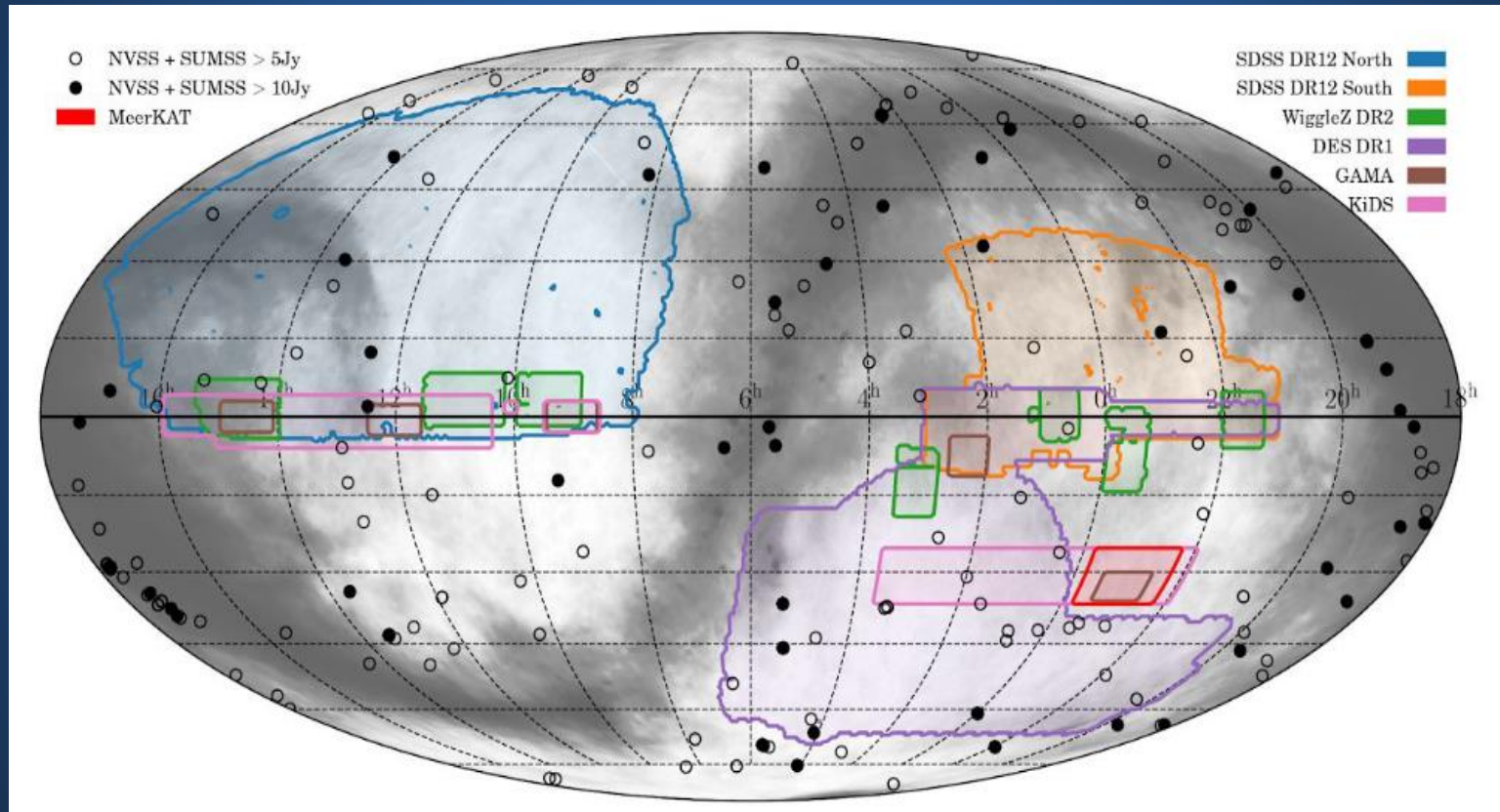


Updates on calibration of MeerKLASS 2021 data

Jingying Wang (王婧颖)
on behalf of the MeerKLASS team
2023-01-19

MeerKAT Proposal (Year 2021)

