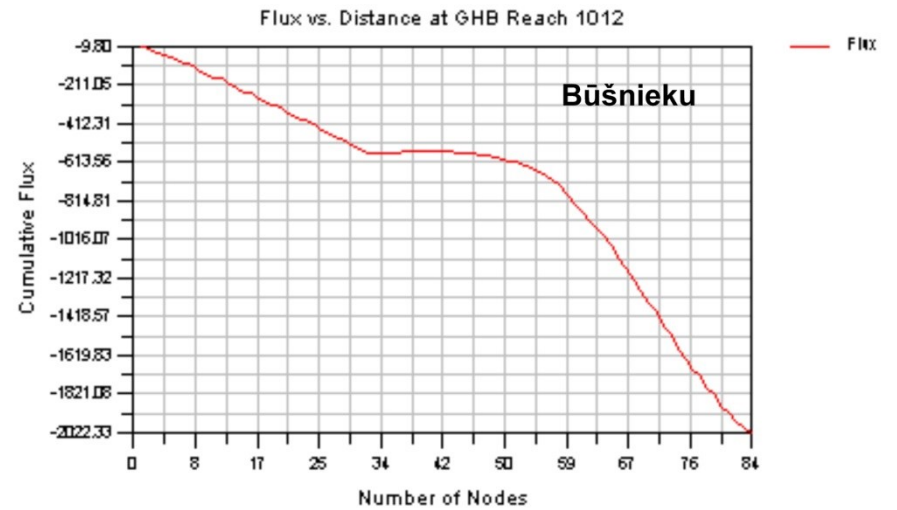
Flux



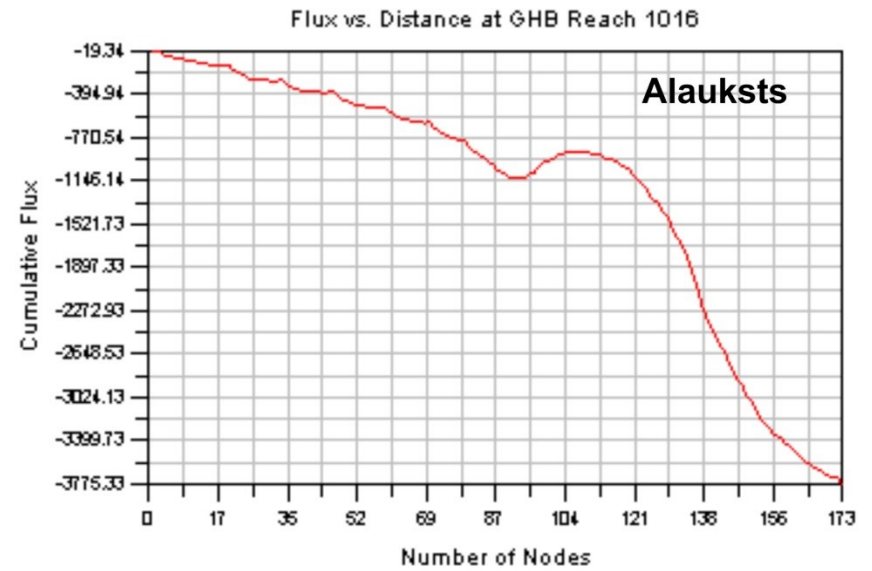
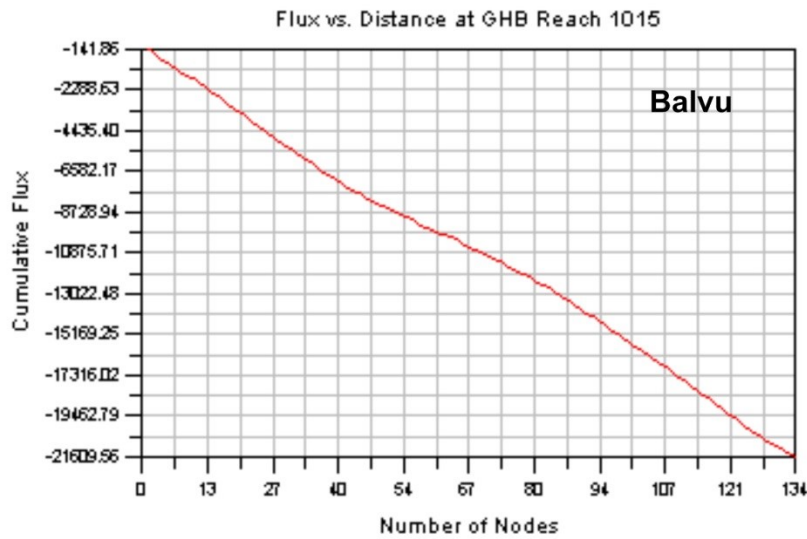
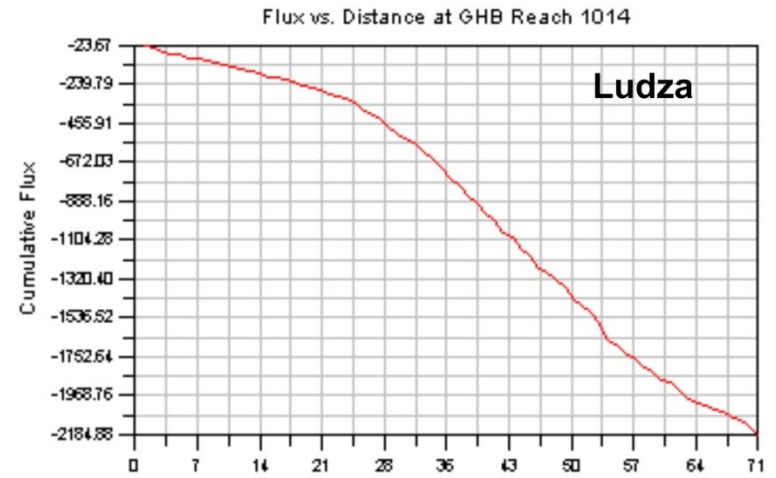
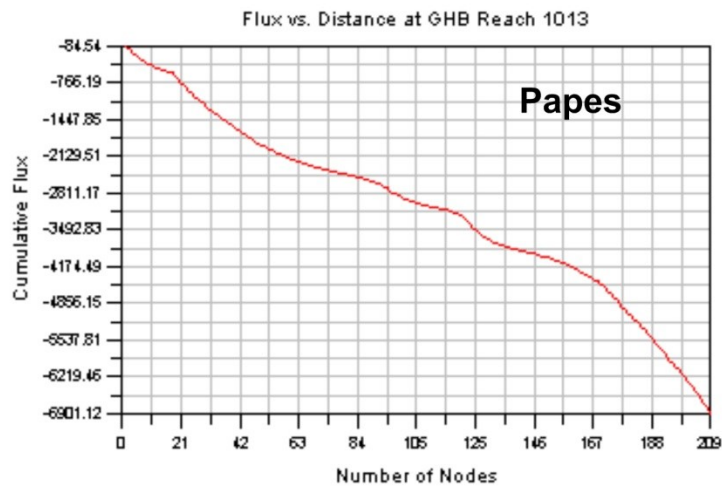
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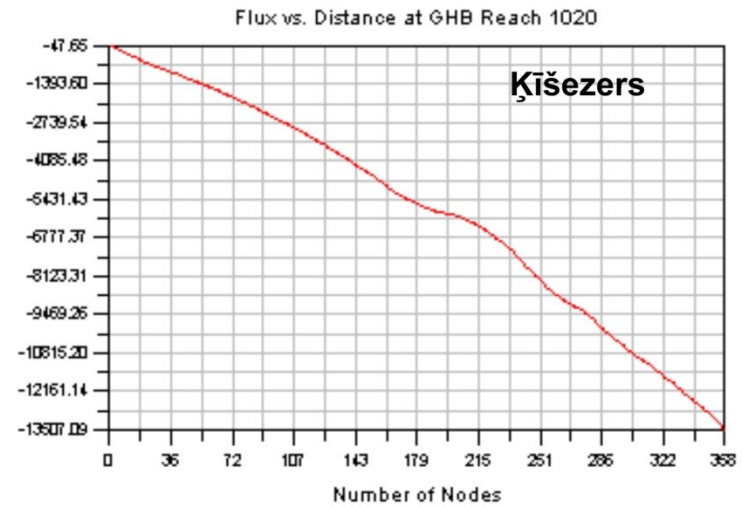
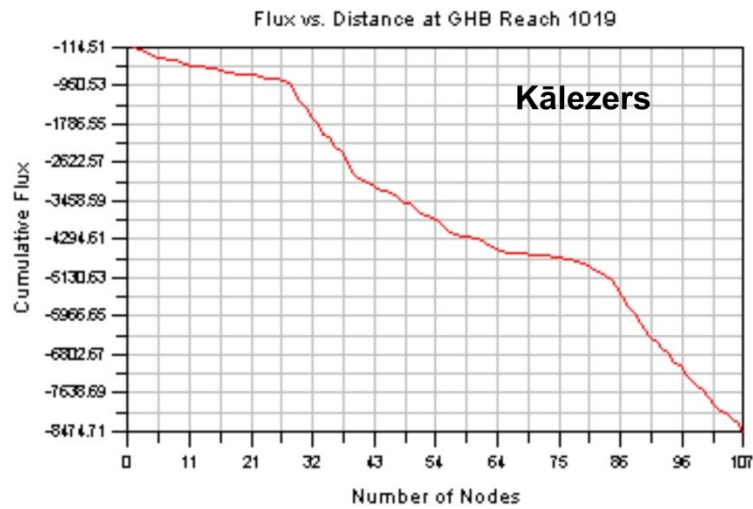
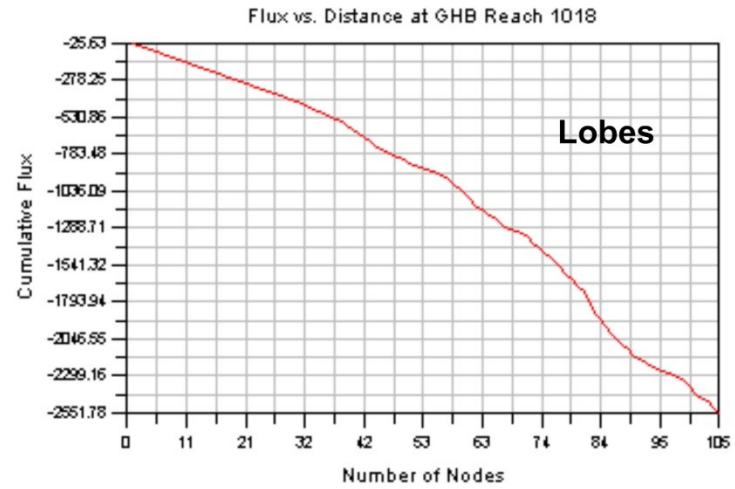
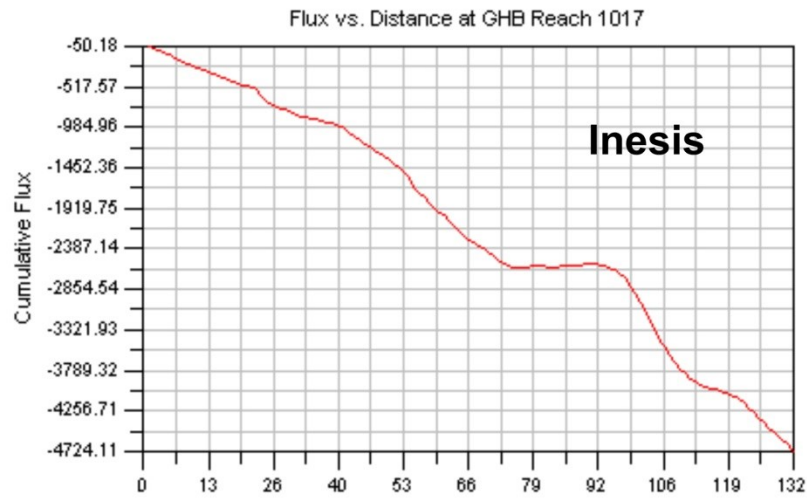


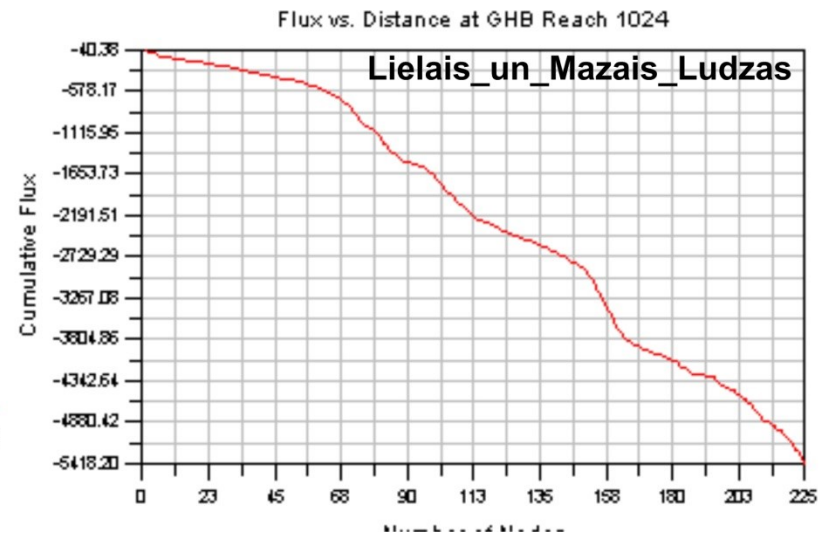
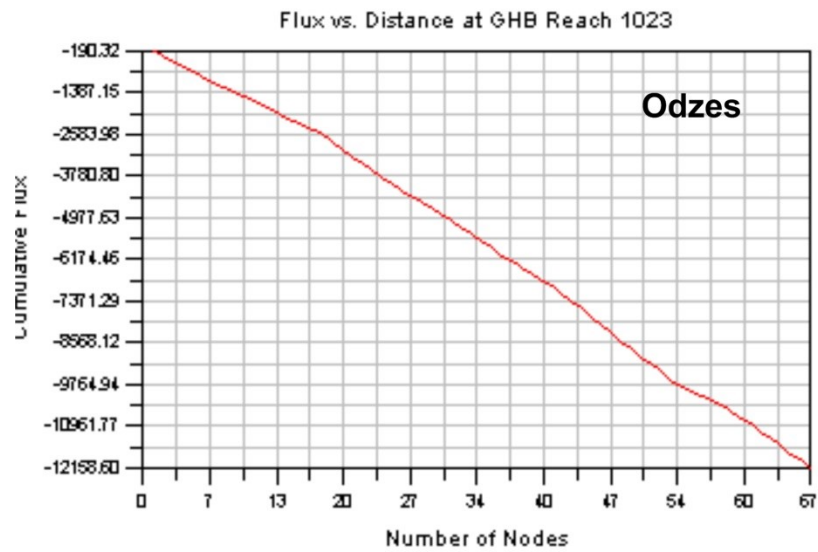
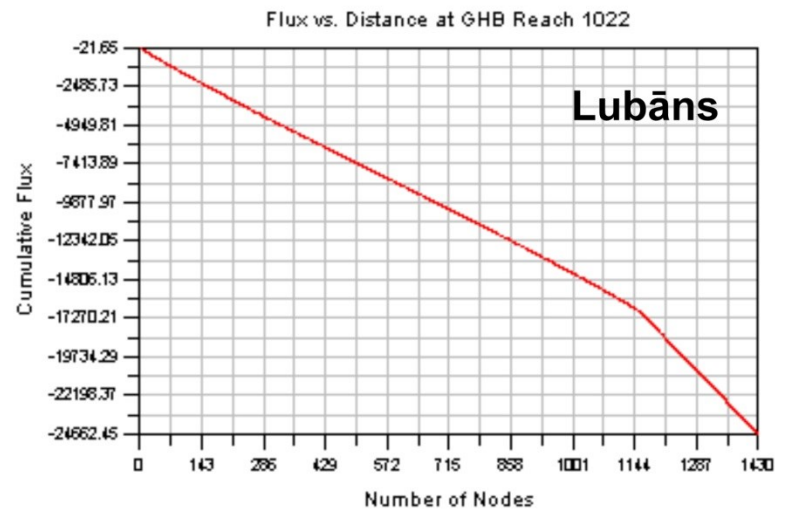
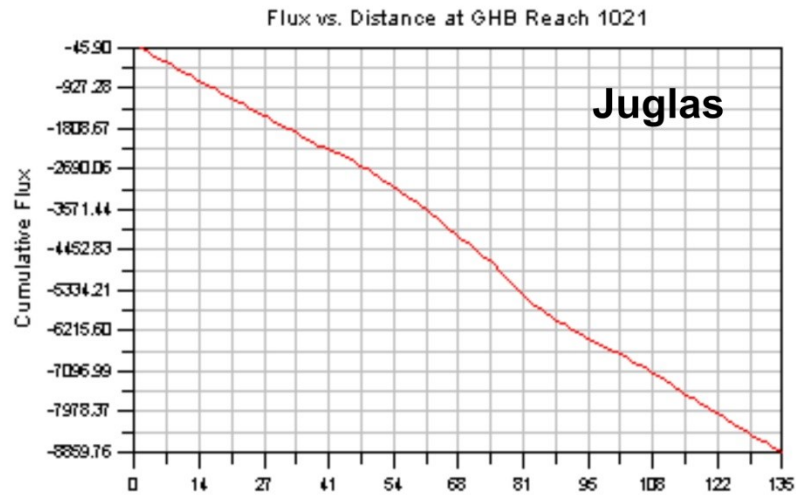
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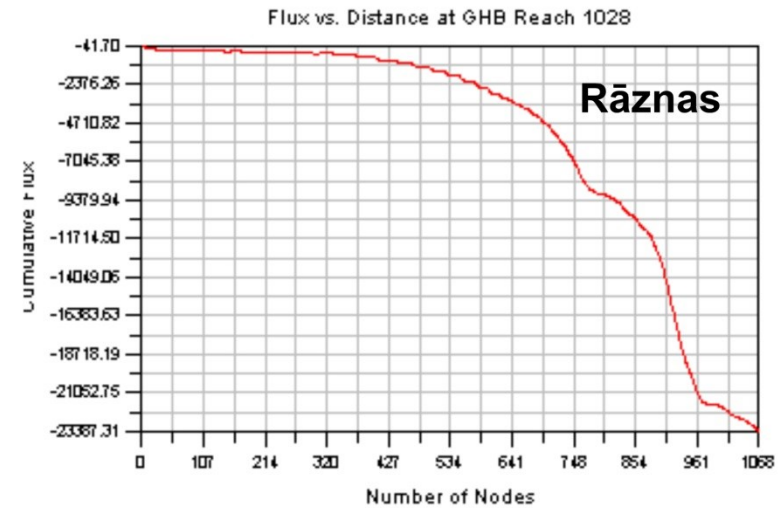
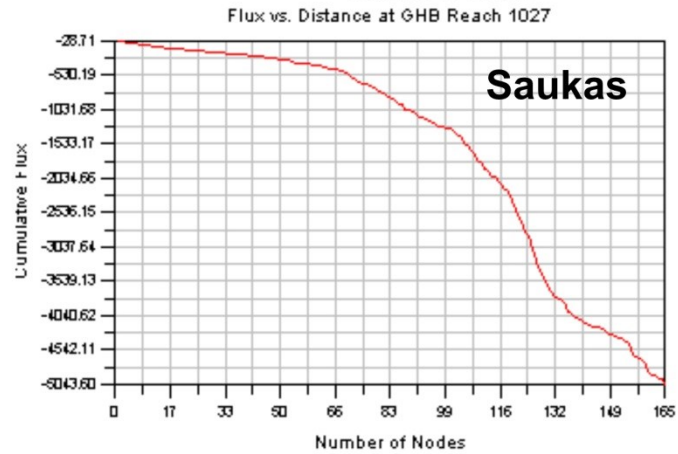
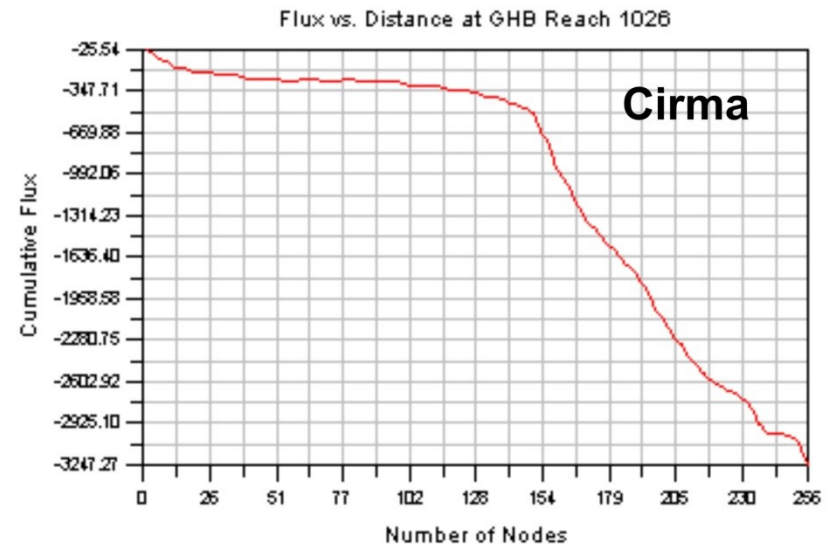
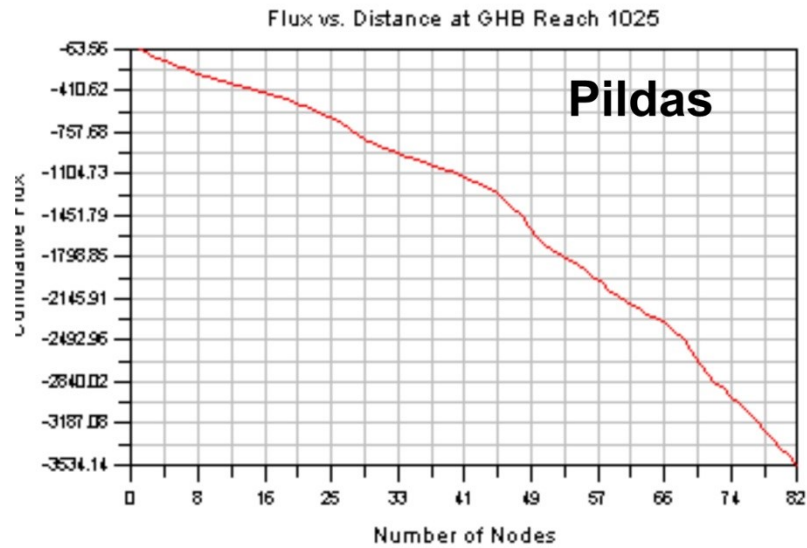


