Novel ways to compare precipitation variables

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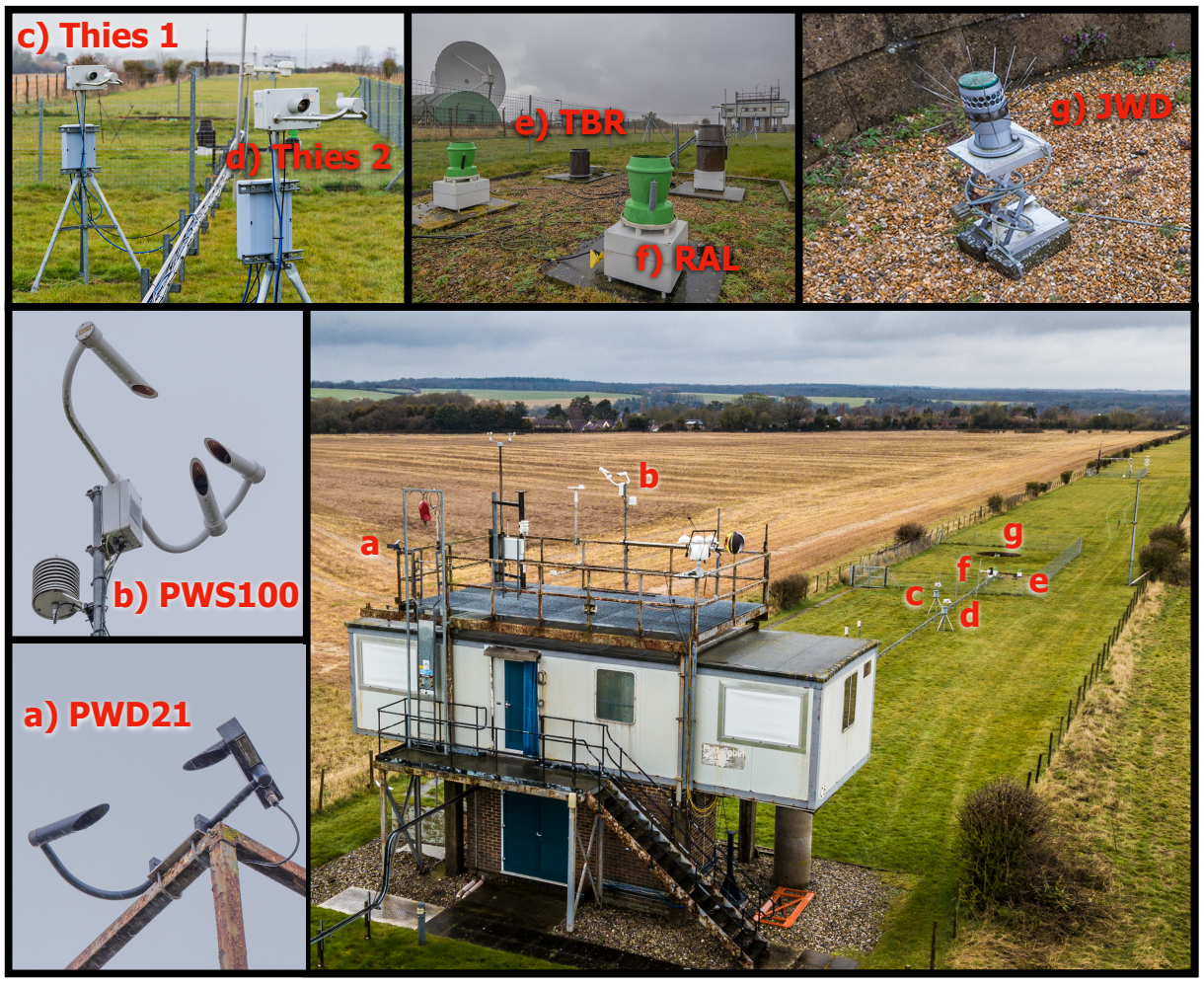
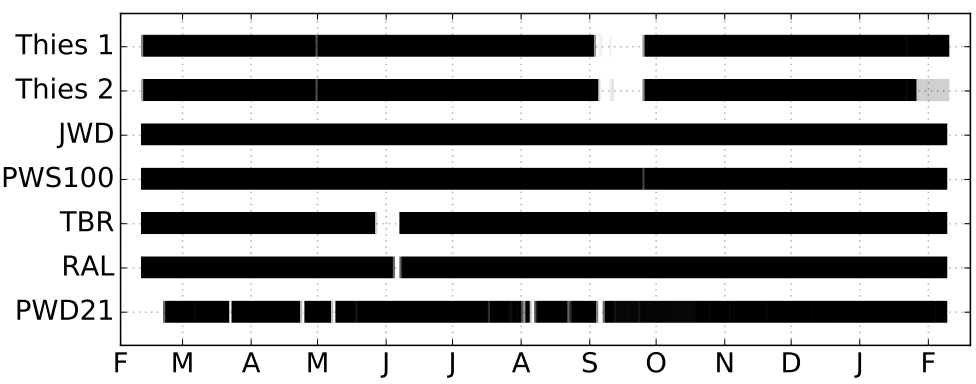
A UK network of 14 disdrometers were installed in 2017. Two were placed at Chilbolton Observatory for 1 year to check consistency vs. other precipitation instruments.