HI intensity mapping with MeerKAT: Hunting down the power spectrum



In 2021 we got

1.5 hrs scan

x 60 dishes

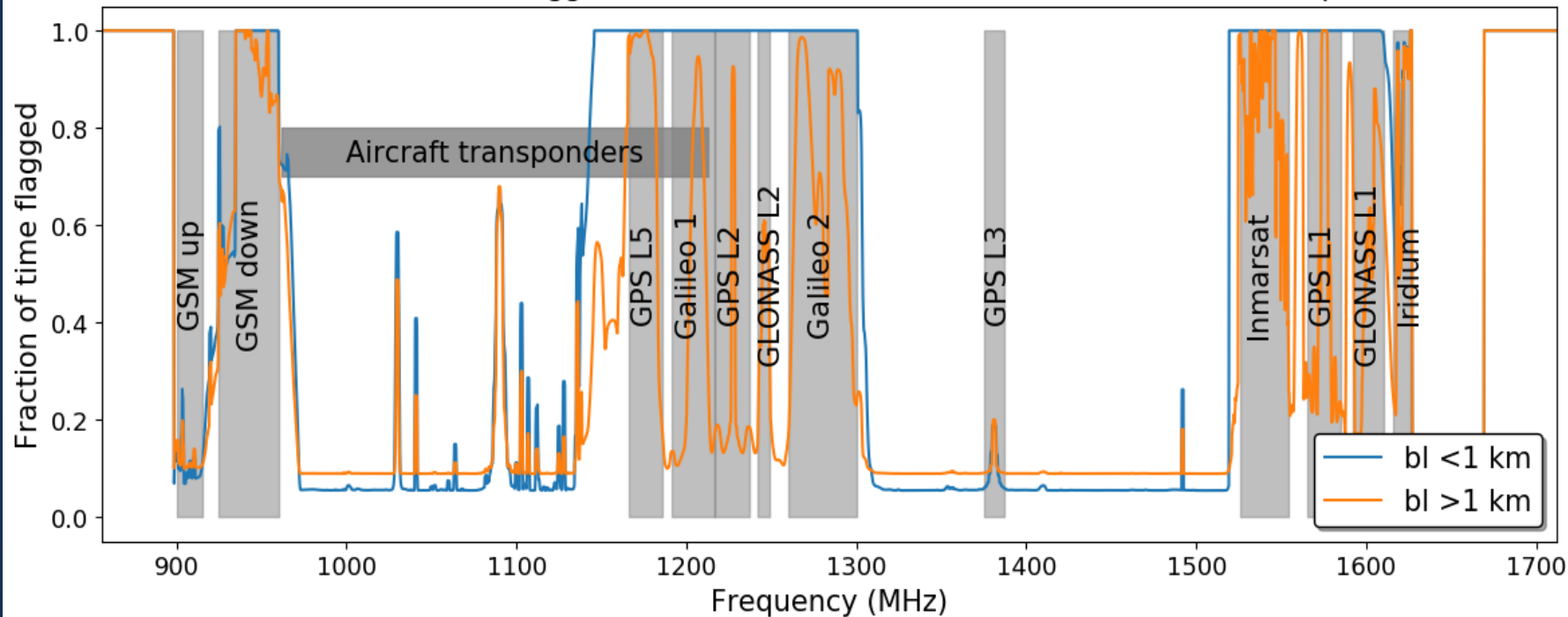
x 41 blocks

Table 1. Basic information of observation blocks used in this work.