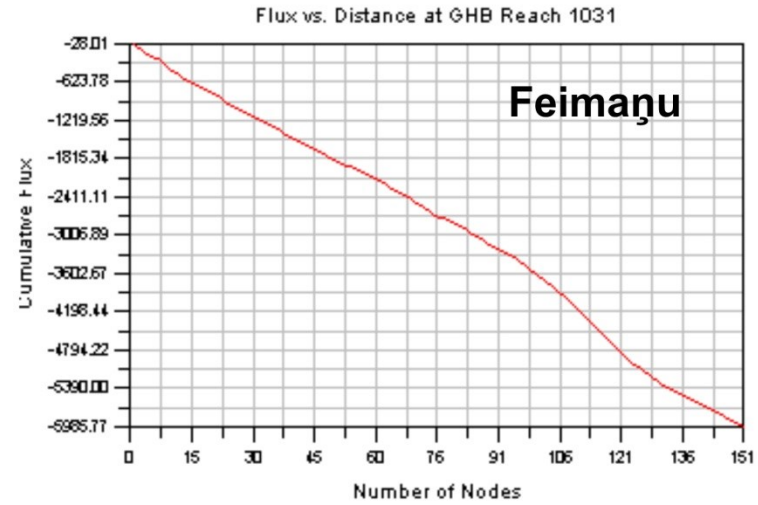
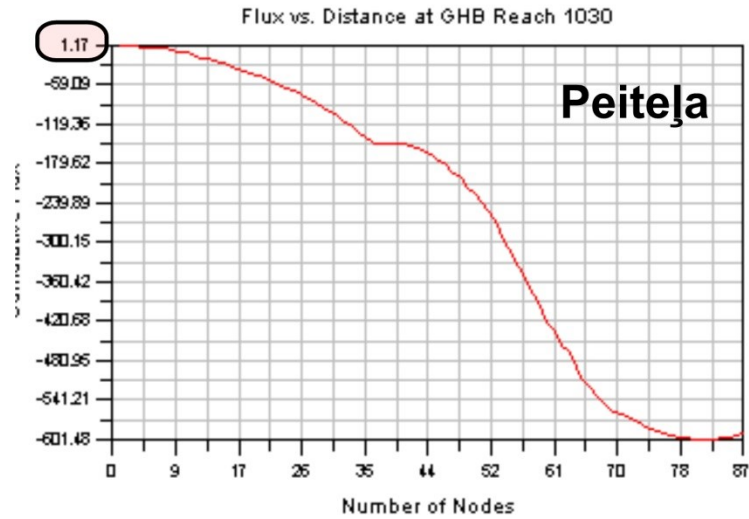
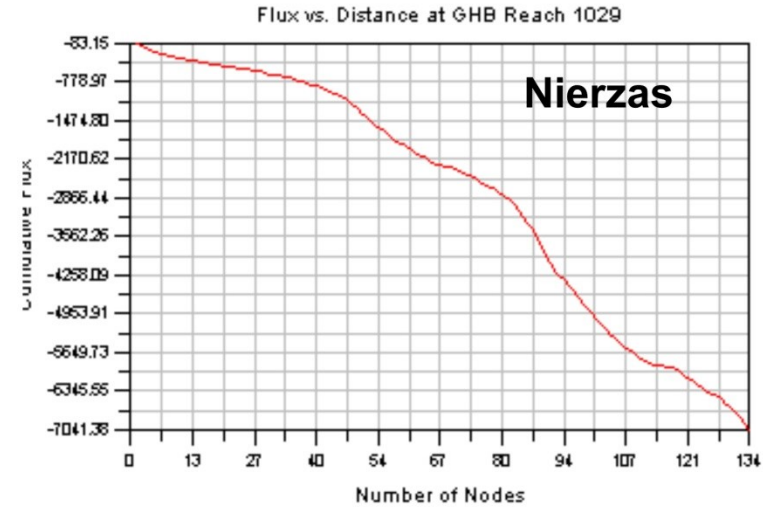
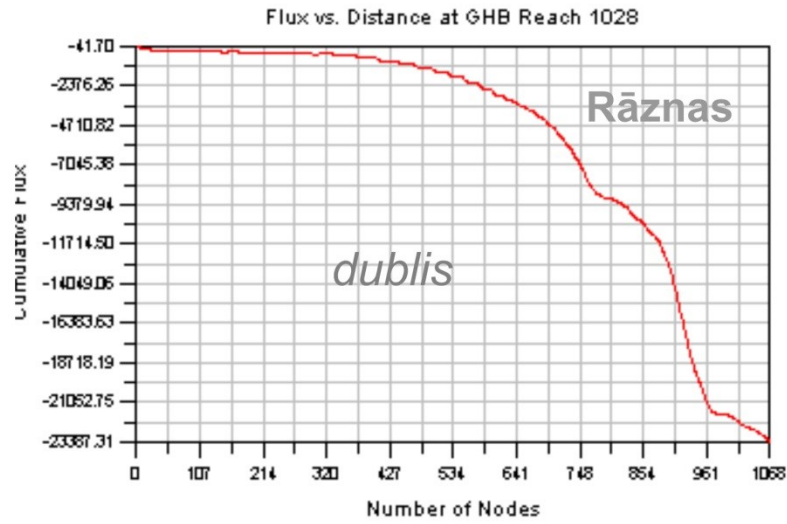
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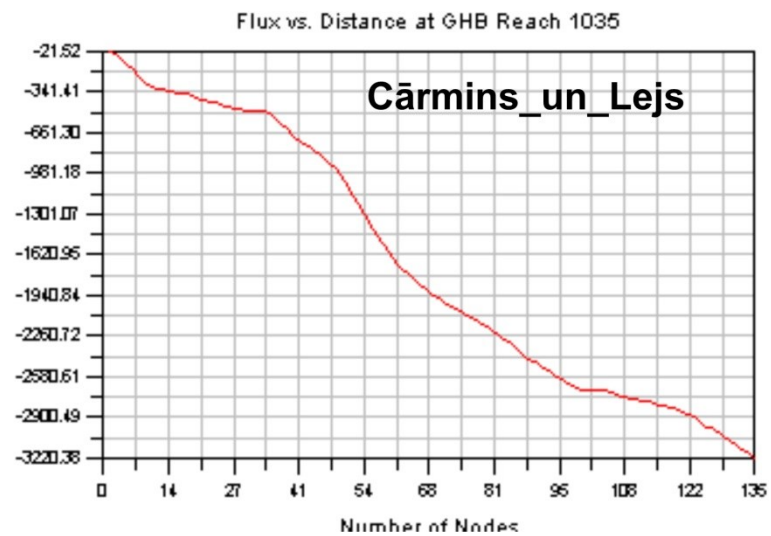
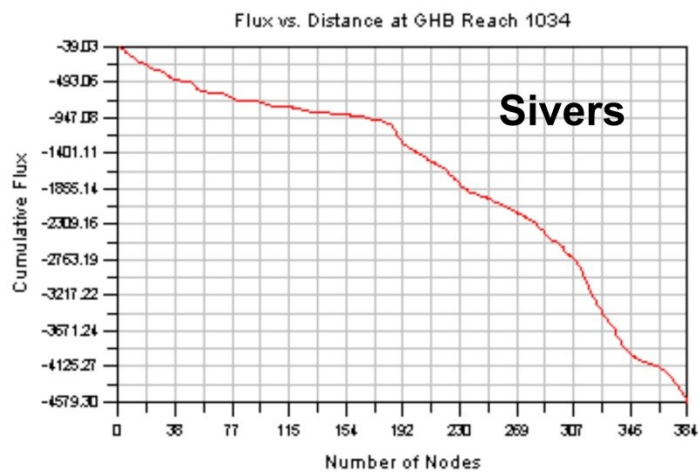
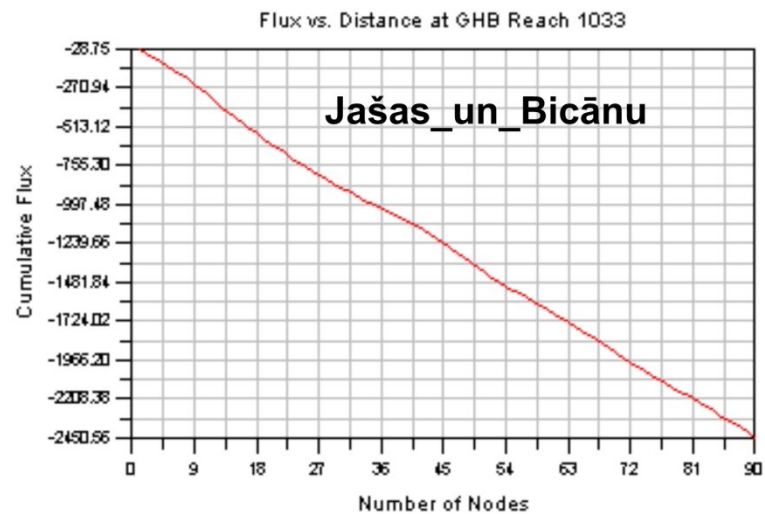
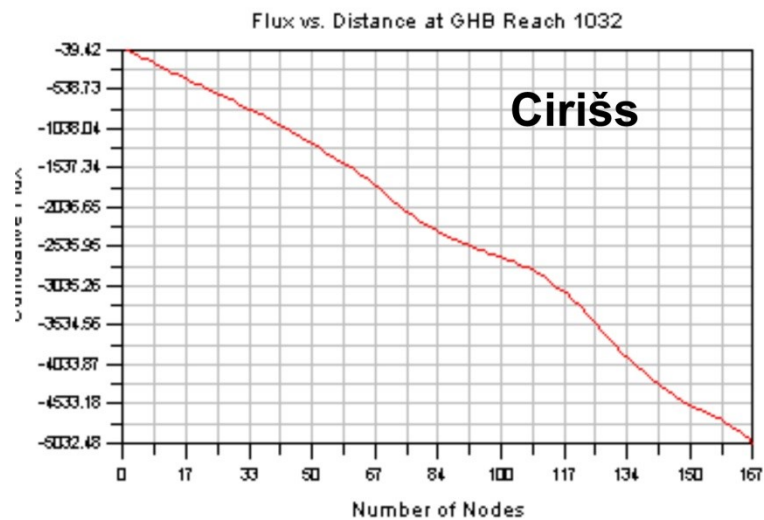


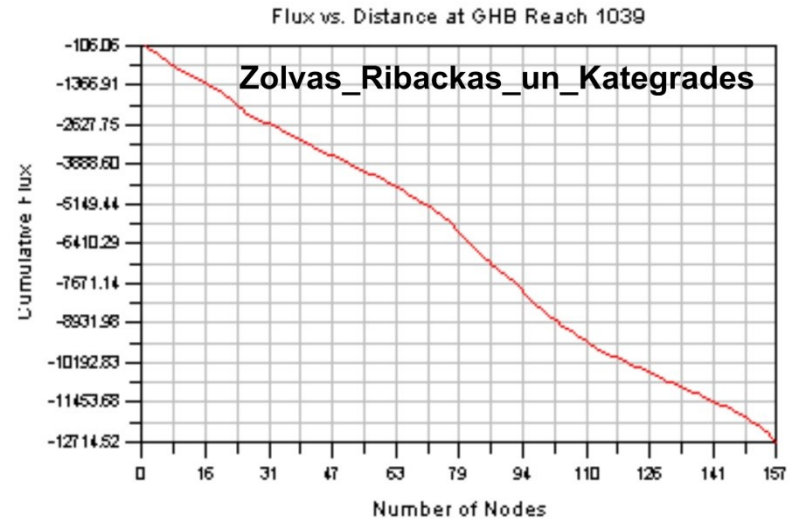
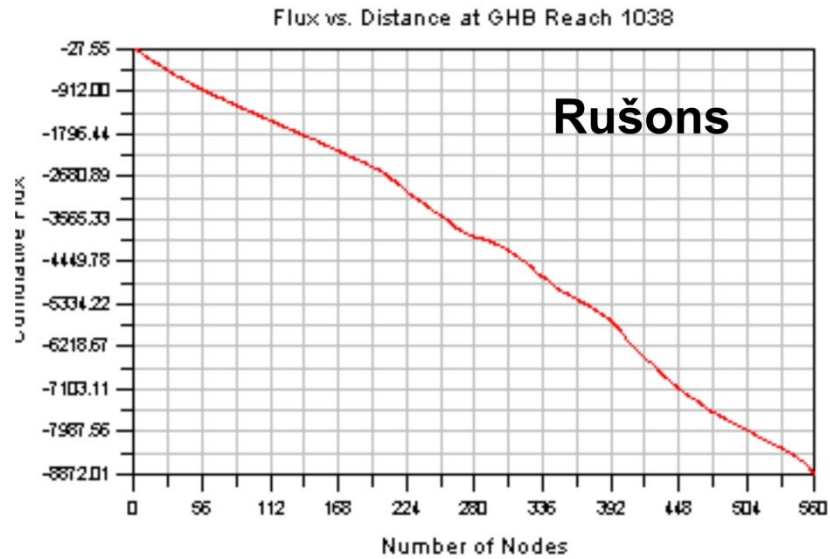
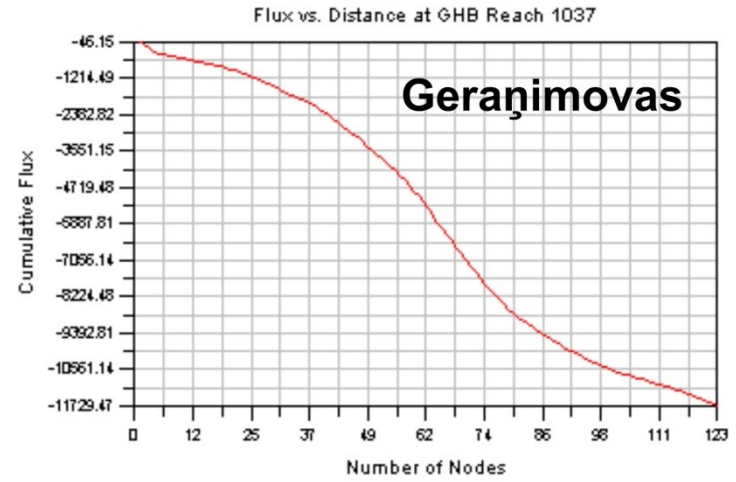
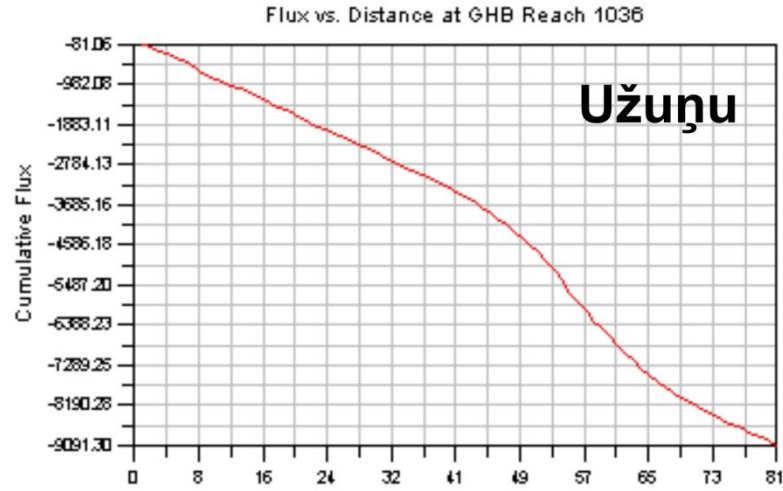


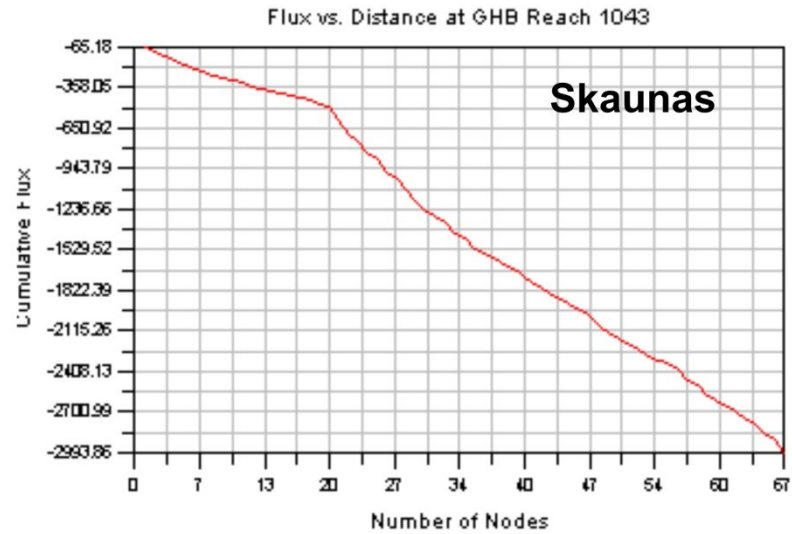
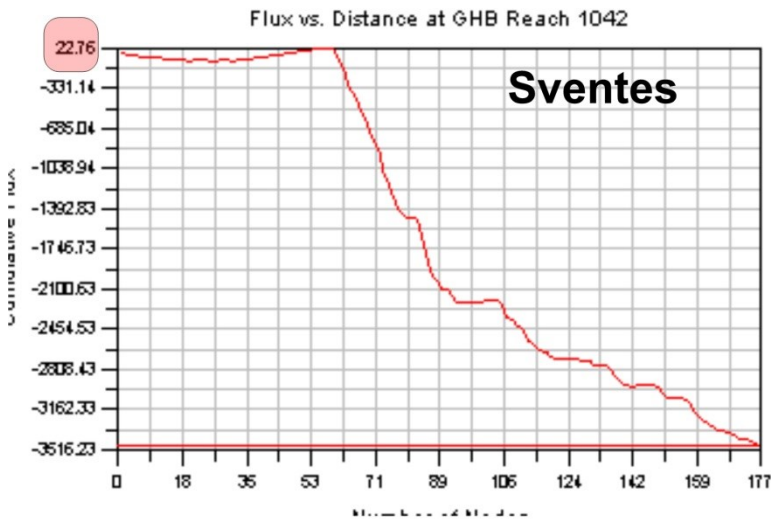
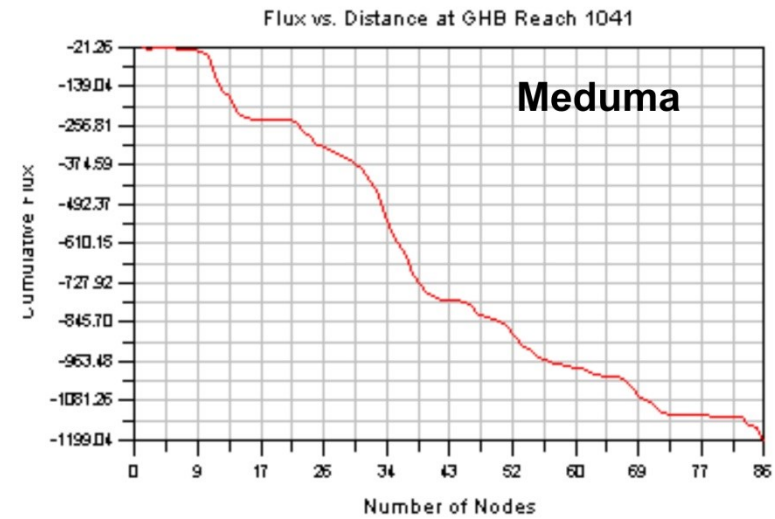
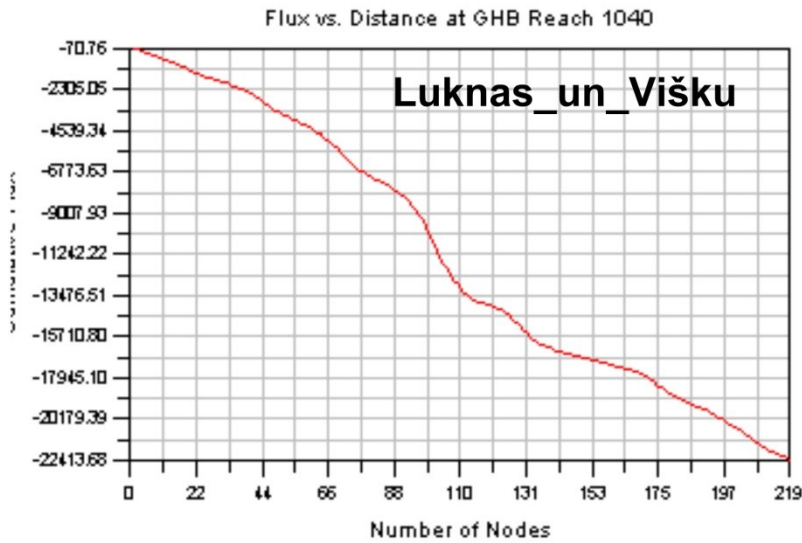


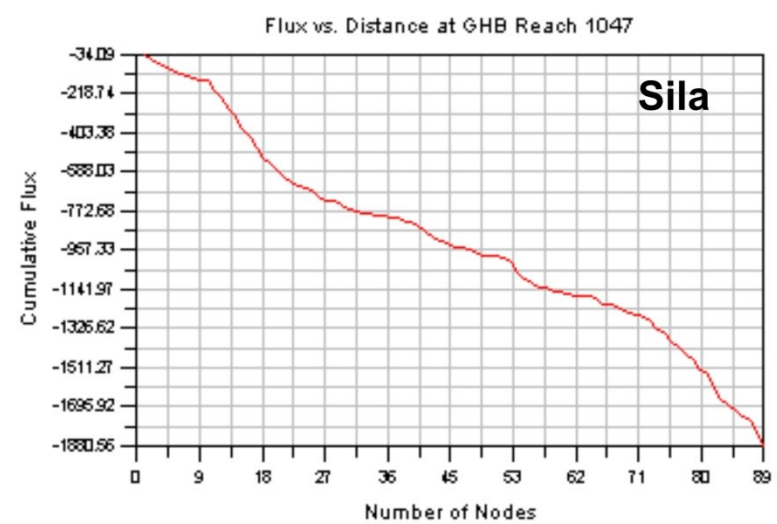
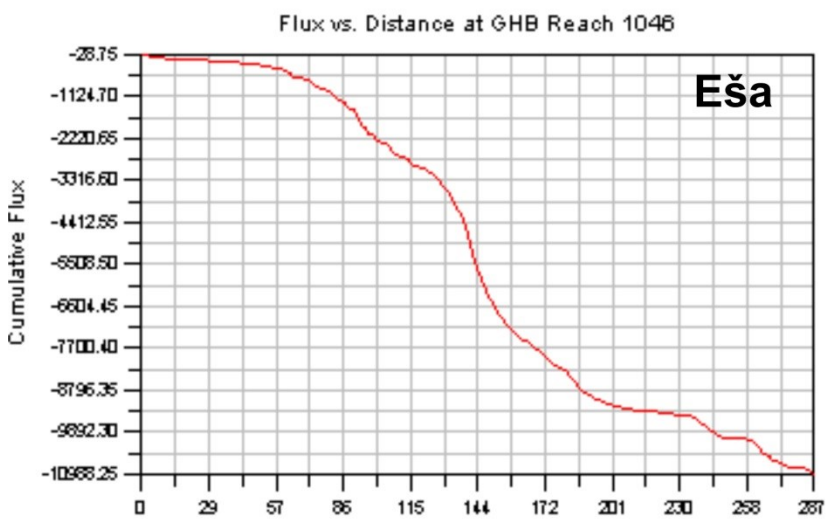
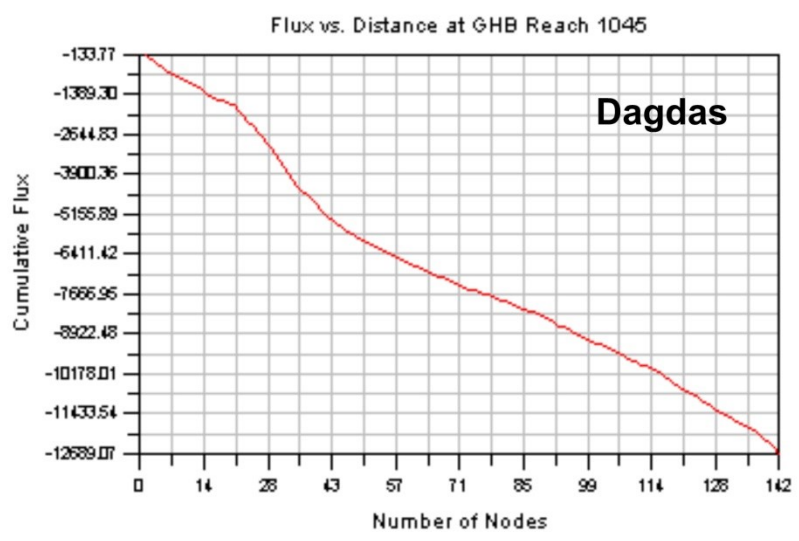
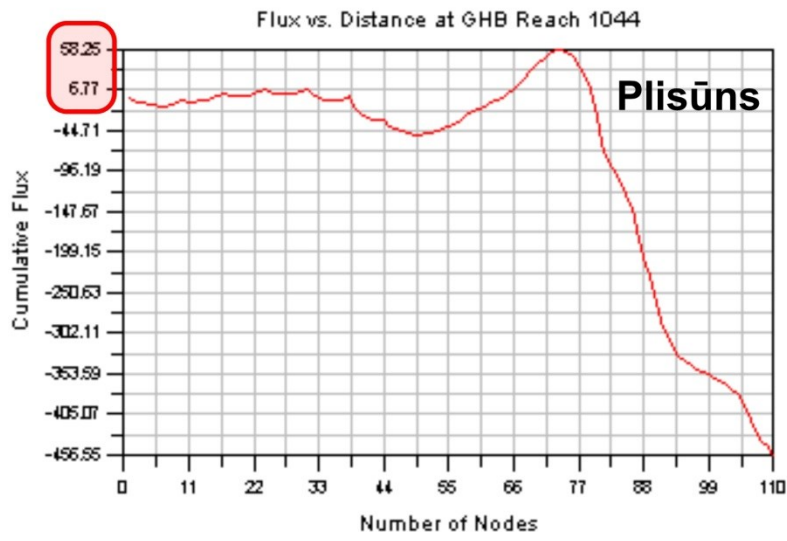


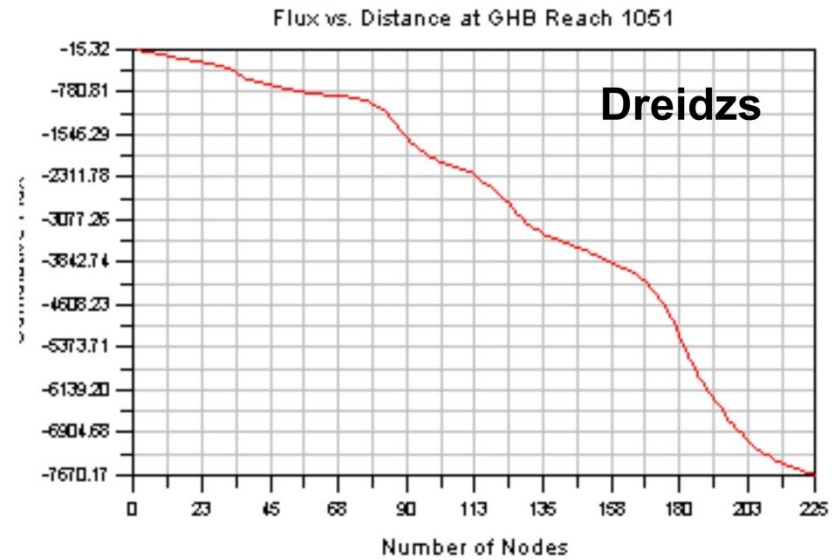
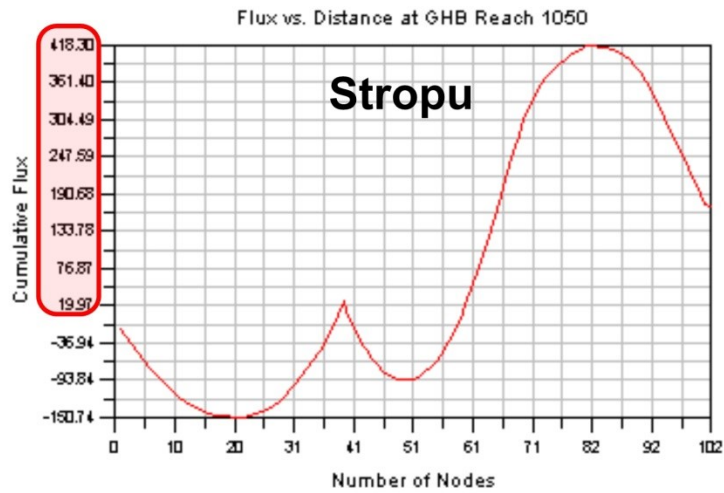
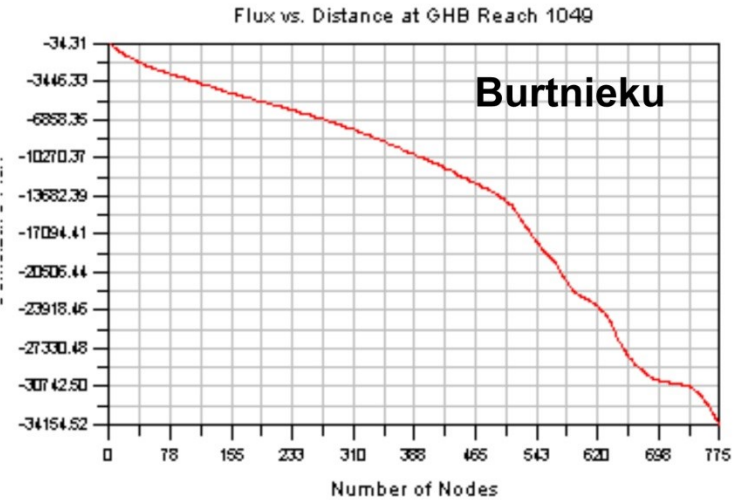
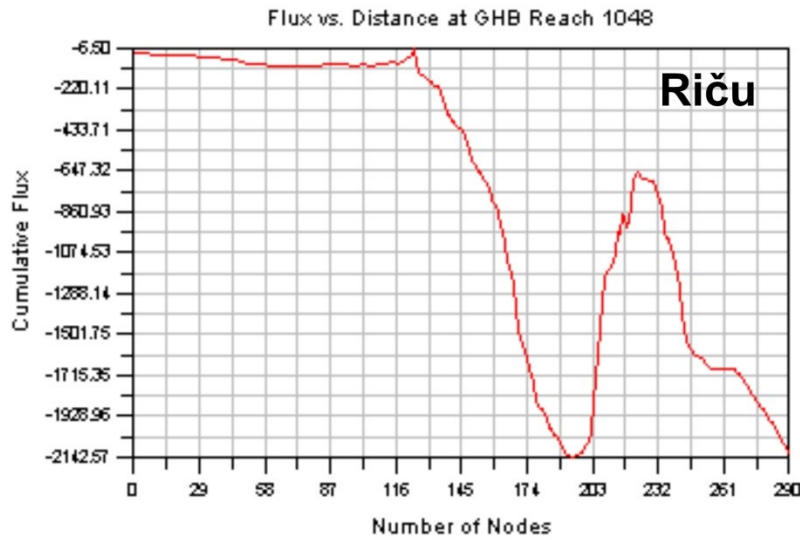


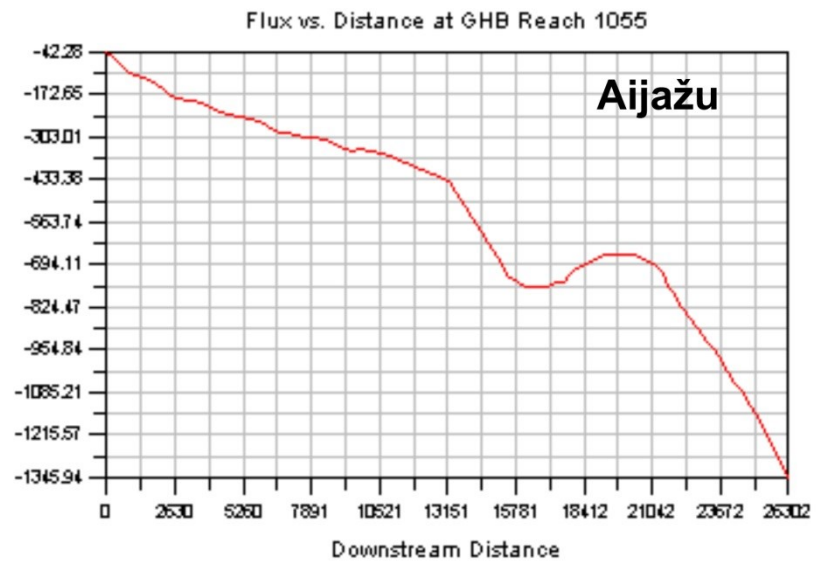
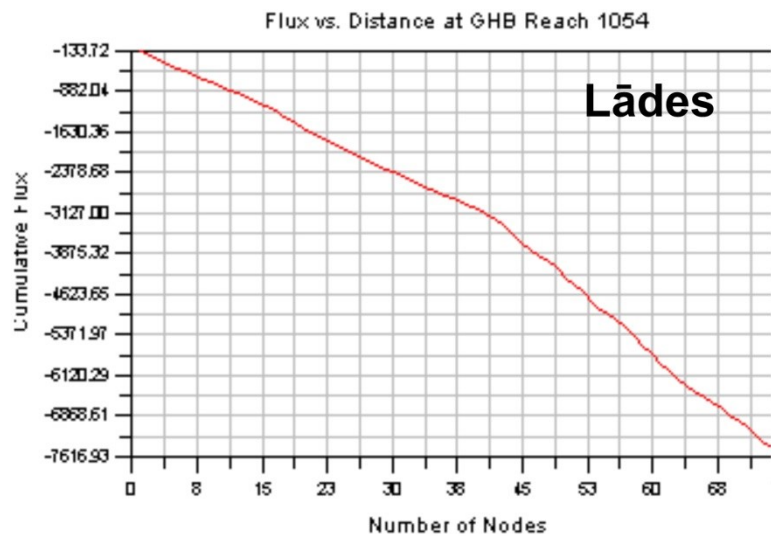
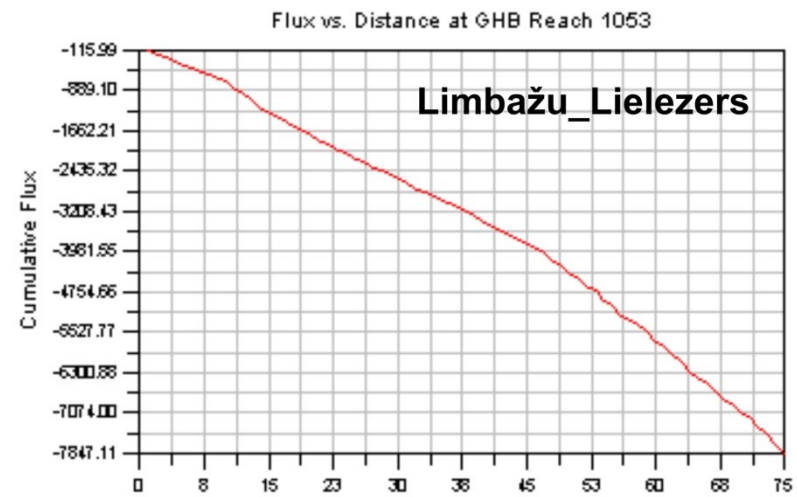
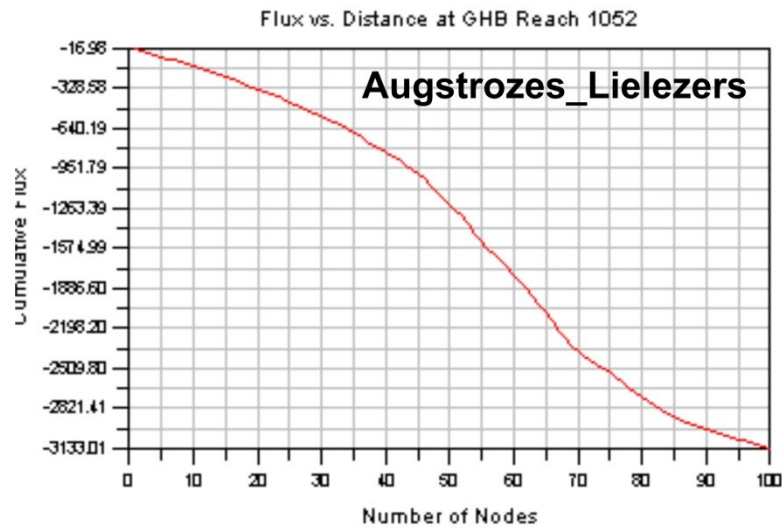