Block ID (Unix Timestamp)	Short name (in this paper)	Observation start time (UTC time)	Sunset	az range ($^{\circ}$)	el ($^{\circ}$)	Calibrator source	Motion of field
obs1630519596	obs210901	2021-09-01 18:06:53	09-01 16:14:50	[98.0, 111.9]	42.3	PKS 1934-638	Rising
obs1631379874	obs210911	2021-09-11 17:04:51	09-11 16:20:28	[100.1, 113.2]	37.8	PKS 1934-638	Rising
obs1631387336	obs210911	2021-09-11 19:09:13	09-11 16:20:28	[86.6, 108.8]	63.0	PKS 1934-638	Rising
obs1631552188	obs210913	2021-09-13 16:56:49	09-13 16:21:35	[100.1, 113.2]	37.7	PKS 1934-638	Rising
obs1631559762	obs210913	2021-09-13 19:02:58	09-13 16:21:35	[86.4, 108.8]	63.3	PKS 1934-638	Rising
obs1631659886	obs210914	2021-09-14 22:52:47	09-14 16:22:08	[-108.8, -85.8]	64.1	Pictor A	Setting
obs1631667564	obs210915	2021-09-15 00:59:40	09-14 16:22:08	[-113.1, -99.9]	38.1	Pictor A	Setting
obs1631724508	obs210915	2021-09-15 16:48:49	09-15 16:22:42	[100.3, 113.4]	37.2	PKS 1934-638	Rising
obs1631732038	obs210915	2021-09-15 18:54:17	09-15 16:22:42	[86.9, 108.7]	62.6	PKS 1934-638	Rising
obs1631810671	obs210916	2021-09-16 16:44:51	09-16 16:23:16	[100.2, 113.3]	37.5	PKS 1934-638	Rising
obs1631818149	obs210916	2021-09-16 18:49:27	09-16 16:23:16	[86.8, 108.8]	62.7	PKS 1934-638	Rising
obs1631982988	obs210918	2021-09-18 16:36:47	09-18 16:24:23	[100.2, 113.3]	37.4	PKS 1934-638	Rising
obs1631990463	obs210918	2021-09-18 18:41:19	09-18 16:24:23	[86.9, 108.8]	62.6	PKS 1934-638	Rising
obs1632069690	obs210919	2021-09-19 16:41:48	09-19 16:24:57	[99.5, 112.9]	38.9	PKS 1934-638	Rising
obs1632077222	obs210919	2021-09-19 18:47:18	09-19 16:24:57	[85.6, 108.8]	64.4	PKS 1934-638	Rising
obs1632184922	obs210921	2021-09-21 00:44:34	09-20 16:25:31	[-113.7, -100.7]	36.3	Pictor A	Setting
obs1632505883	obs210924	2021-09-24 17:51:44	09-24 16:27:48	[90.4, 109.0]	57.0	PKS 1934-638	Rising
obs1632760885	obs210927	2021-09-27 16:41:43	09-27 16:29:33	[96.6, 111.1]	45.2	PKS 1934-638	Rising
obs1633365980	obs211004	2021-10-04 16:46:39	10-04 16:33:46	[93.1, 109.7]	52.1	PKS 1934-638	Rising
obs1633970780	obs211011	2021-10-11 16:46:38	10-11 16:38:15	[89.9, 108.9]	58.0	PKS 1934-638	Rising
obs1634252028	obs211014	2021-10-14 22:55:17	10-14 16:40:15	[-113.0, -99.8]	38.5	Pictor A	Setting
obs1634402485	obs211016	2021-10-16 16:41:45	10-16 16:41:37	[88.0, 108.7]	61.0	PKS 1934-638	Rising
obs1634748682	obs211020	2021-10-20 16:51:50	10-20 16:44:25	[84.1, 109.1]	66.2	PKS 1934-638	Rising
obs1634835083	obs211021	2021-10-21 16:51:43	10-21 16:45:08	[83.4, 109.2]	67.0	PKS 1934-638	Rising
obs1637346562	obs211119	2021-11-19 18:31:59	11-19 17:08:34	[-109.0, -84.6]	65.7	Pictor A	Setting
obs1637354605	obs211119	2021-11-19 20:44:44	11-19 17:08:34	[-113.4, -100.4]	37.2	Pictor A	Setting
obs1637691677	obs211123	2021-11-23 18:22:58	11-23 17:11:59	[-108.8, -86.4]	63.2	Pictor A	Setting
obs1637699408	obs211123	2021-11-23 20:31:33	11-23 17:11:59	[-113.8, -101.0]	35.9	Pictor A	Setting
obs1638130295	obs211128	2021-11-28 20:13:37	11-28 17:16:12	[-113.9, -101.1]	35.5	Pictor A	Setting
obs1638294319	obs211130	2021-11-30 17:47:13	11-30 17:17:51	[-108.9, -84.9]	65.3	Pictor A	Setting
obs1638301944	obs211130	2021-11-30 19:53:44	11-30 17:17:51	[-113.1, -100.0]	38.1	Pictor A	Setting
obs1638386189	obs211201	2021-12-01 19:18:31	12-01 17:18:39	[-111.2, -96.8]	44.7	Pictor A	Setting
obs1638639082	obs211204	2021-12-04 17:33:15	12-04 17:21:03	[-108.9, -85.4]	64.6	Pictor A	Setting
obs1638647186	obs211204	2021-12-04 19:47:48	12-04 17:21:03	[-113.9, -101.1]	35.7	Pictor A	Setting
obs1638898468	obs211207	2021-12-07 17:36:20	12-07 17:23:20	[-108.7, -87.7]	61.4	Pictor A	Setting
obs1639157507	obs211210	2021-12-10 17:33:41	12-10 17:25:31	[-108.8, -88.8]	59.7	Pictor A	Setting
obs1639331184	obs211212	2021-12-12 17:48:20	12-12 17:26:53	[-109.3, -91.8]	54.6	Pictor A	Setting
obs1639935088	obs211219	2021-12-19 17:34:00	12-19 17:31:08	[-109.5, -92.8]	52.7	Pictor A	Setting
obs1640540184	obs211226	2021-12-26 17:39:00	12-26 17:34:21	[-111.0, -96.3]	45.8	Pictor A	Setting
obs1640712986	obs211228	2021-12-28 17:38:01	12-28 17:35:03	[-111.6, -97.5]	43.2	Pictor A	Setting
obs1640799689	obs211229	2021-12-29 17:43:29	12-29 17:35:22	[-112.2, -98.5]	41.2	Pictor A	Setting

challenges from radio frequency interference (RFI)

Fraction of time flagged for baselines <1 km and >1 km for 4hr track (XX pol)



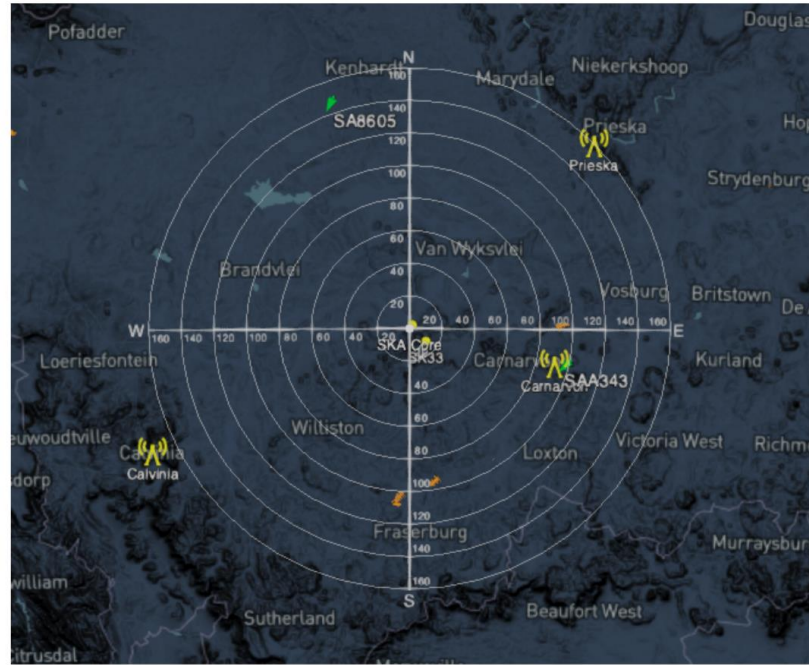
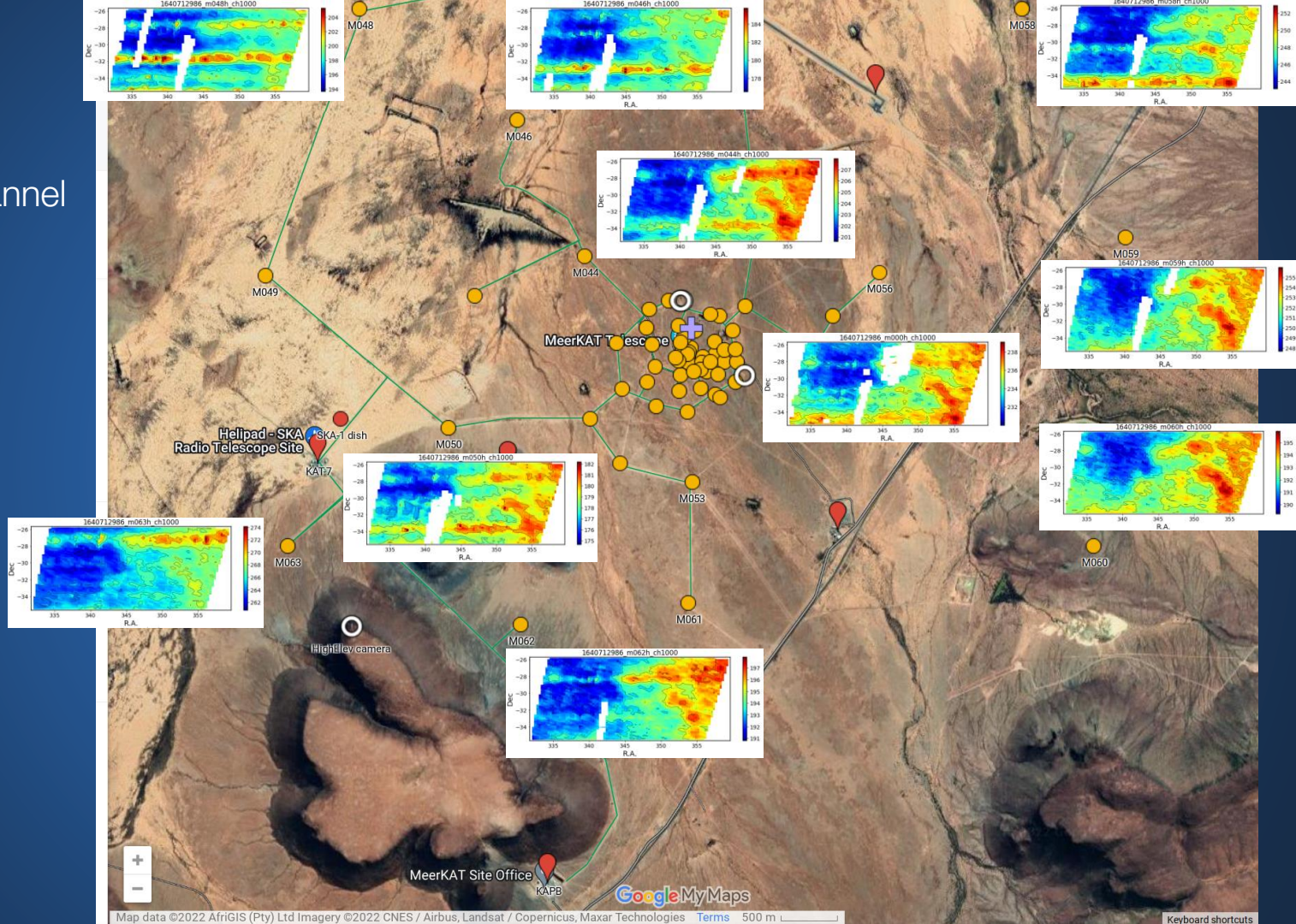


Figure 3.7: A screengrab of the MeerKAT RFI monitoring system. The MeerKAT array is denoted by the yellow dot at the centre. The yellow tower-like structures are the communication towers and the blue dot at around 350° azimuth is a flying aircraft. The annuli represent the distance from the core in km.