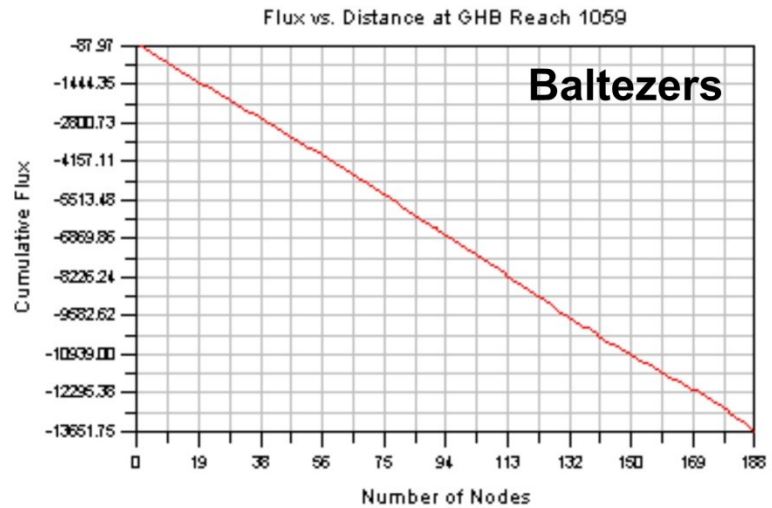
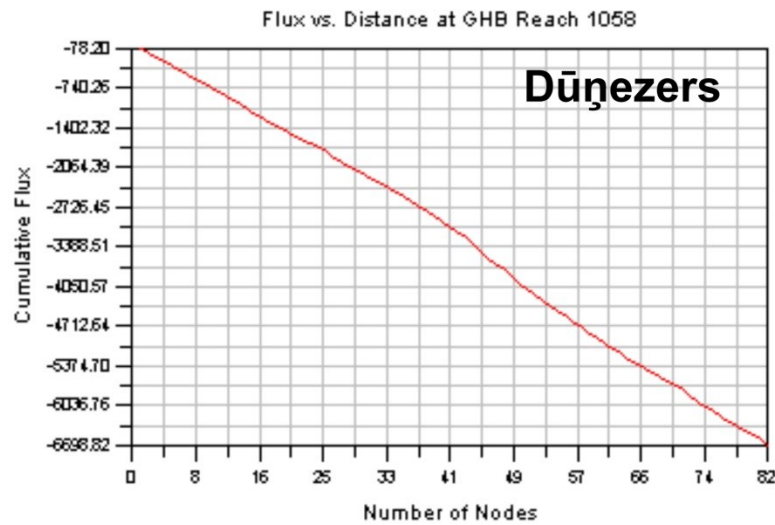
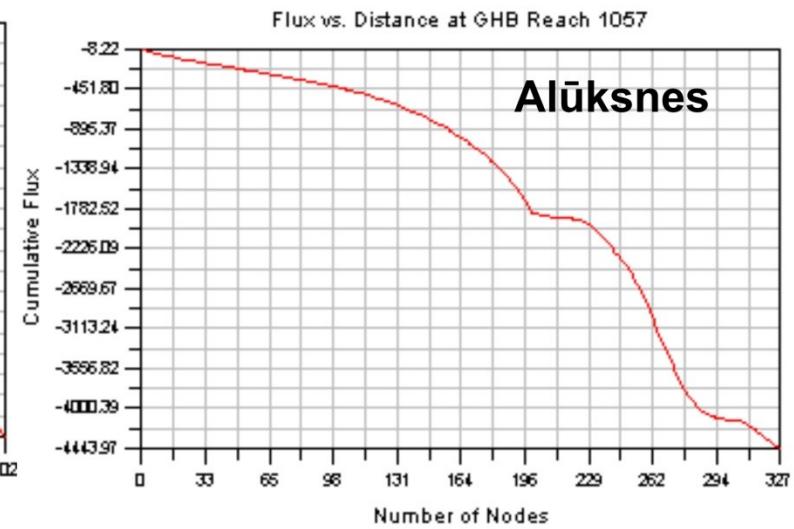
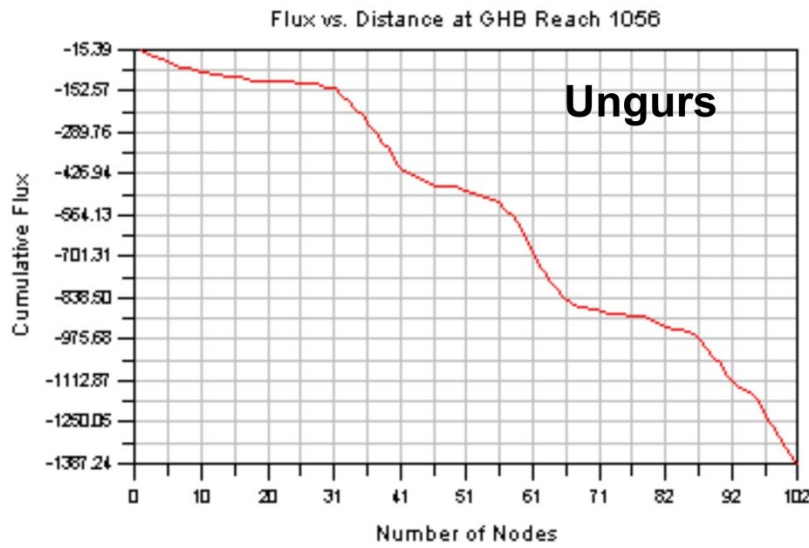


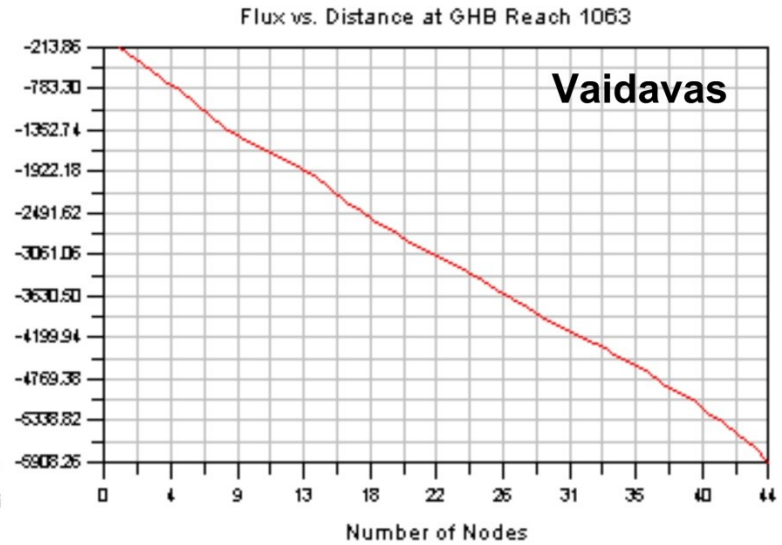
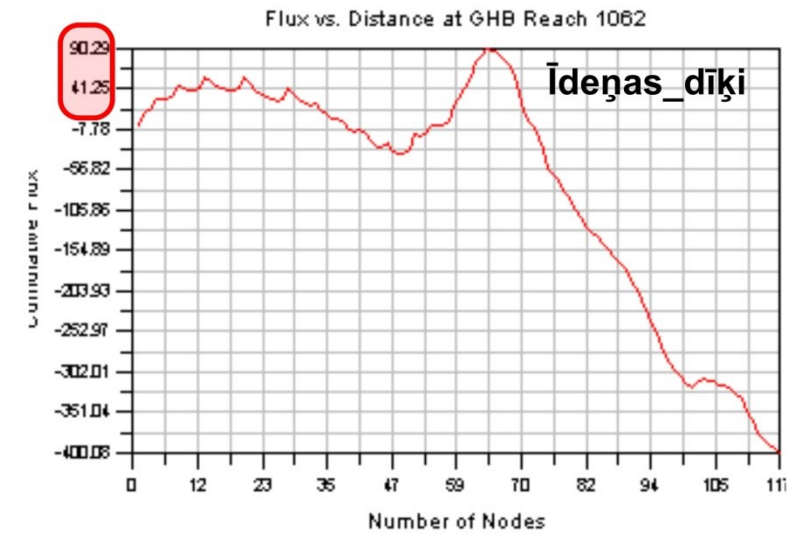
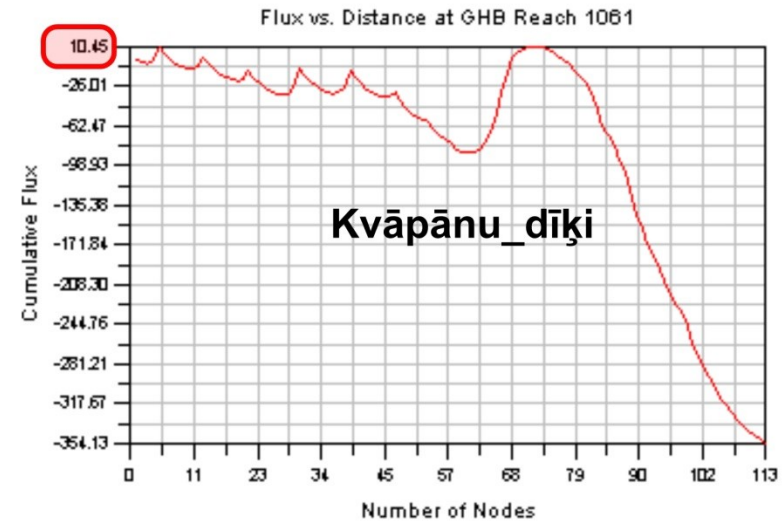
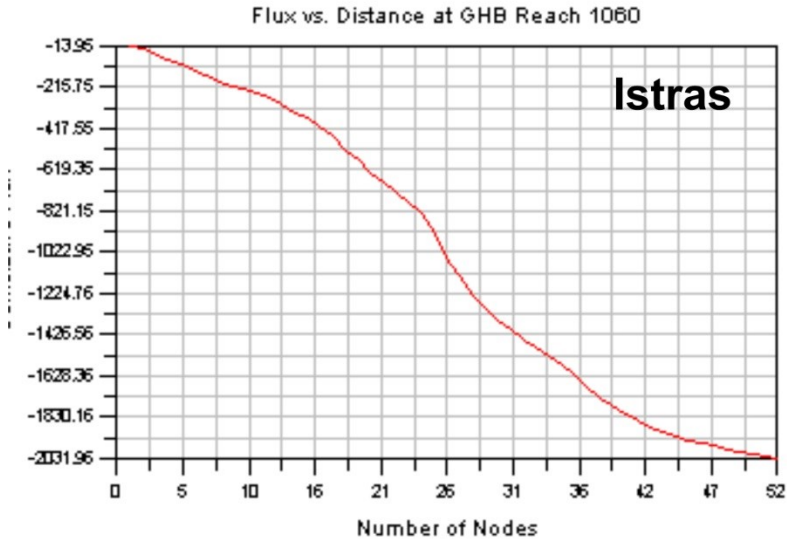


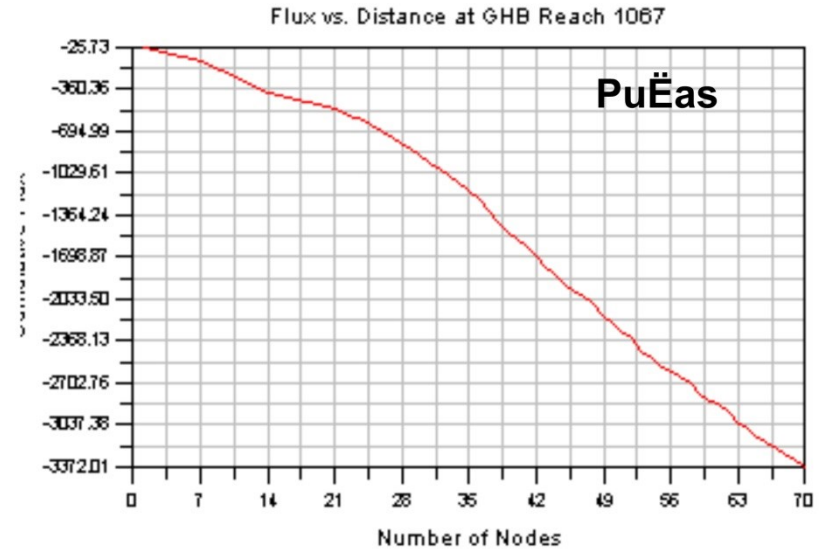
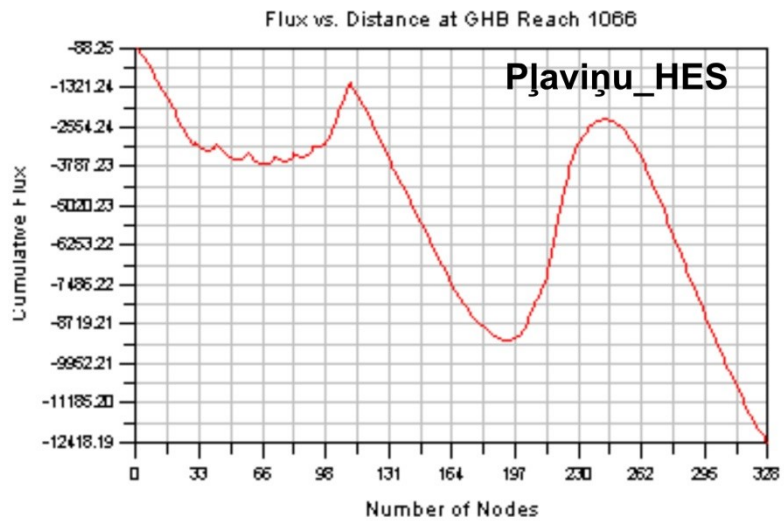
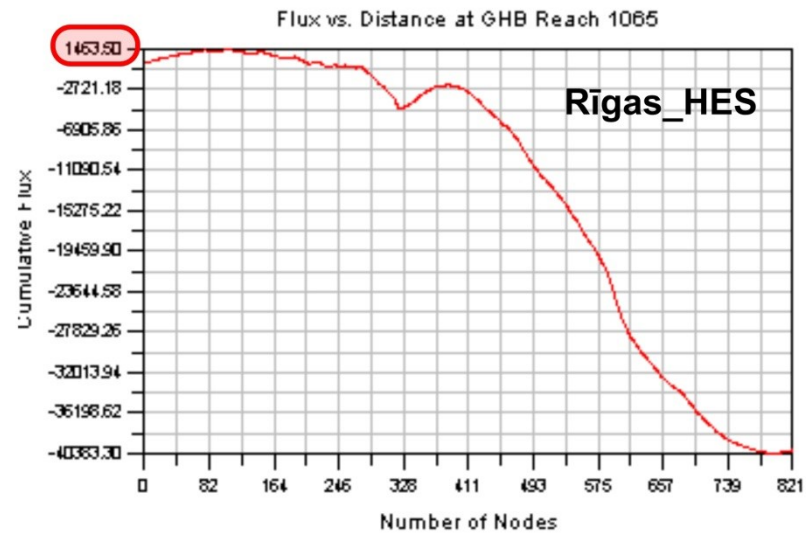
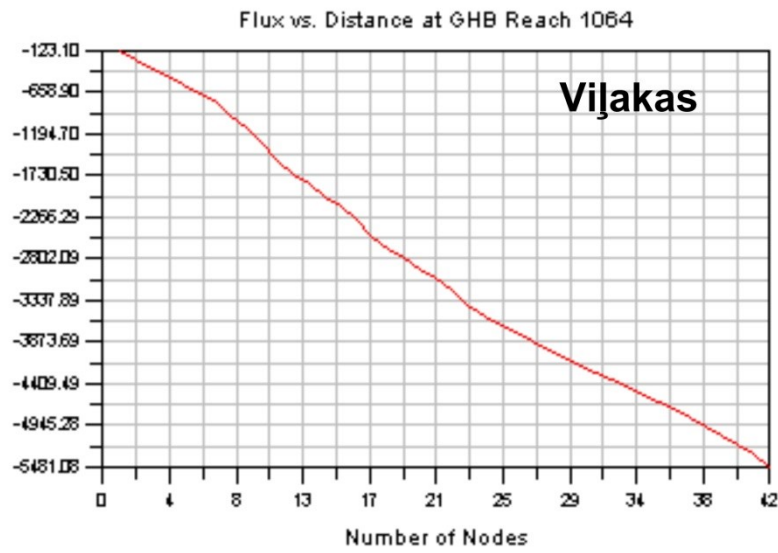


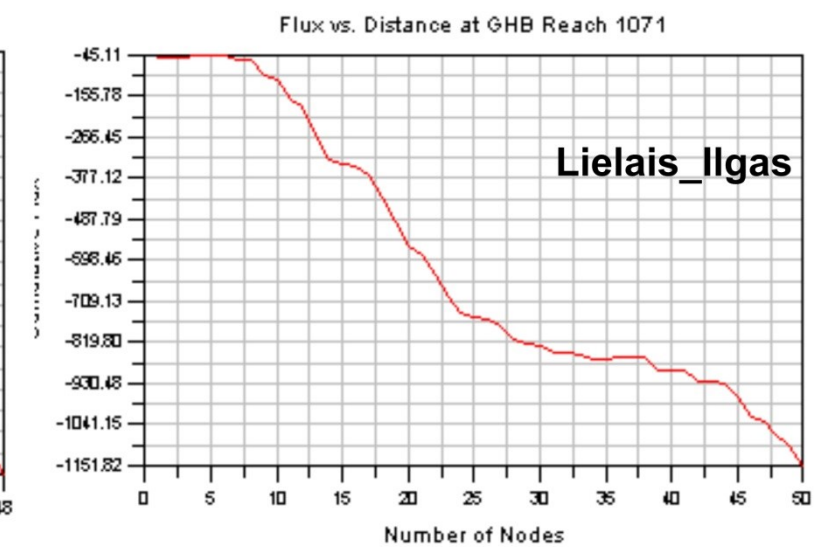
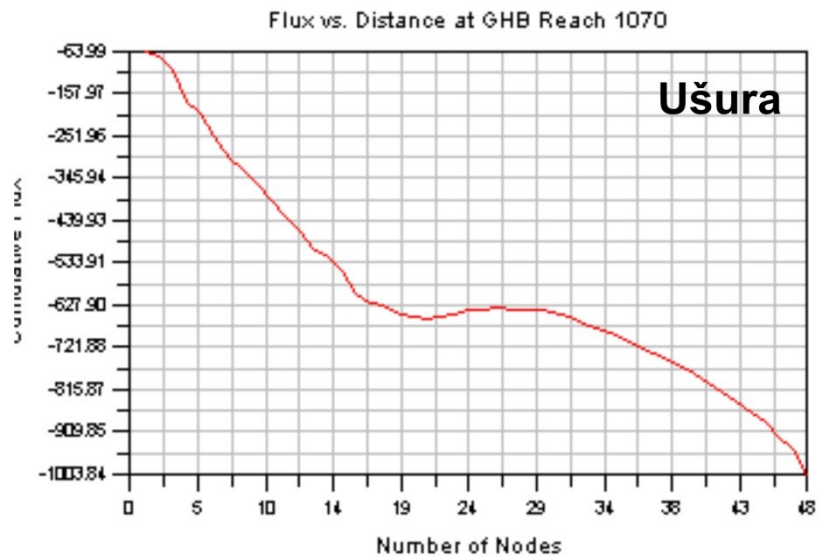
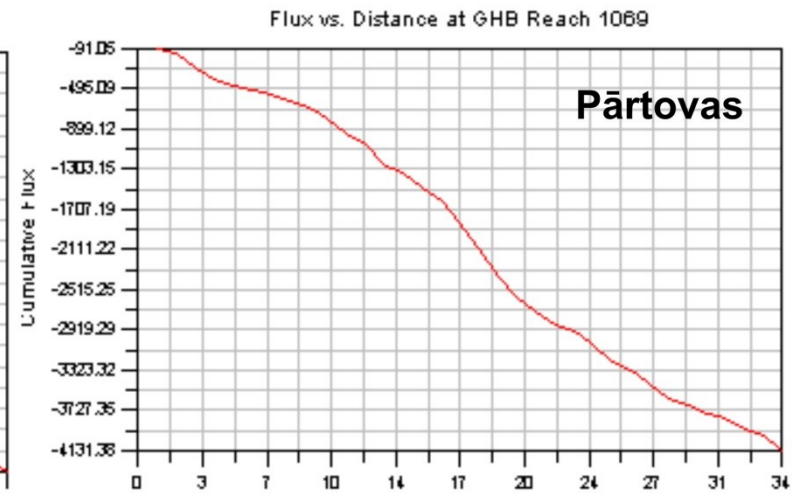
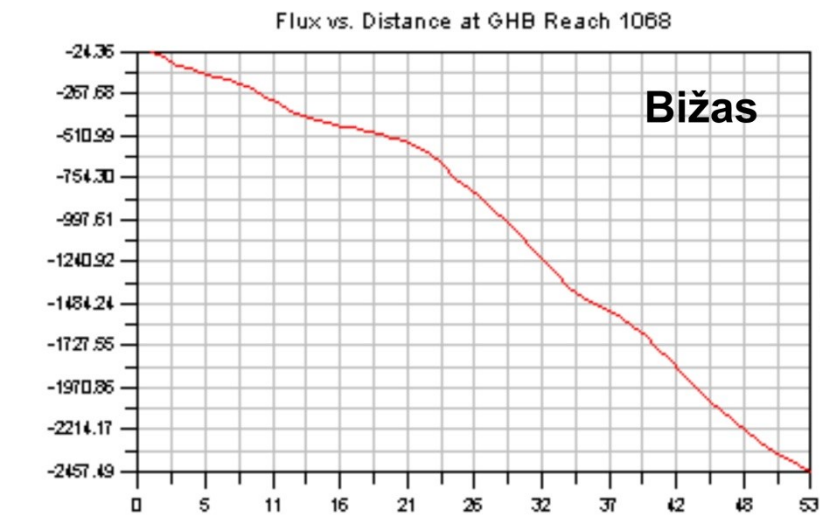