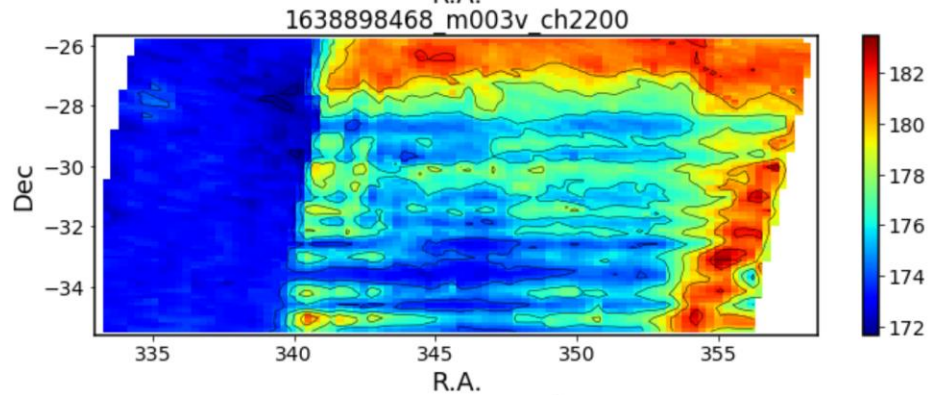
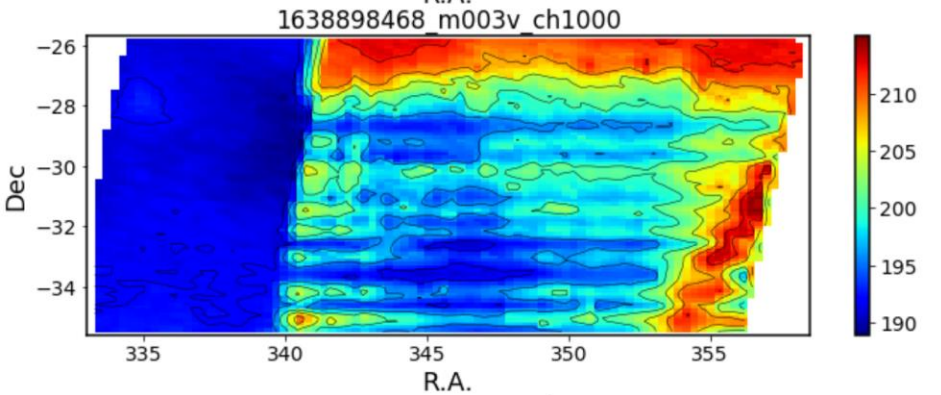
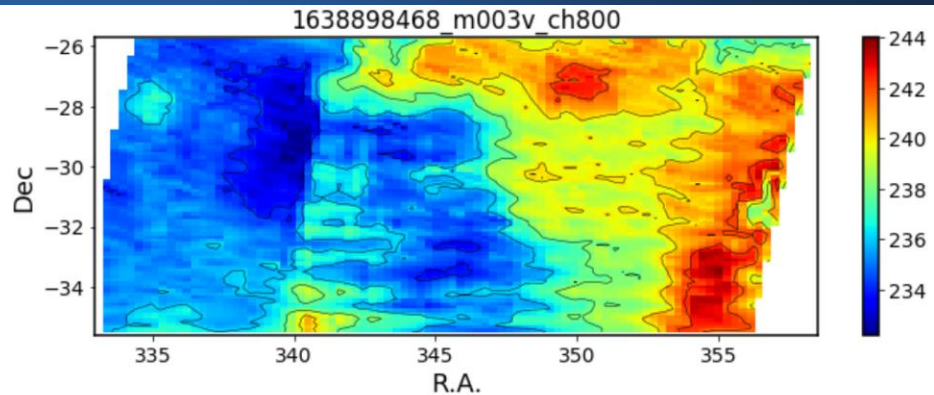
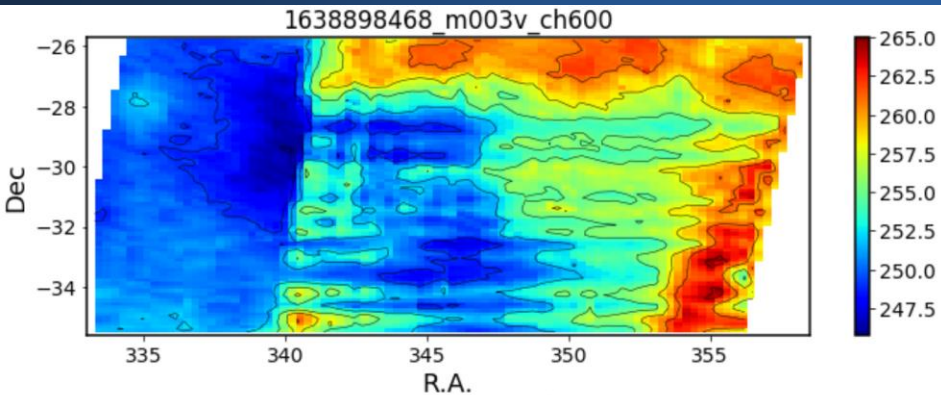
Sihlangu 2019

challenge from RFI:
structures on the maps

raw maps from
different dishes,
same block,
same frequency channel



Load shedding?

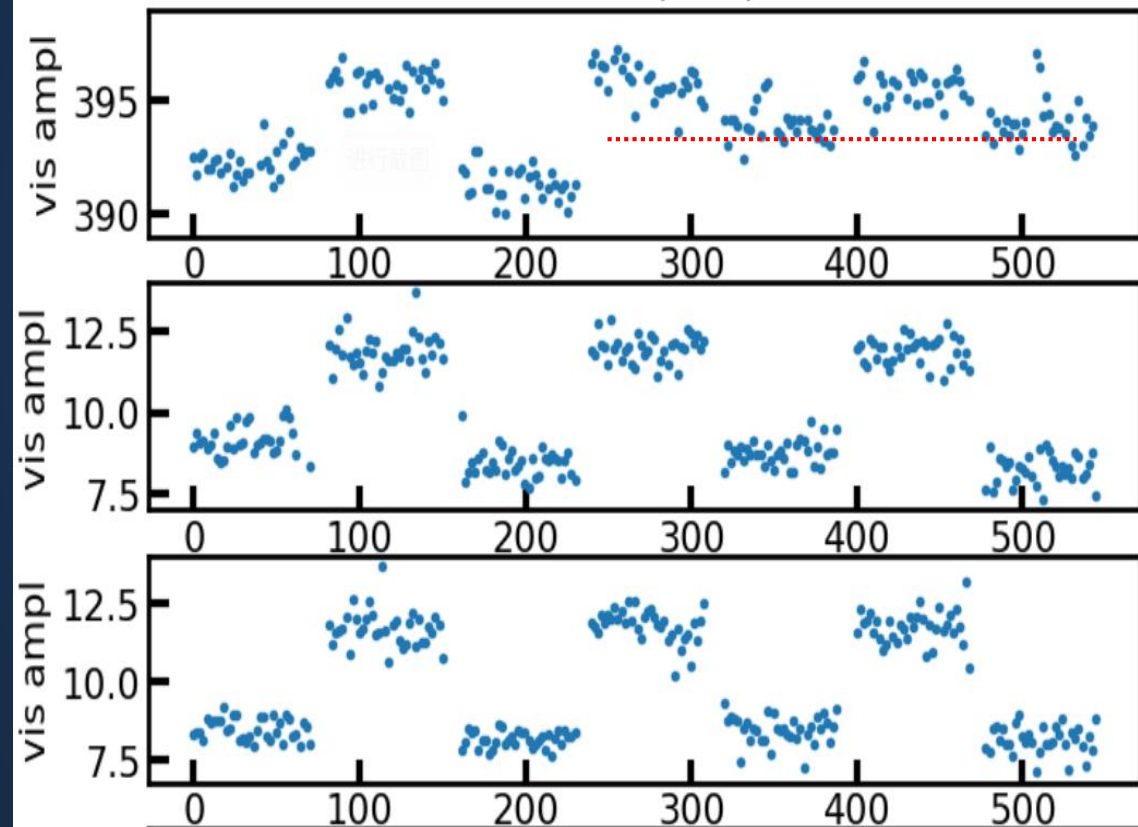


challenge from RFI:
when using a weak calibrator

Calibrator: PKS1934-638 (16.4 Jy at 1410 MHz; 6.24 Jy at 408 MHz)



1634835083, VV, ch800



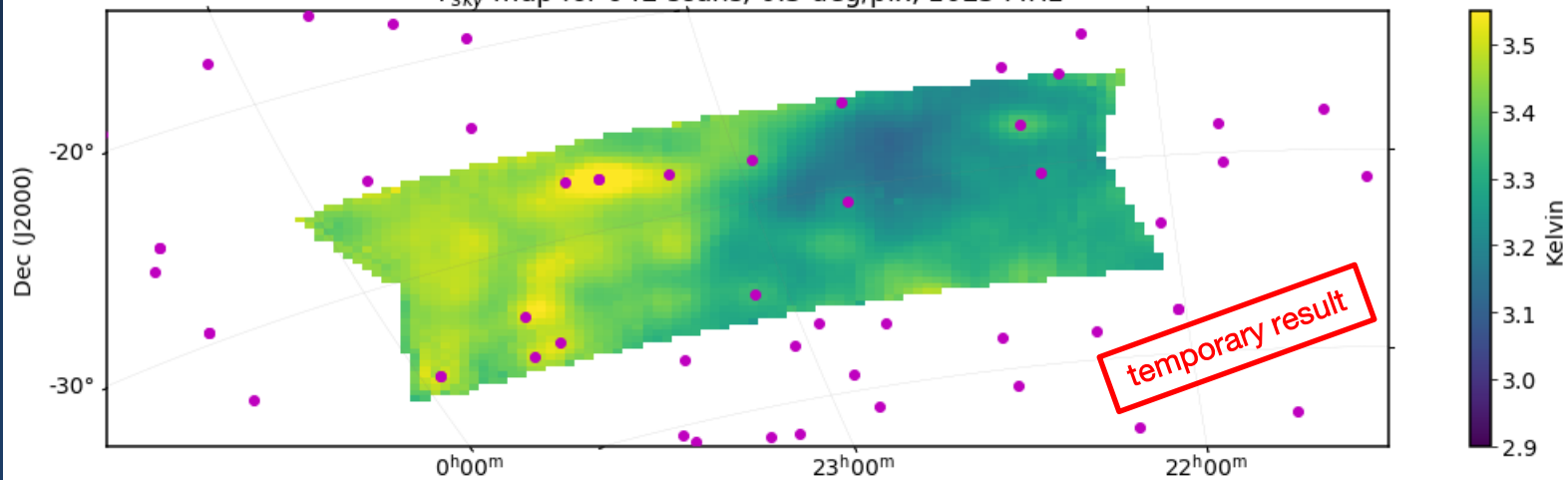
• ('m002',

• ('m002', 'm001')