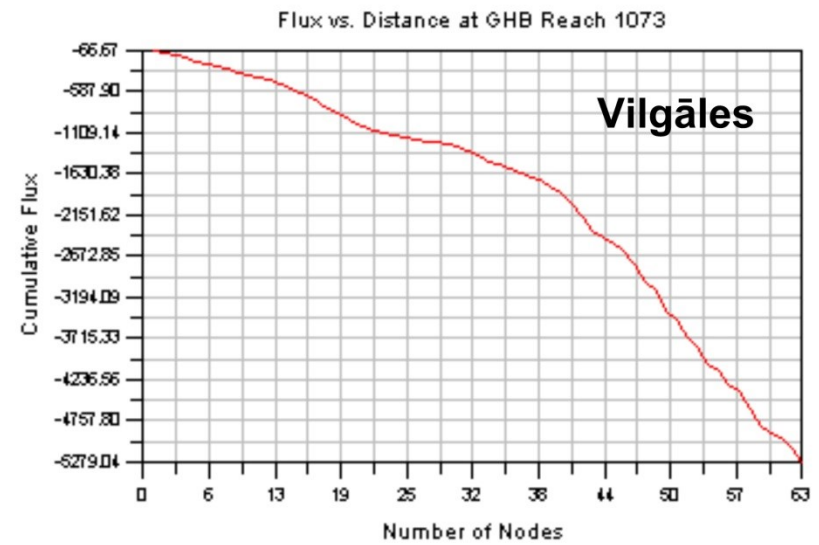
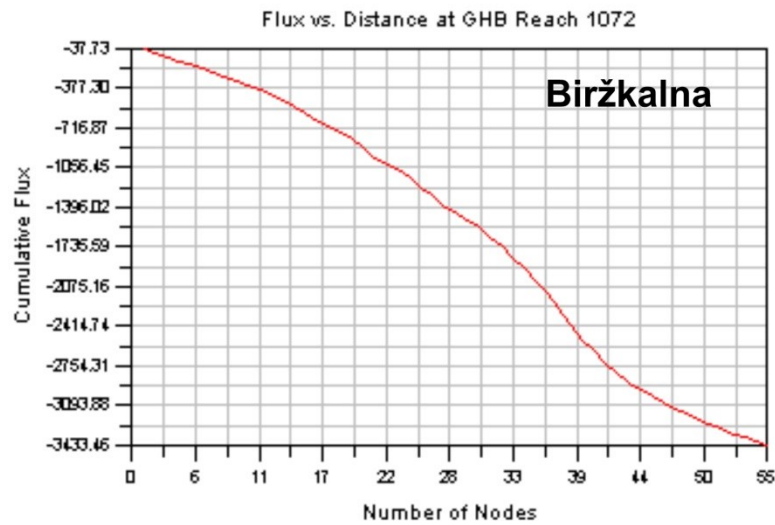






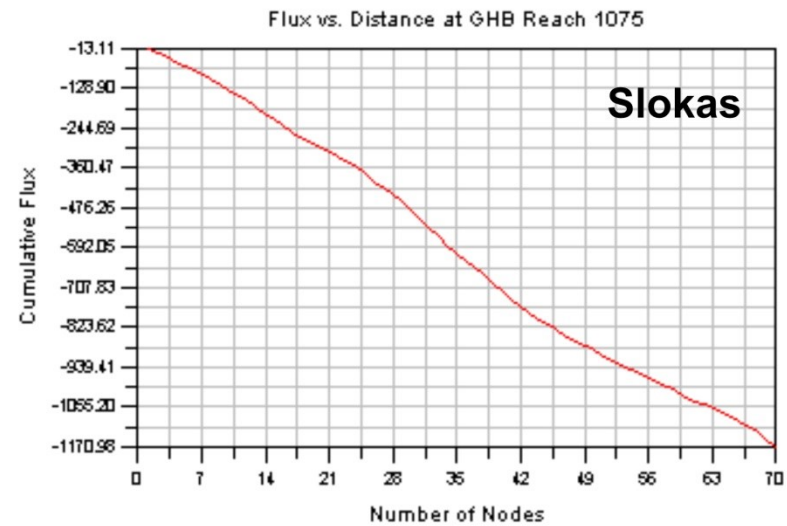


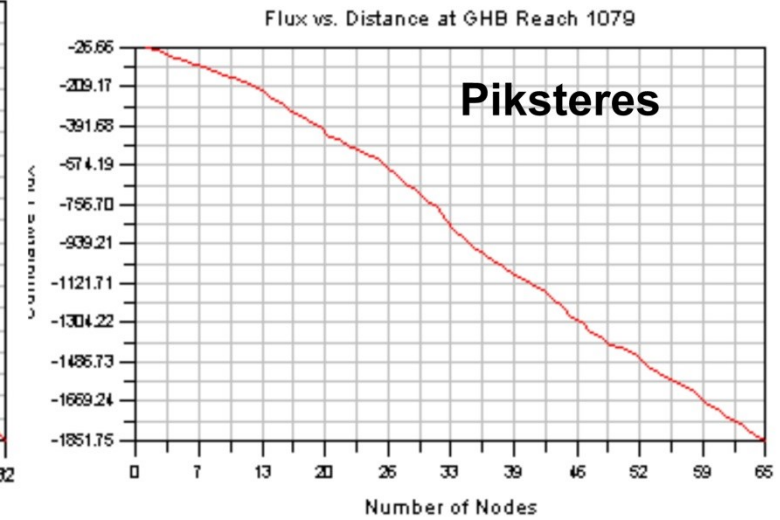
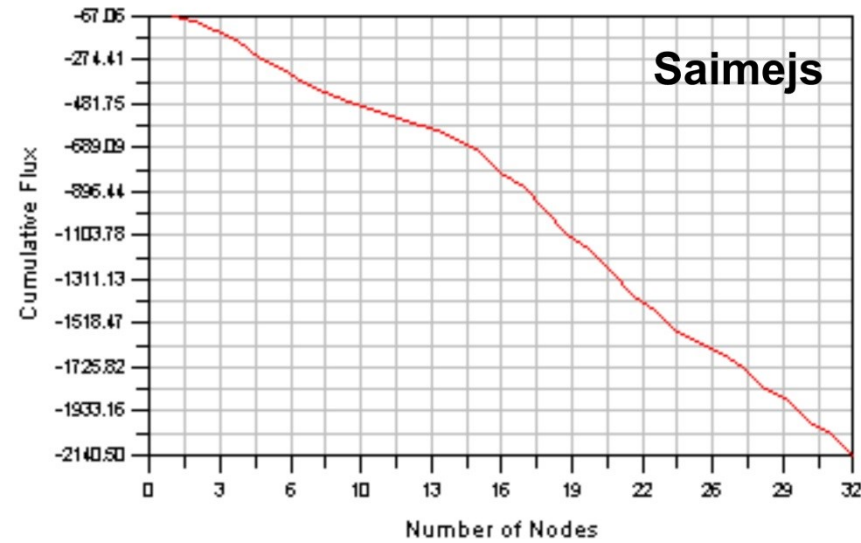
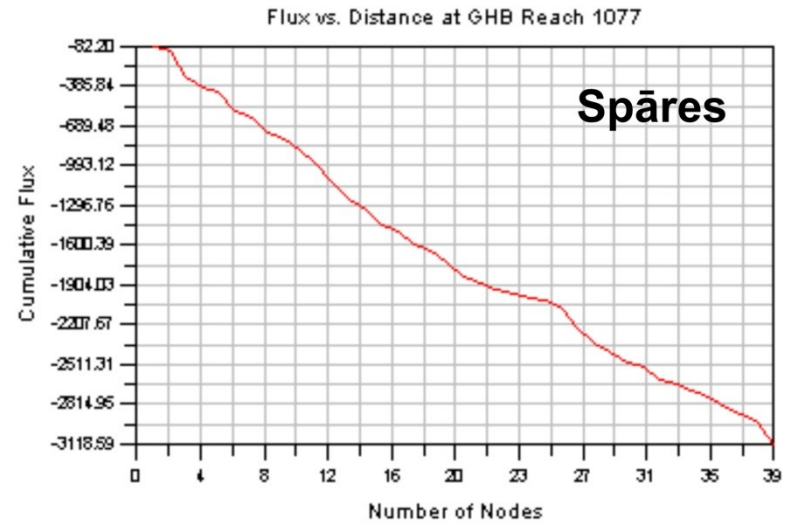
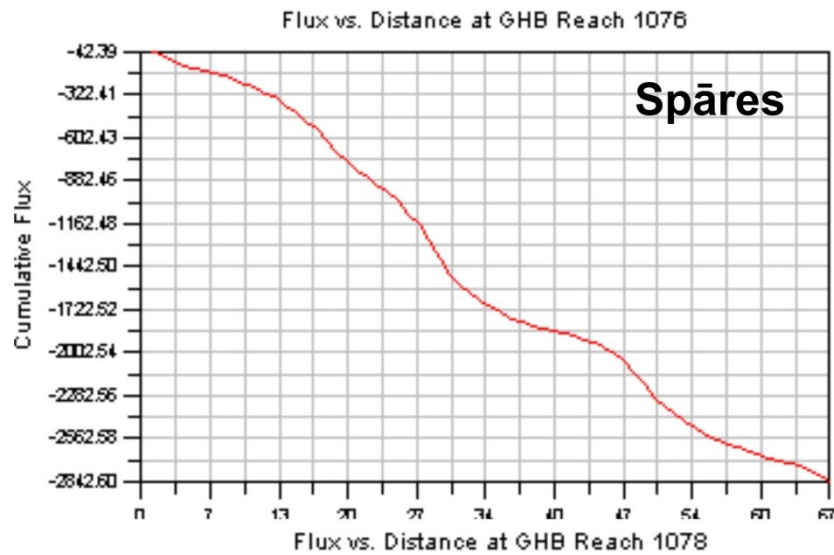


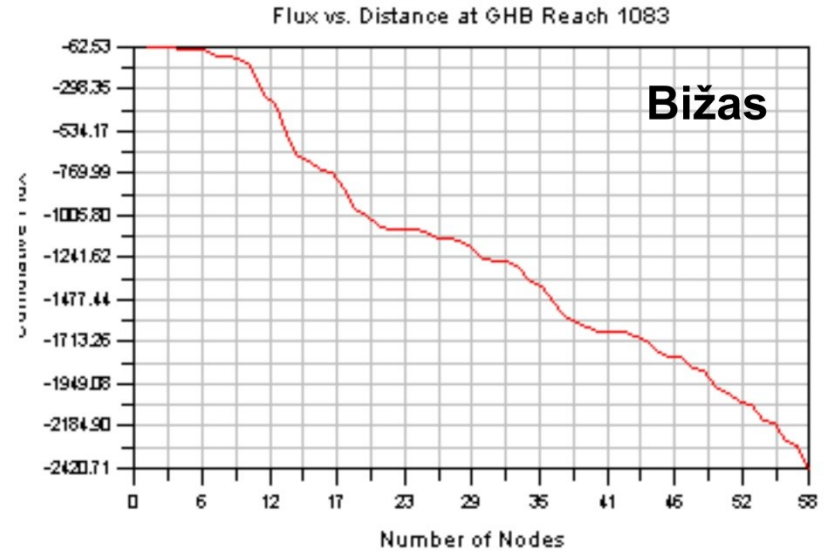
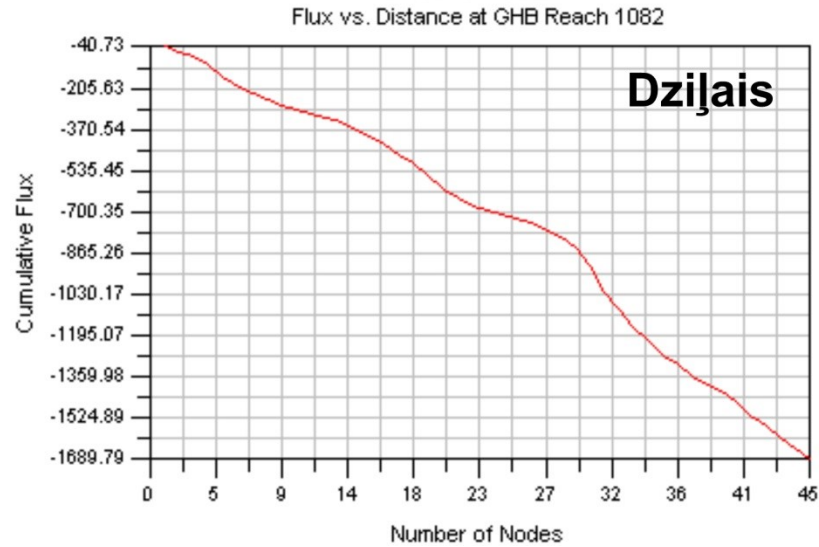
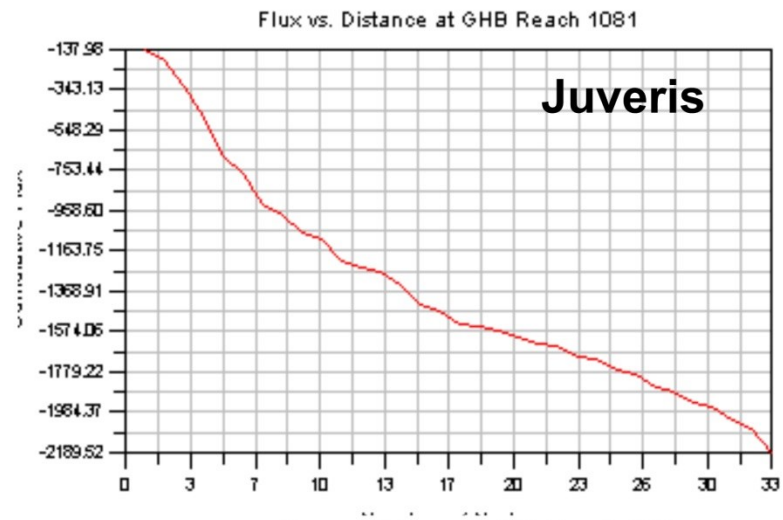
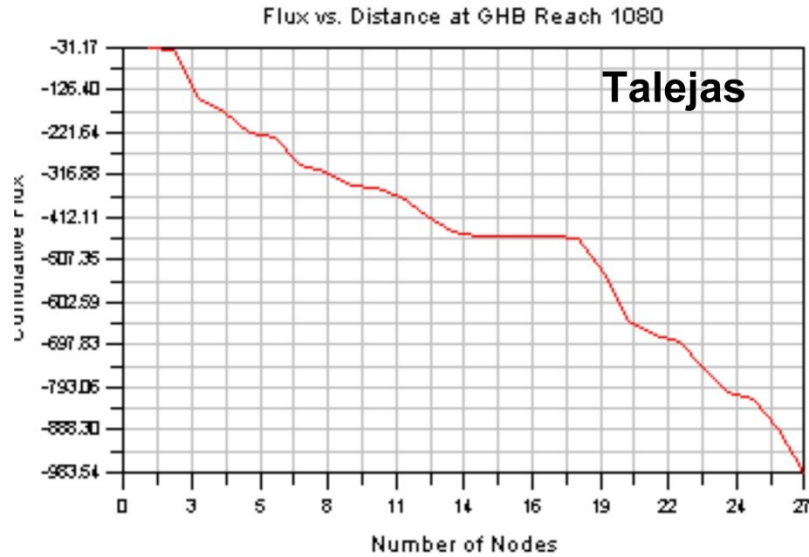


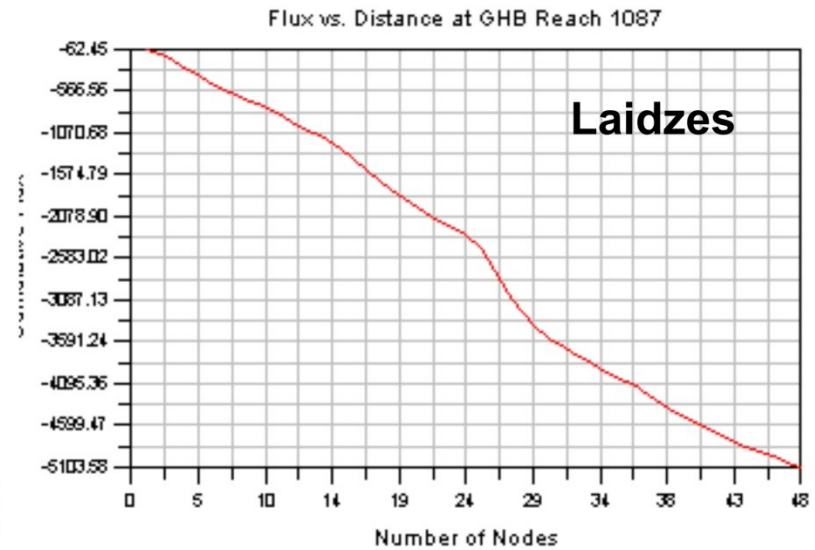
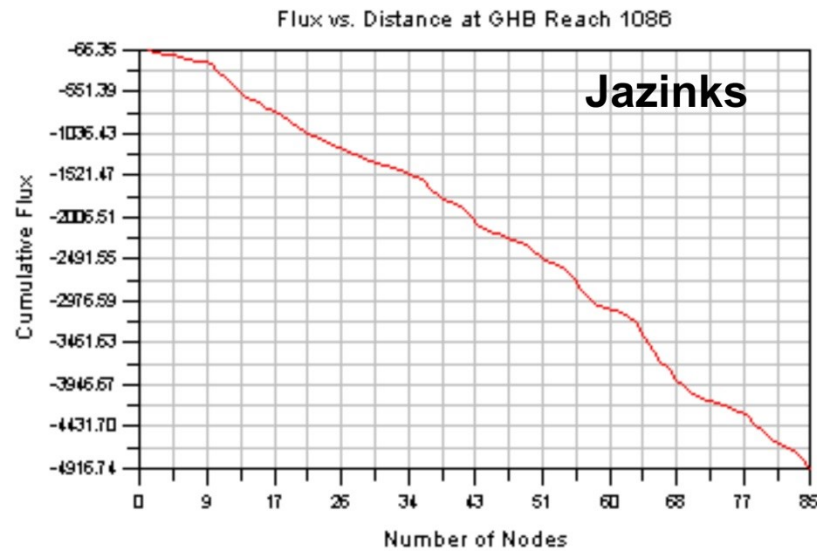
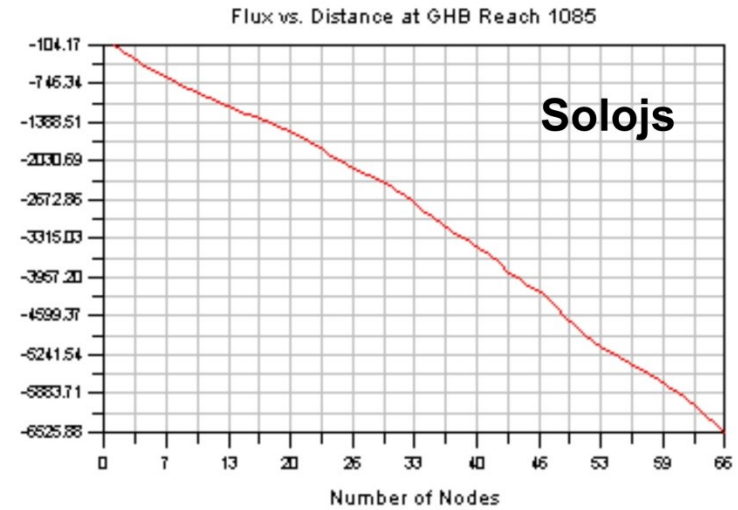
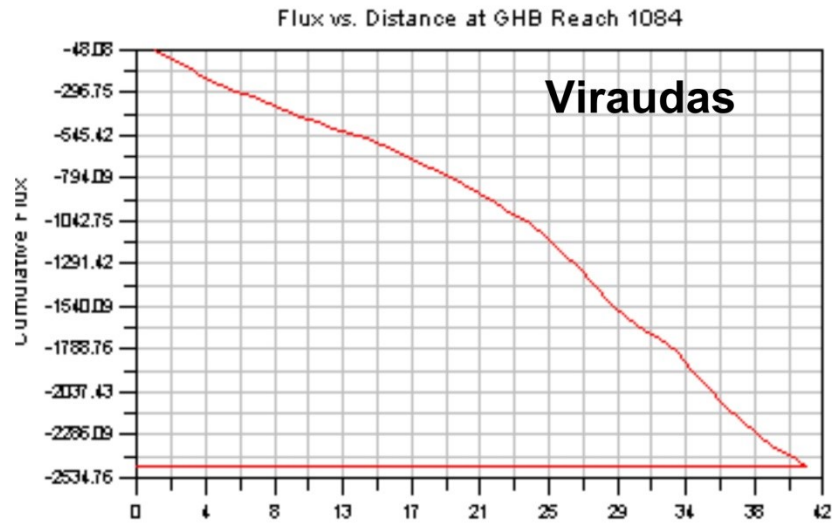
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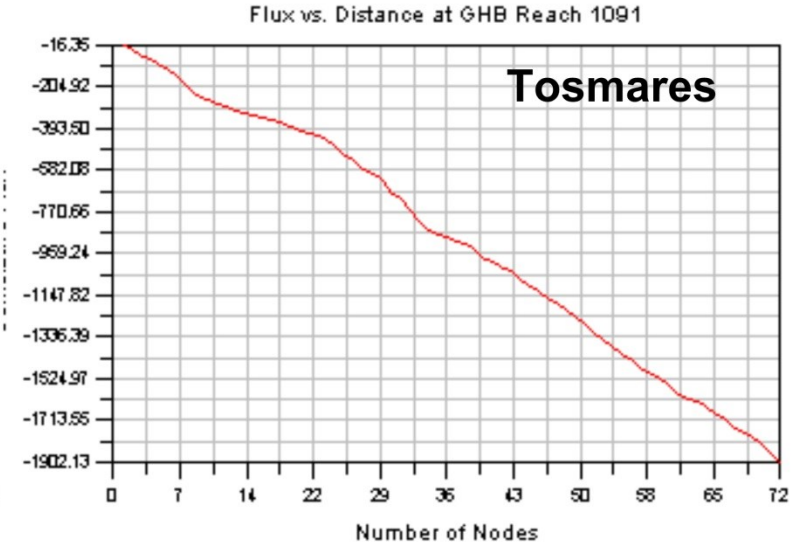
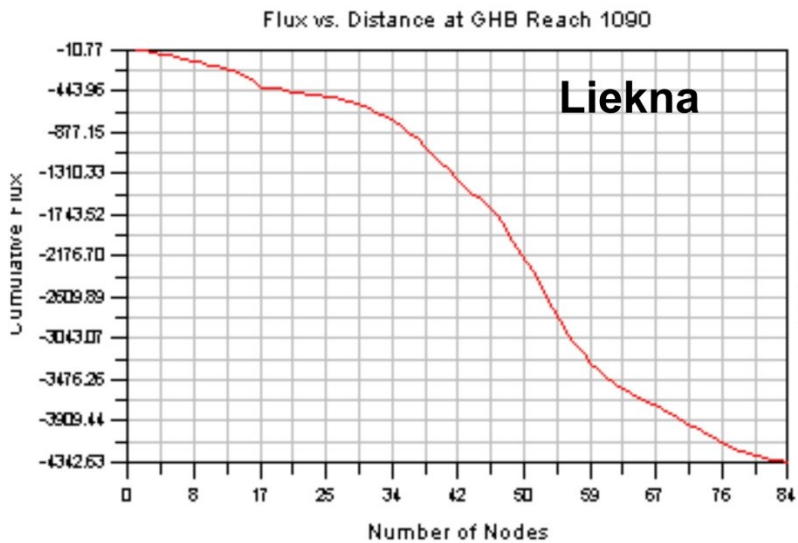
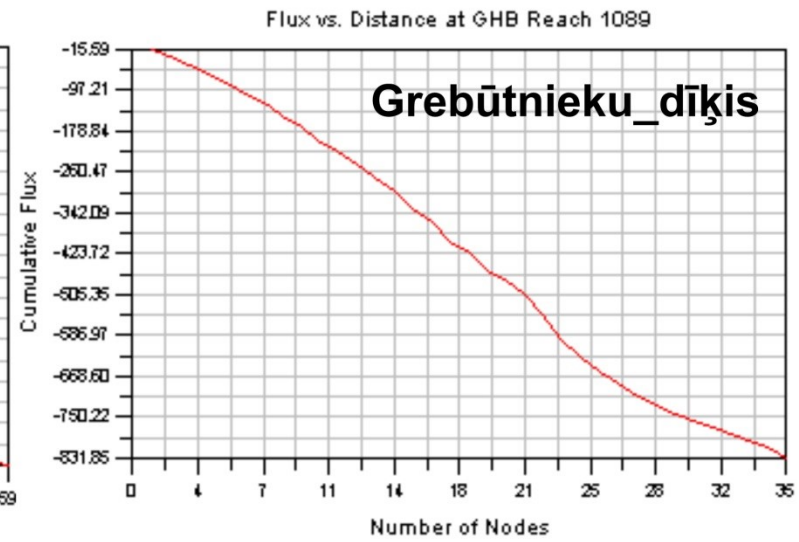
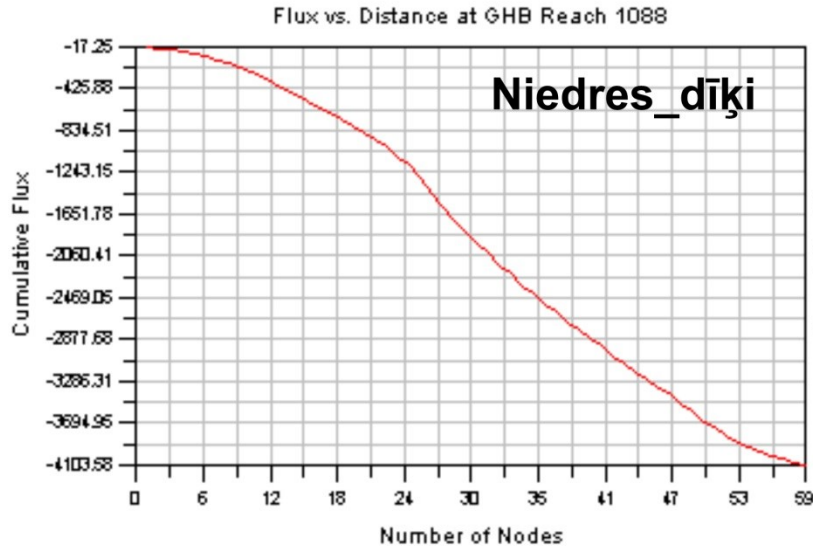
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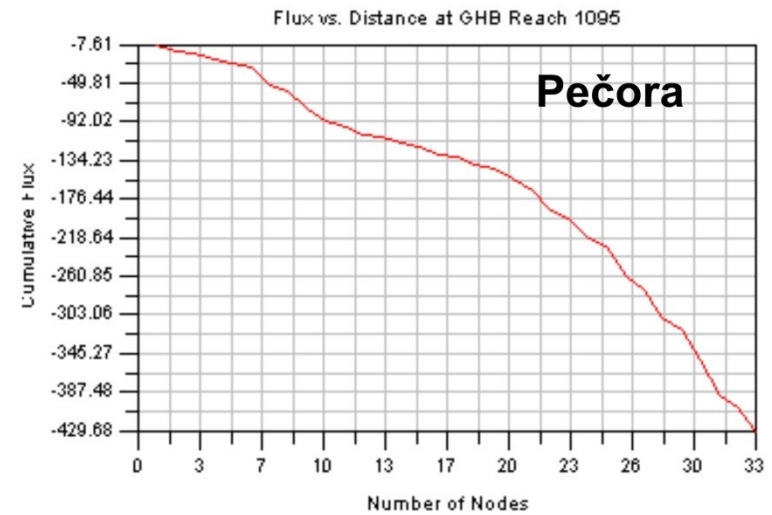
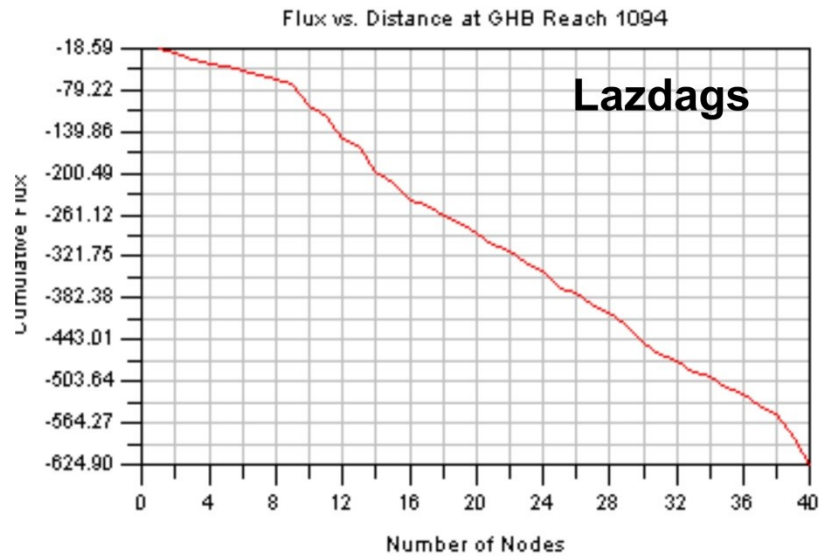
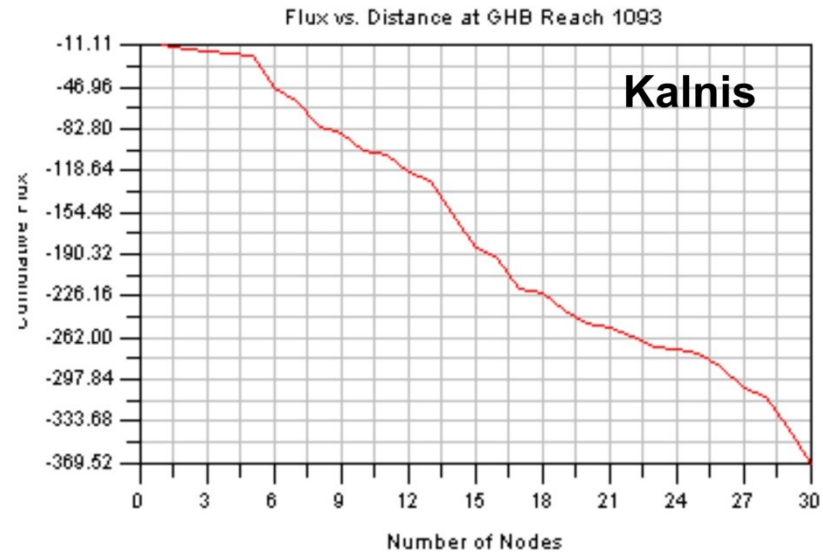
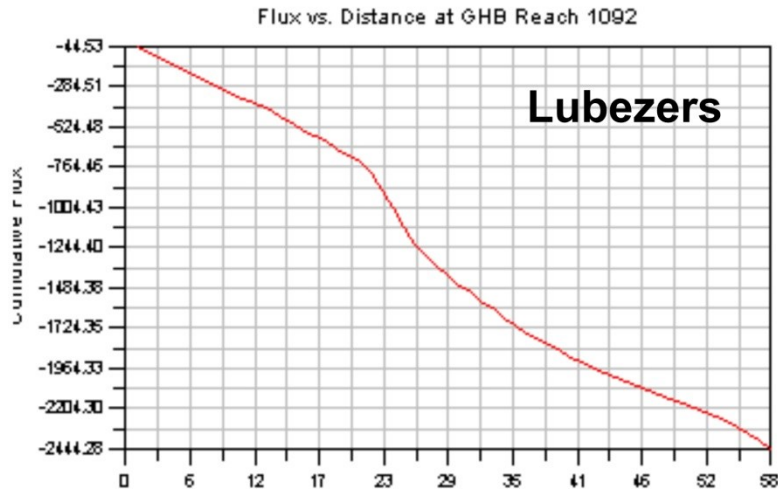


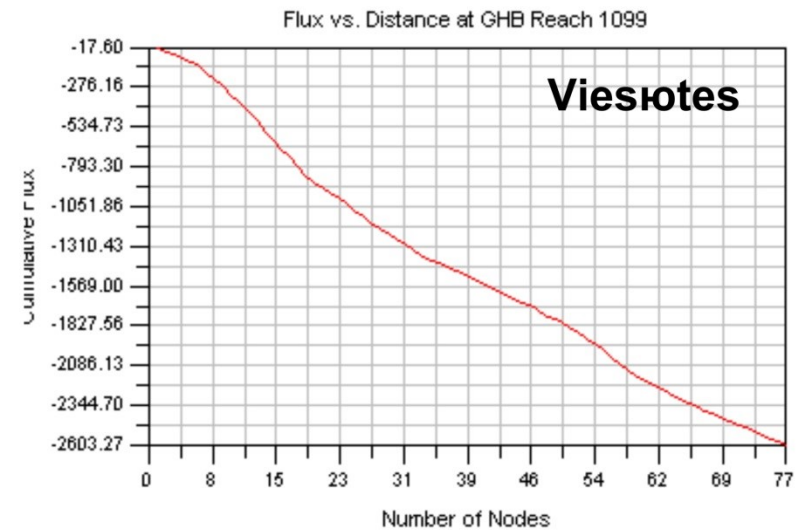
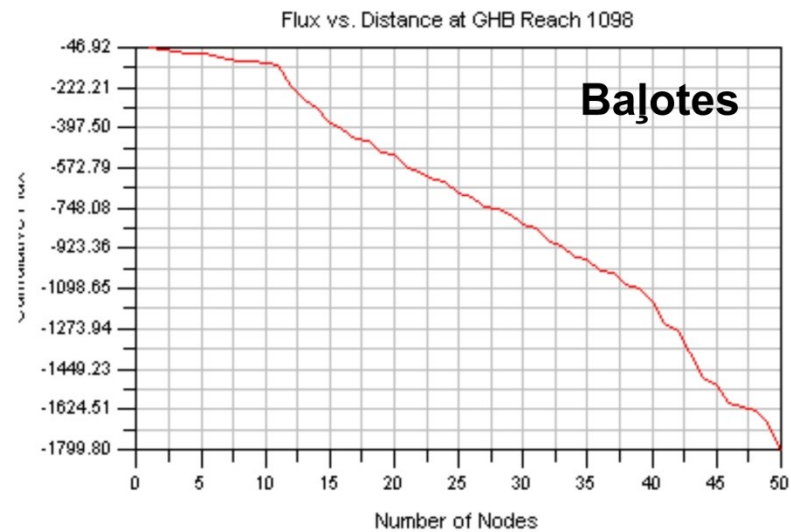
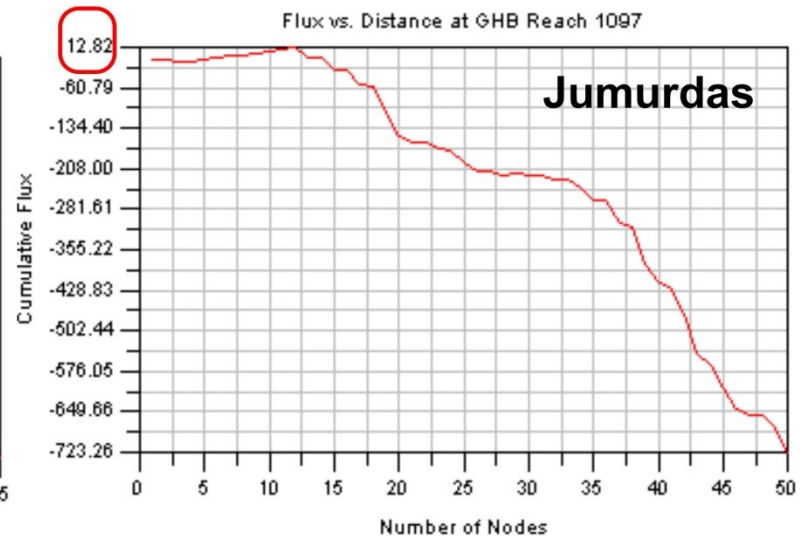
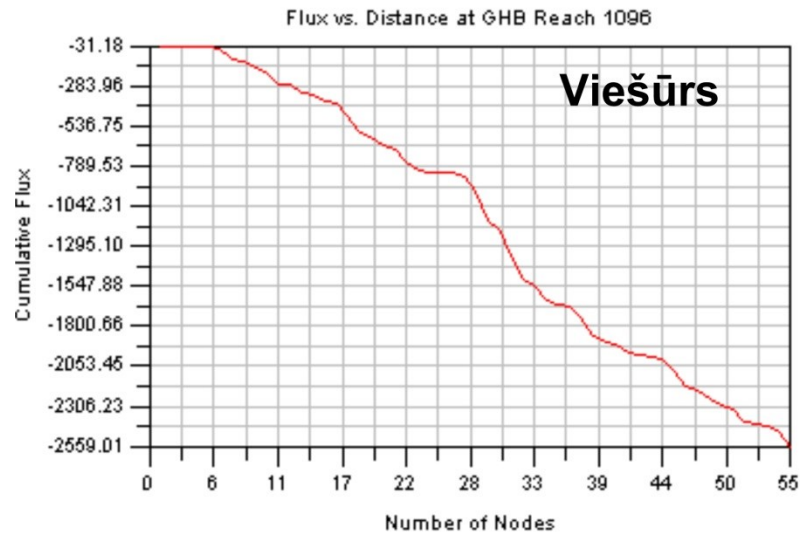