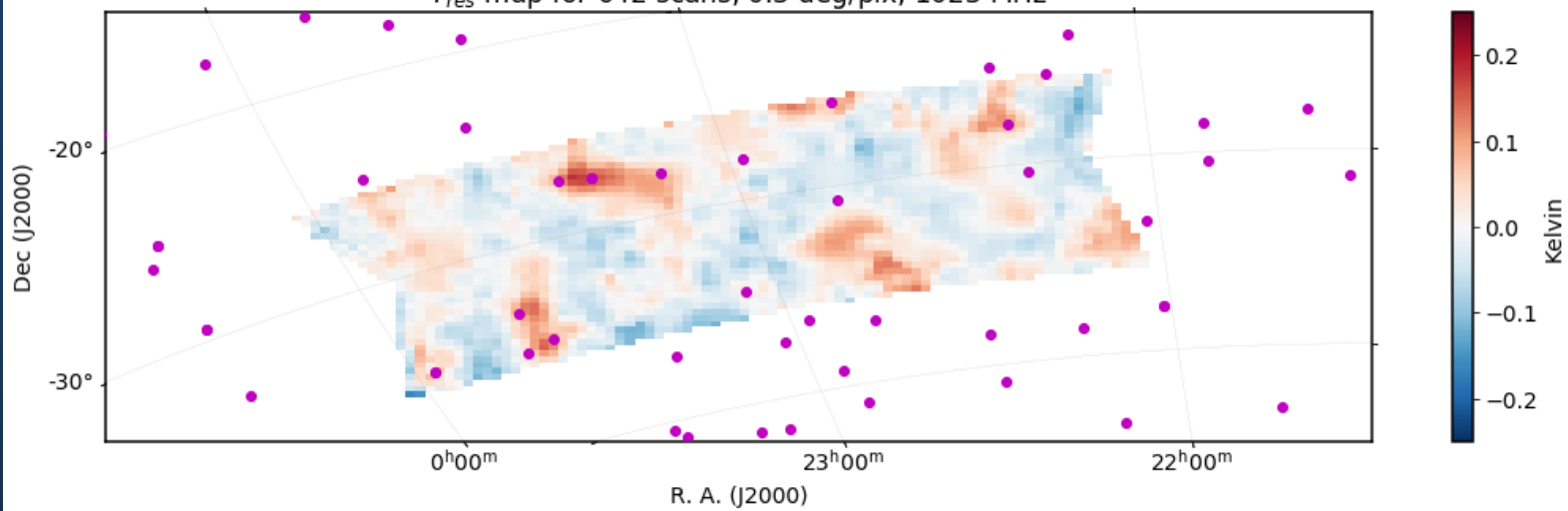
• ('m002', 'm003')