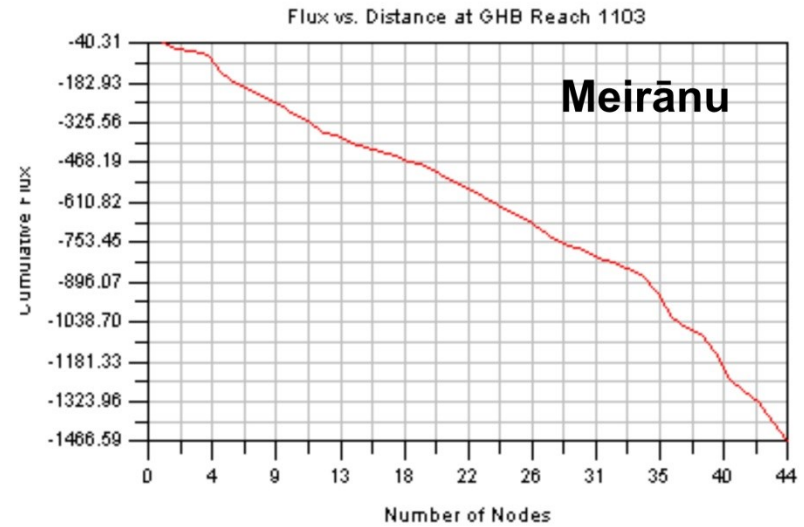
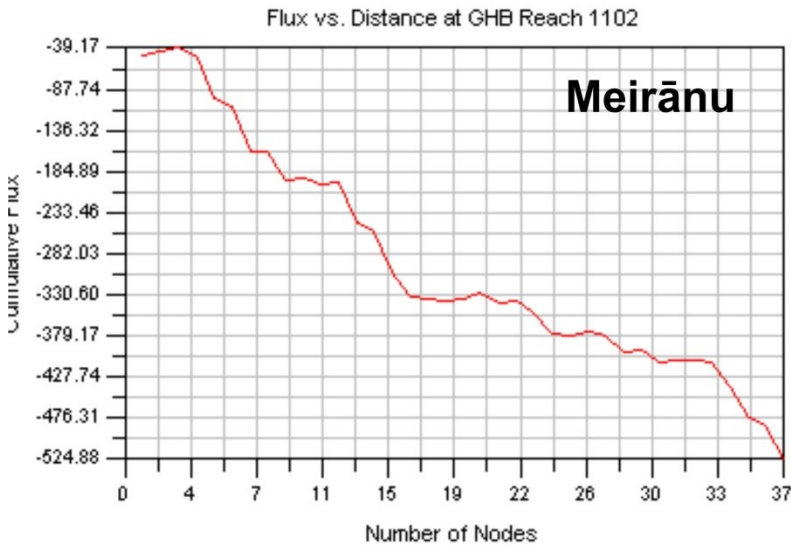
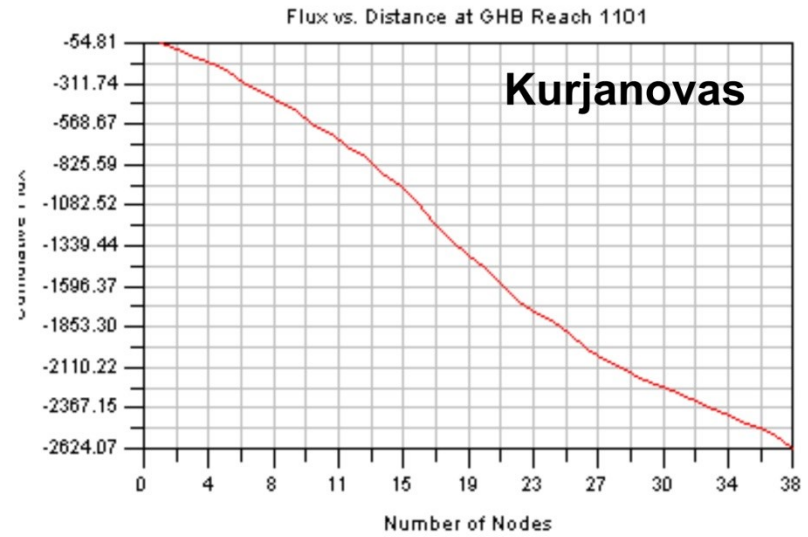
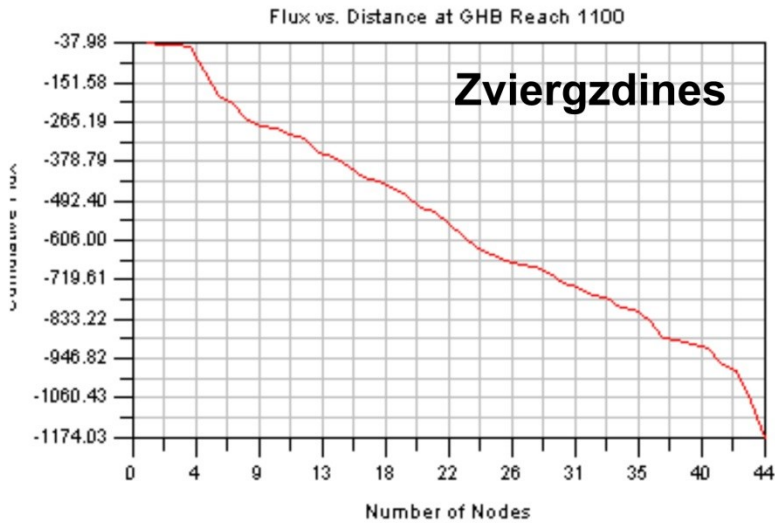


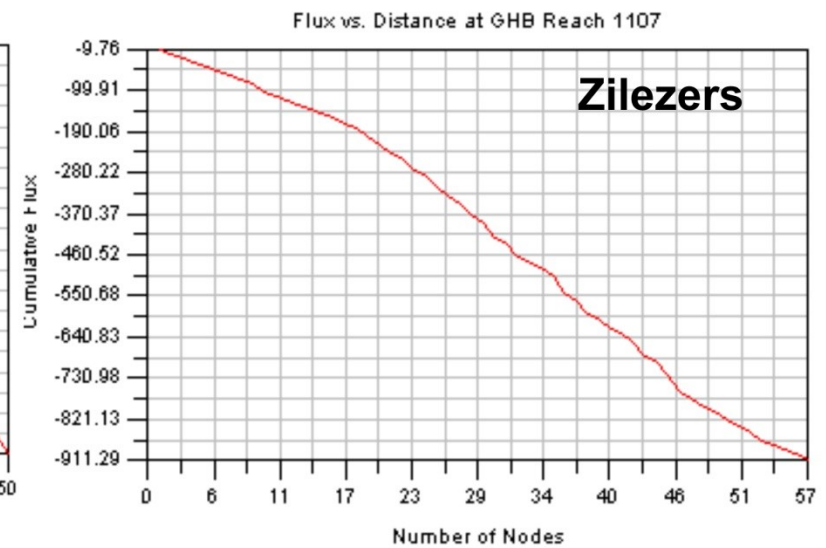
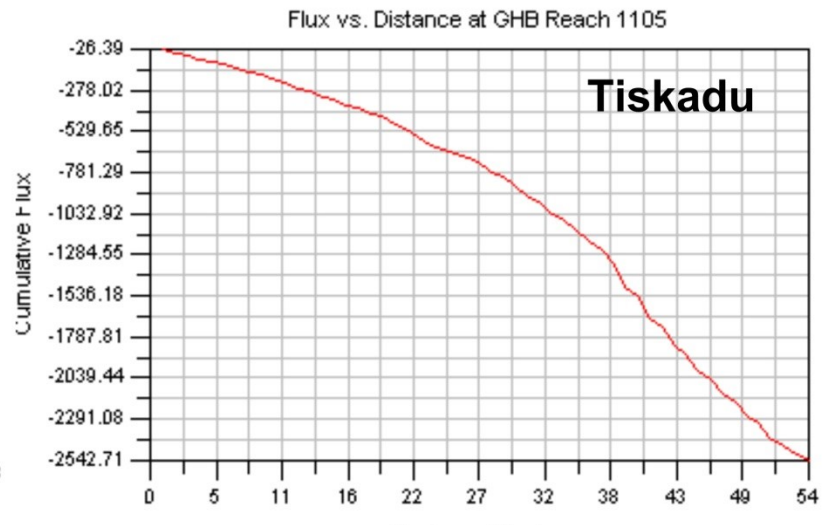
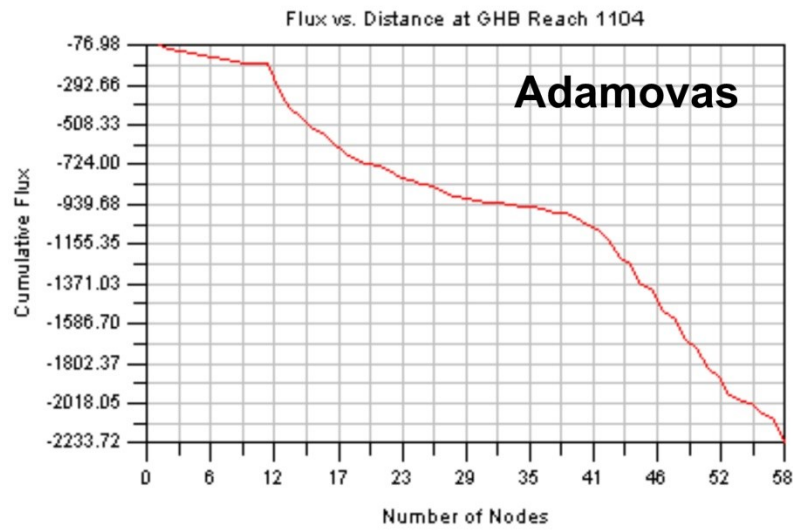




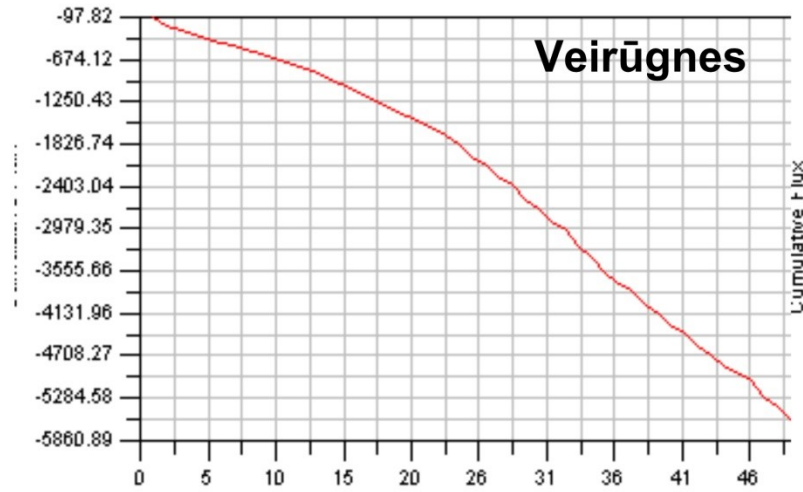




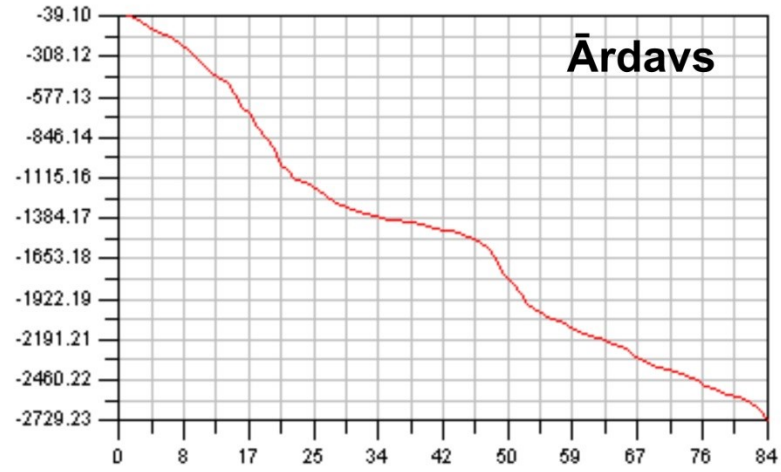




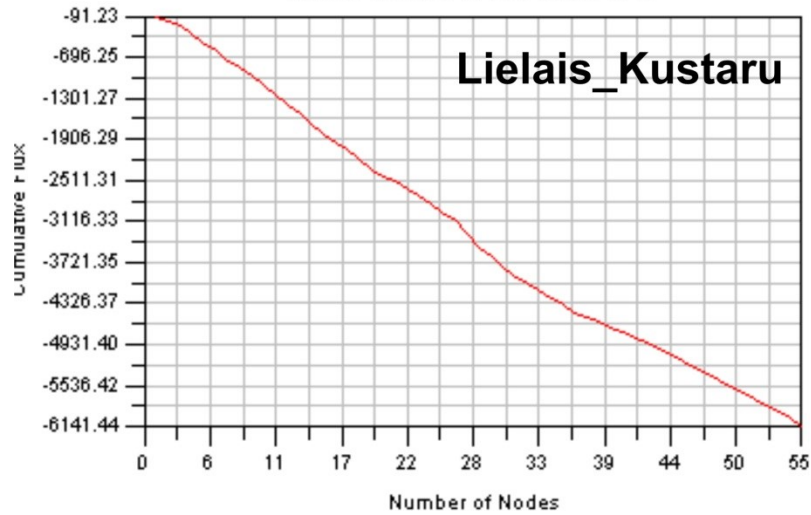
Flux vs. Distance at GHB Reach 1108



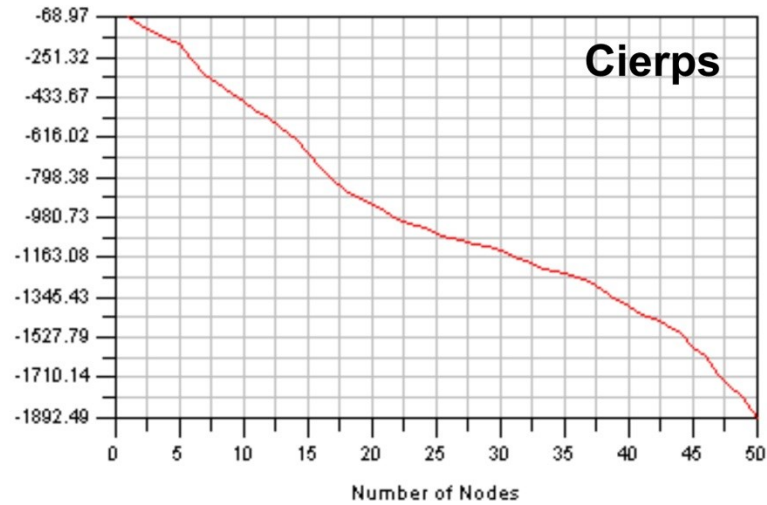
Flux vs. Distance at GHB Reach 1109

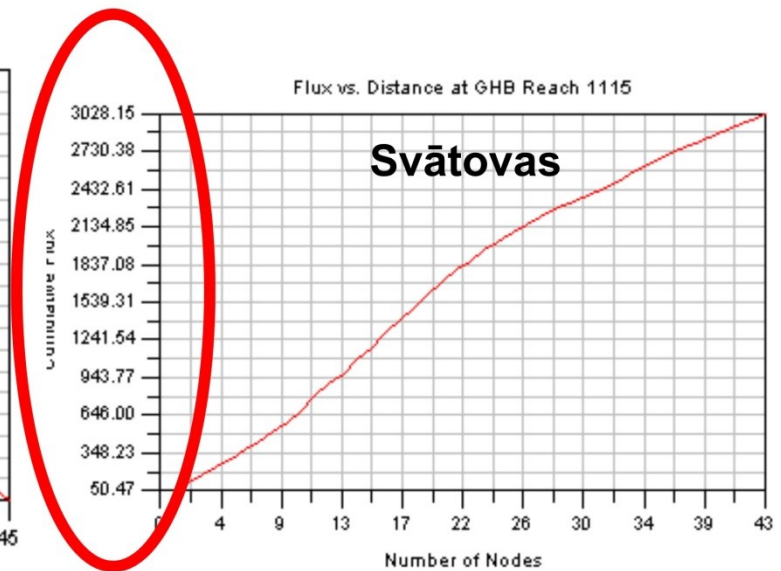
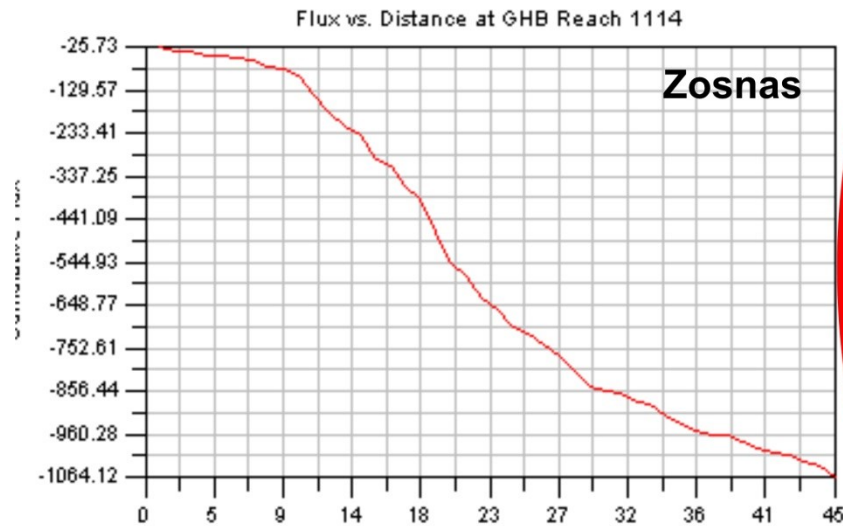
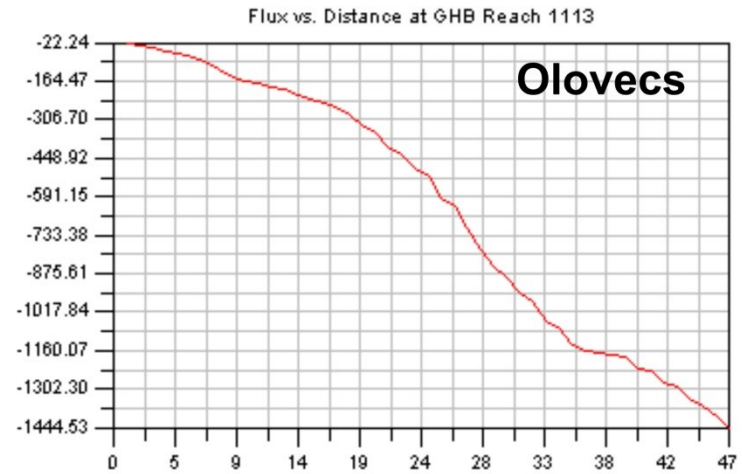
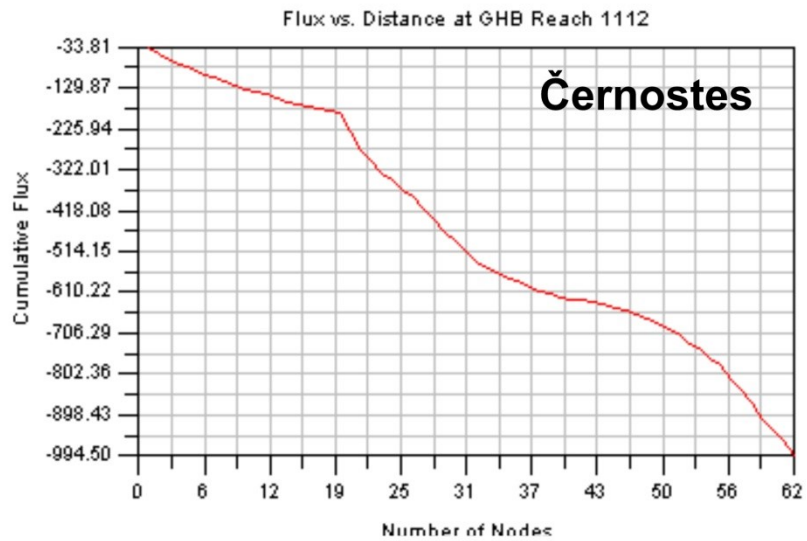


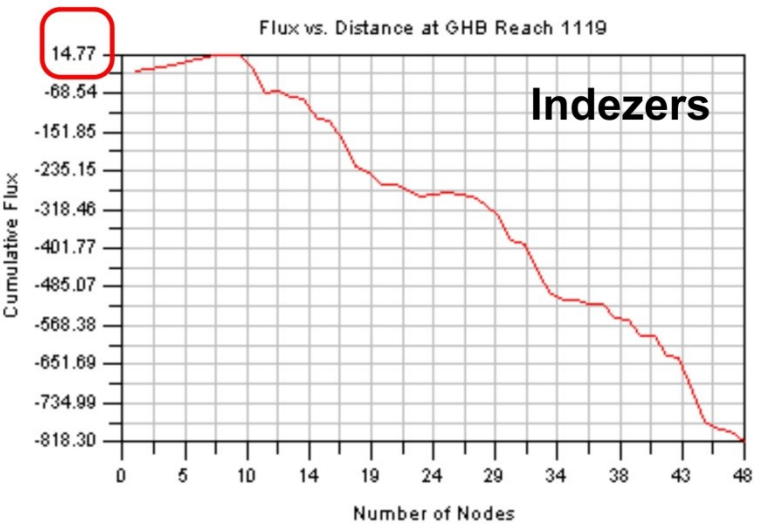
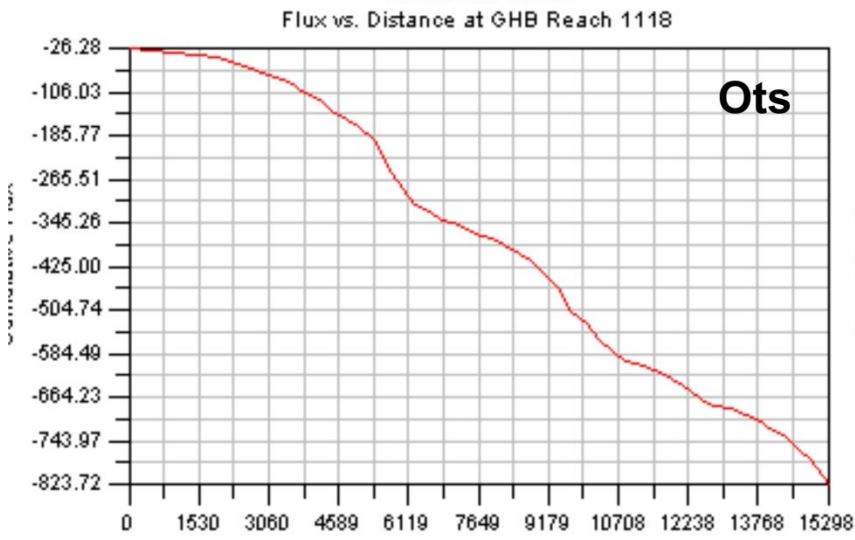
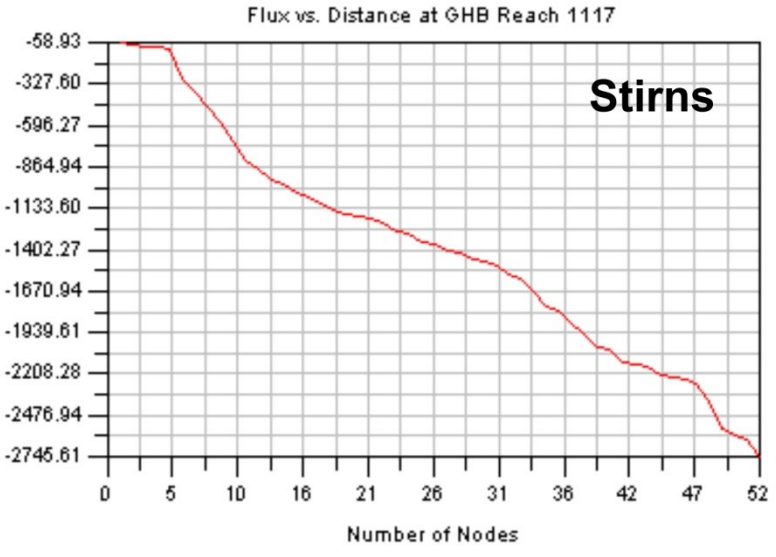
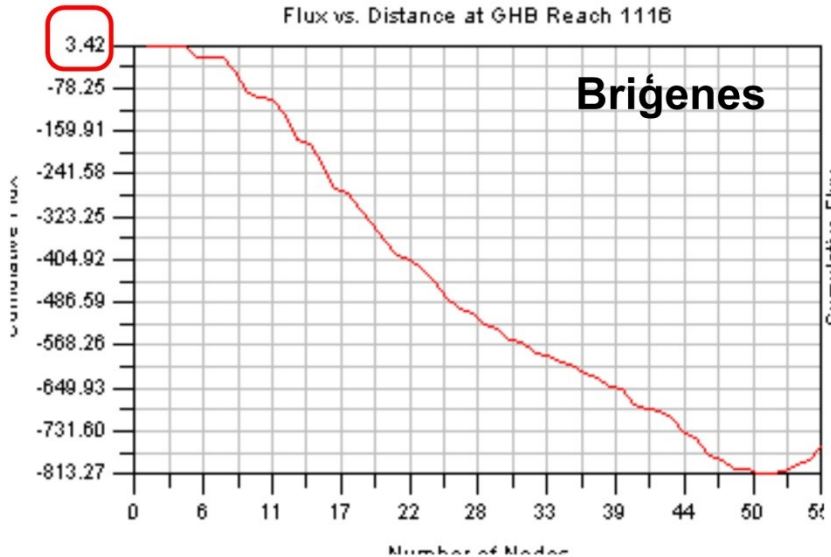
Flux vs. Distance at GHB Reach 1110

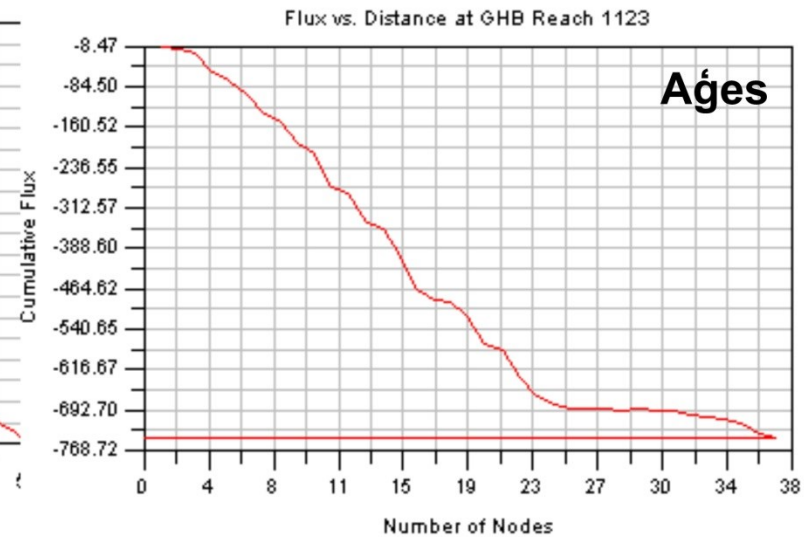
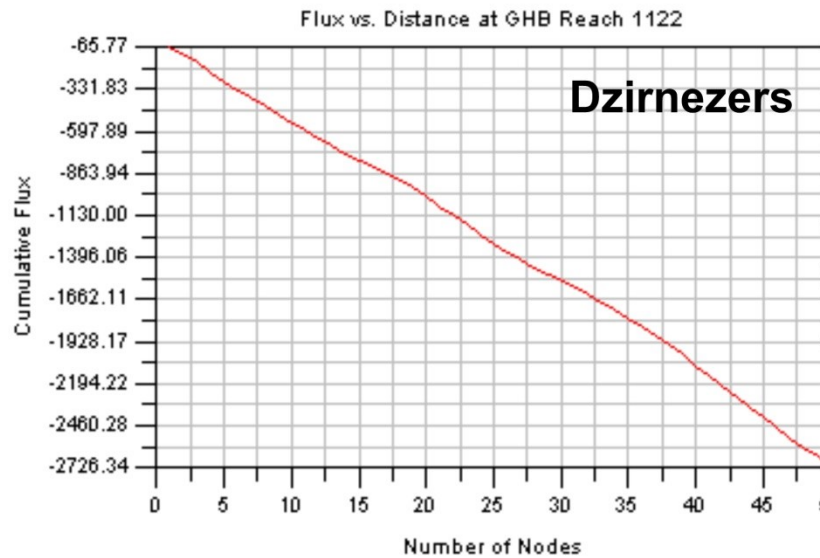
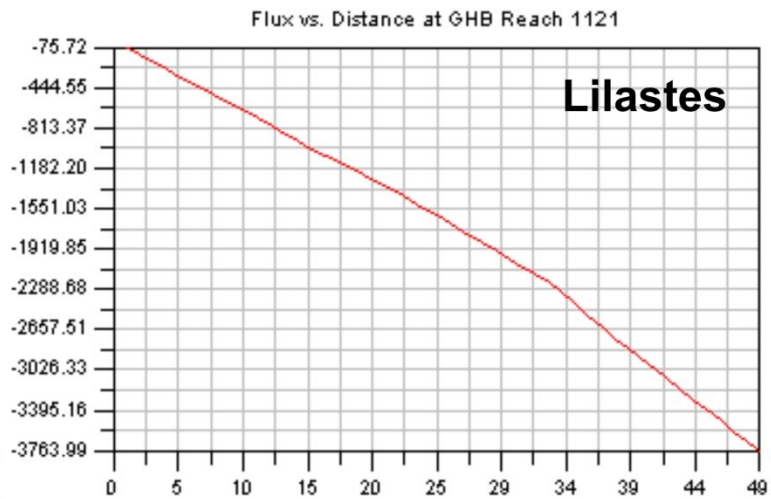
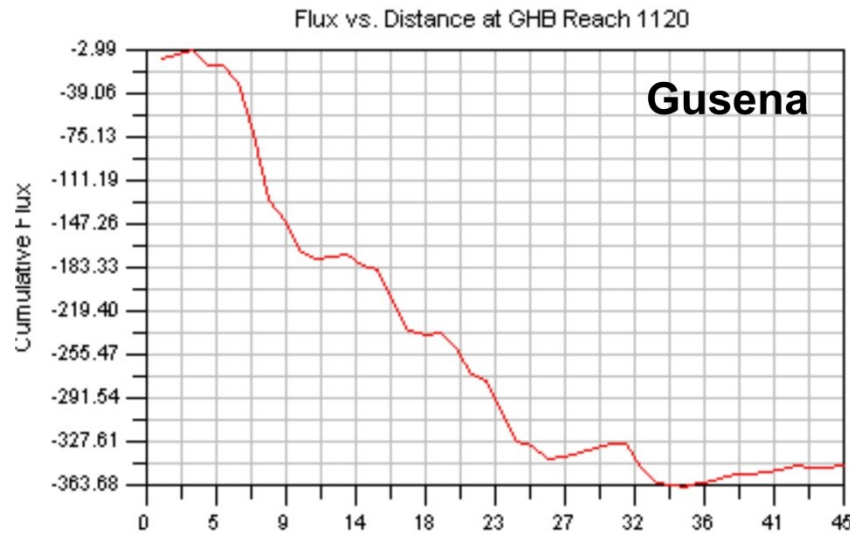


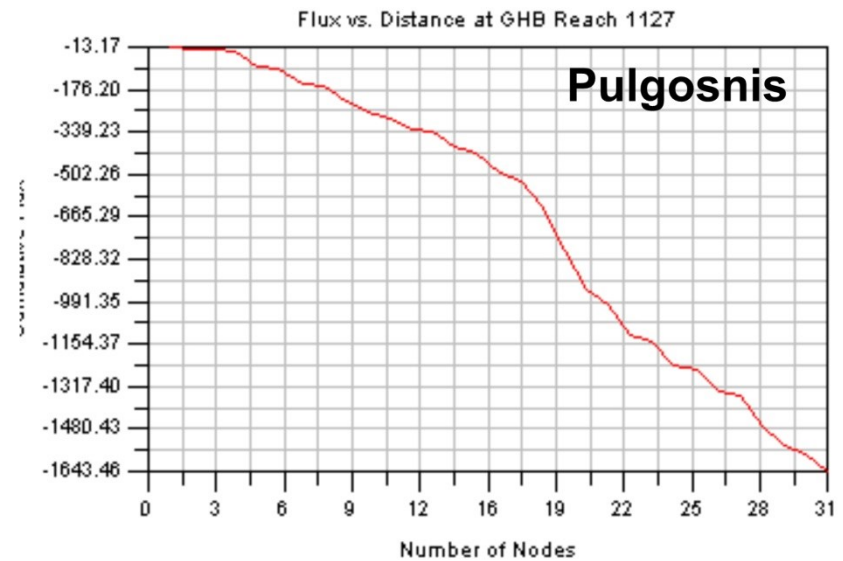
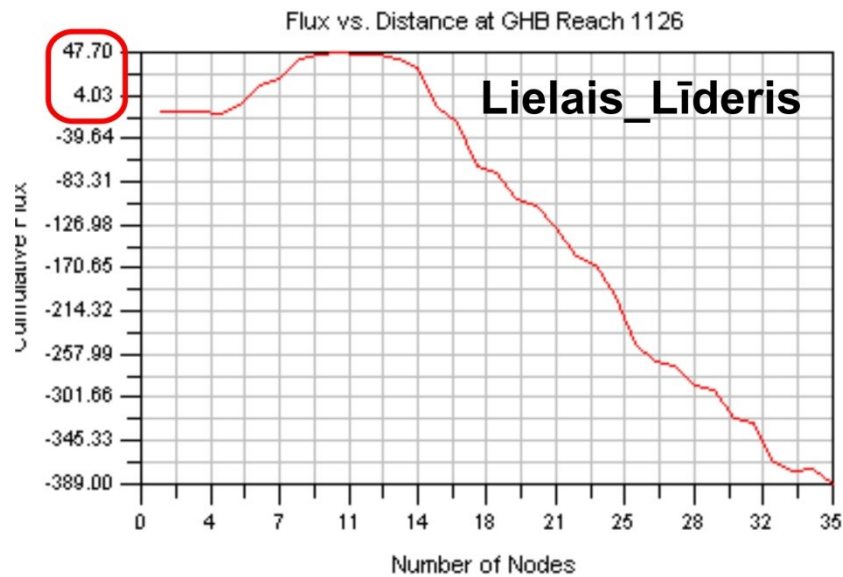
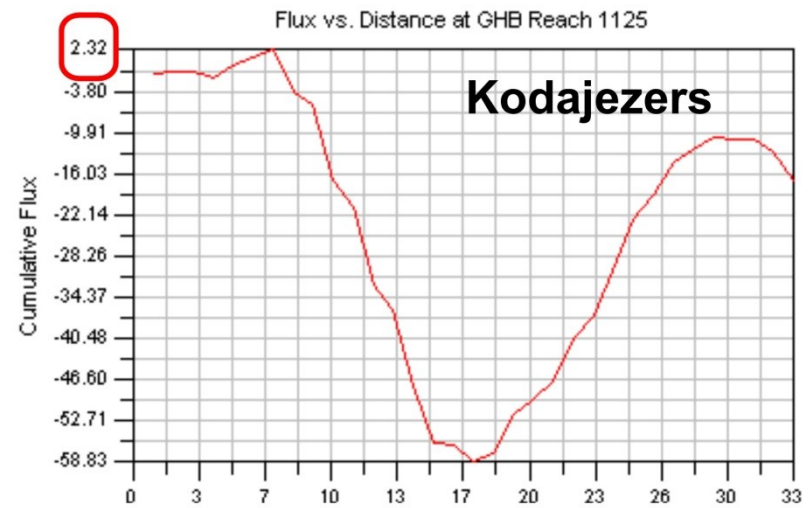
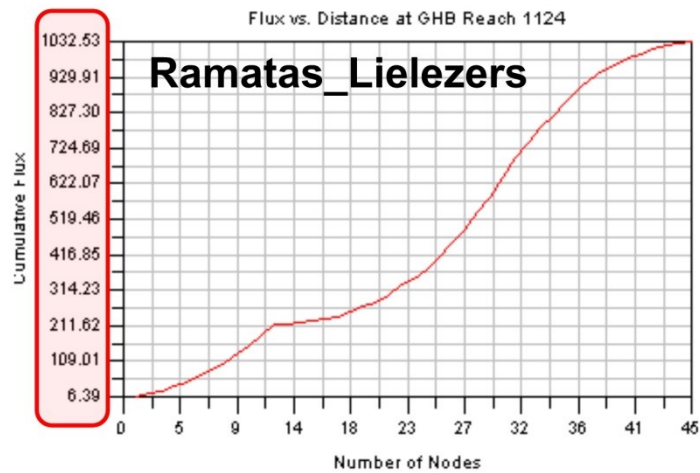
Flux vs. Distance at GHB Reach 1111

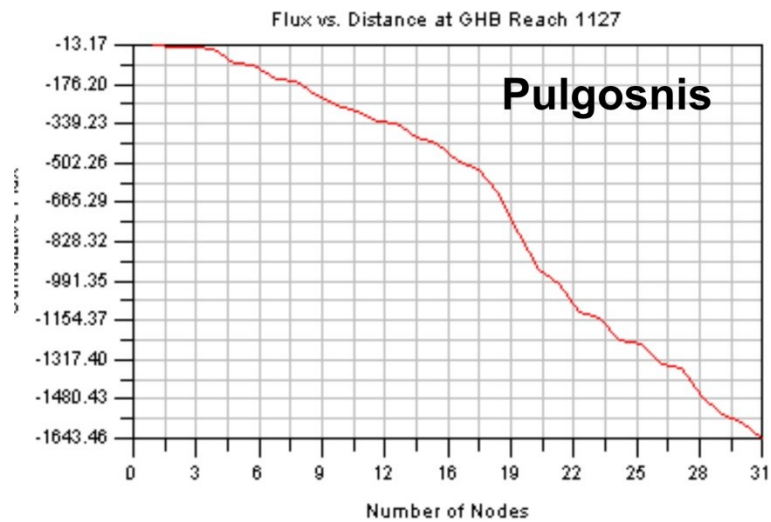












**EZERU PLŪSMU KATALOGS
2016_05.17**