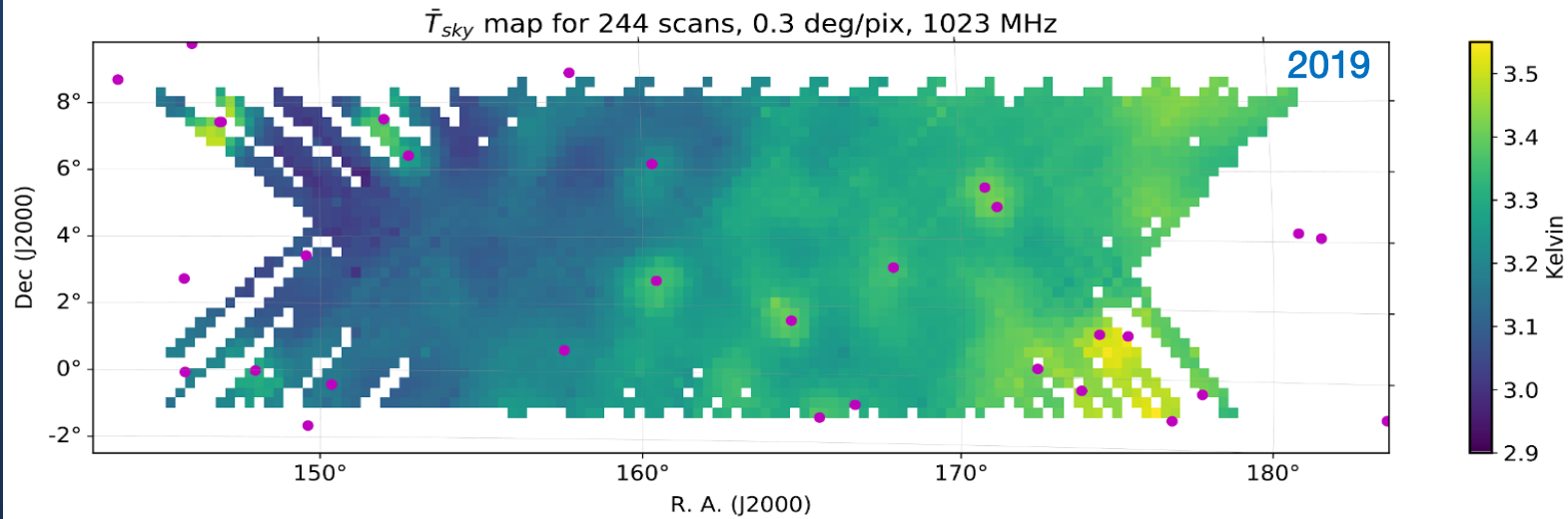
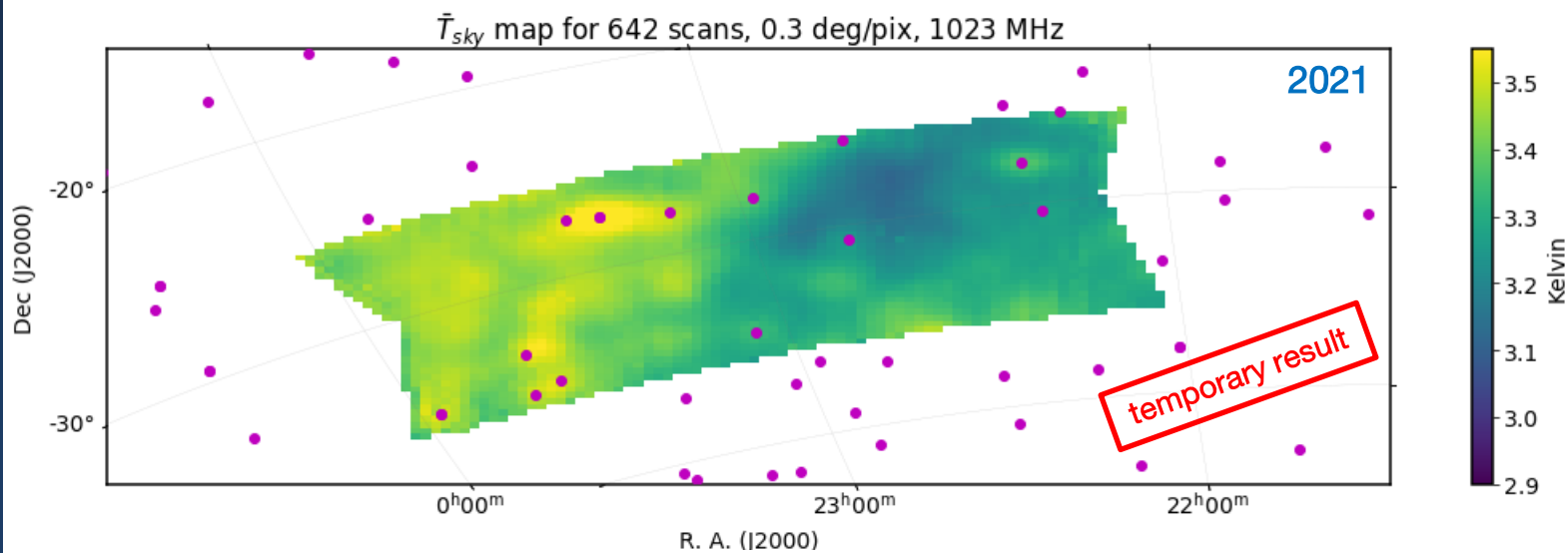
After a lot of work on RFI flagging
Level-1 for scanning (sky maps)
Level-2 for tracking (calibrator)
DONE BY MeerKLASS TEAM

\bar{T}_{sky} map for 642 scans, 0.3 deg/pix, 1023 MHz

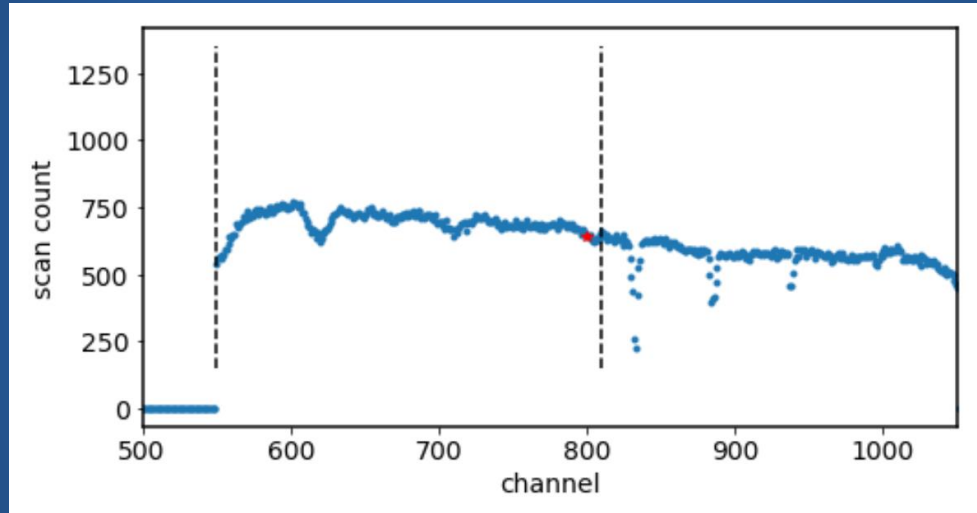


\bar{T}_{res} map for 642 scans, 0.3 deg/pix, 1023 MHz





Maximum remaining scan number is $\sim 750 \ll 2400 (=60 \times 40)$



finally we have 966 scans, from 27 of the 41 blocks