Instruments and variables examined in this study (PW prelim)

	Thies 1	Thies 2	PWS100	PWD21	JWD	RAL	TBR	#	Freq.
DSD	✓	✓	✓	✗	✓	✗	✗	4	5m, 15m, 60m cases
DVD	✓	✓	✓	✗	✗	✗	✗	3	5m, 15m, 60m cases
Rainfall Rate	✓	✓	✓	✓	✓	✓	✓	6	1m, 5m, 15m, 1h, 1d
PW Code	✓	✓	✓	✓	✗	✗	✗	4	1m, 5m, 1h





Instrument 'uptime'. Black indicates 100% upload, clear = 0%. Analysed per day.

Instrument locations at Chilbolton. All within 80 m & to manufacturer specification.

Chilbolton also hosts an array of other sensors such as the NXPol radar, CAMRa and meteorological sensors which have been useful in characterising anomalous data. A Hydromet. paper is in progress.

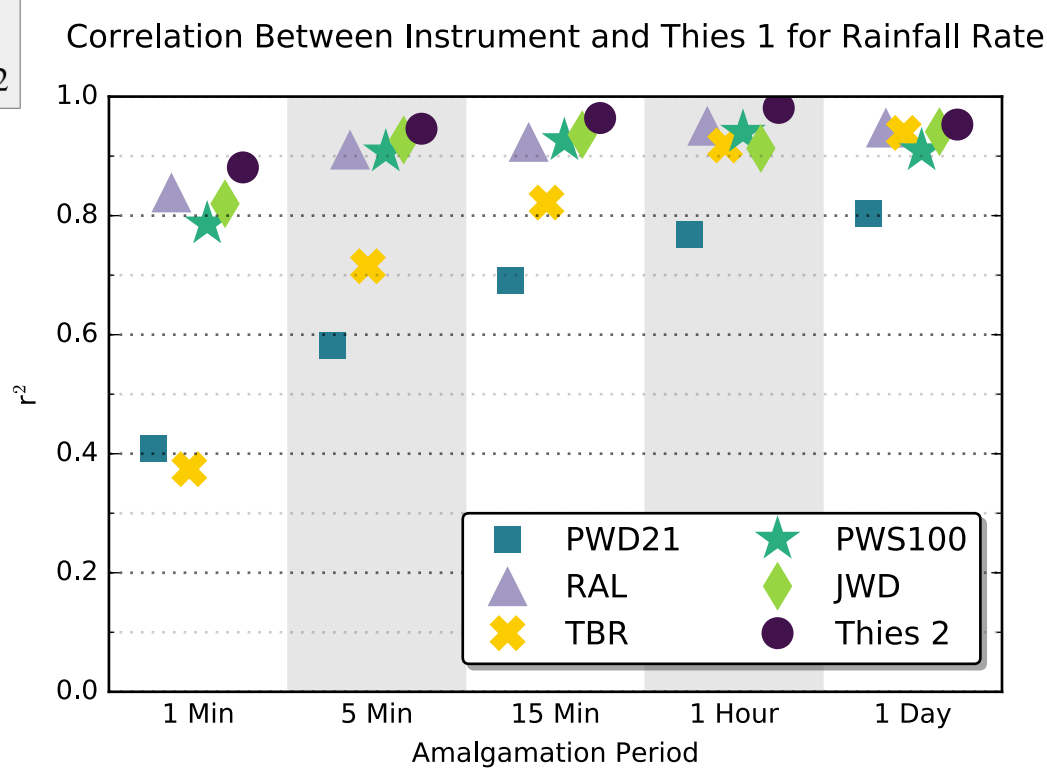
Precipitation Rate

5 Minute Precipitation Rate	PWD21	RAL	TBR	PWS100	JWD	Thies2
Thies1	0.581 0.33 0.15	0.911 0.88 0.20	0.715 0.51 1.83	0.907 1.08 −0.10	0.927 0.79 0.06	0.946 1.05 0.09
Thies2	0.628 0.31 0.09	0.938 0.83 0.08	0.730 0.49 1.67	0.900 0.98 −0.20	0.951 0.73 0.00	
JWD	0.627 0.42 0.09	0.947 1.10 0.08	0.710 0.67 1.67	0.919 1.33 −0.22		
PWS100	0.574 0.28 0.20	0.890 0.75 0.38	0.730 0.45 1.94			
TBR	0.351 0.37 −0.07	0.722 1.18 −1.10				
RAL	0.604 0.36 0.09					

5-min RR scatter-plot r^2 and mc values.

PWD21 & TBR 👎

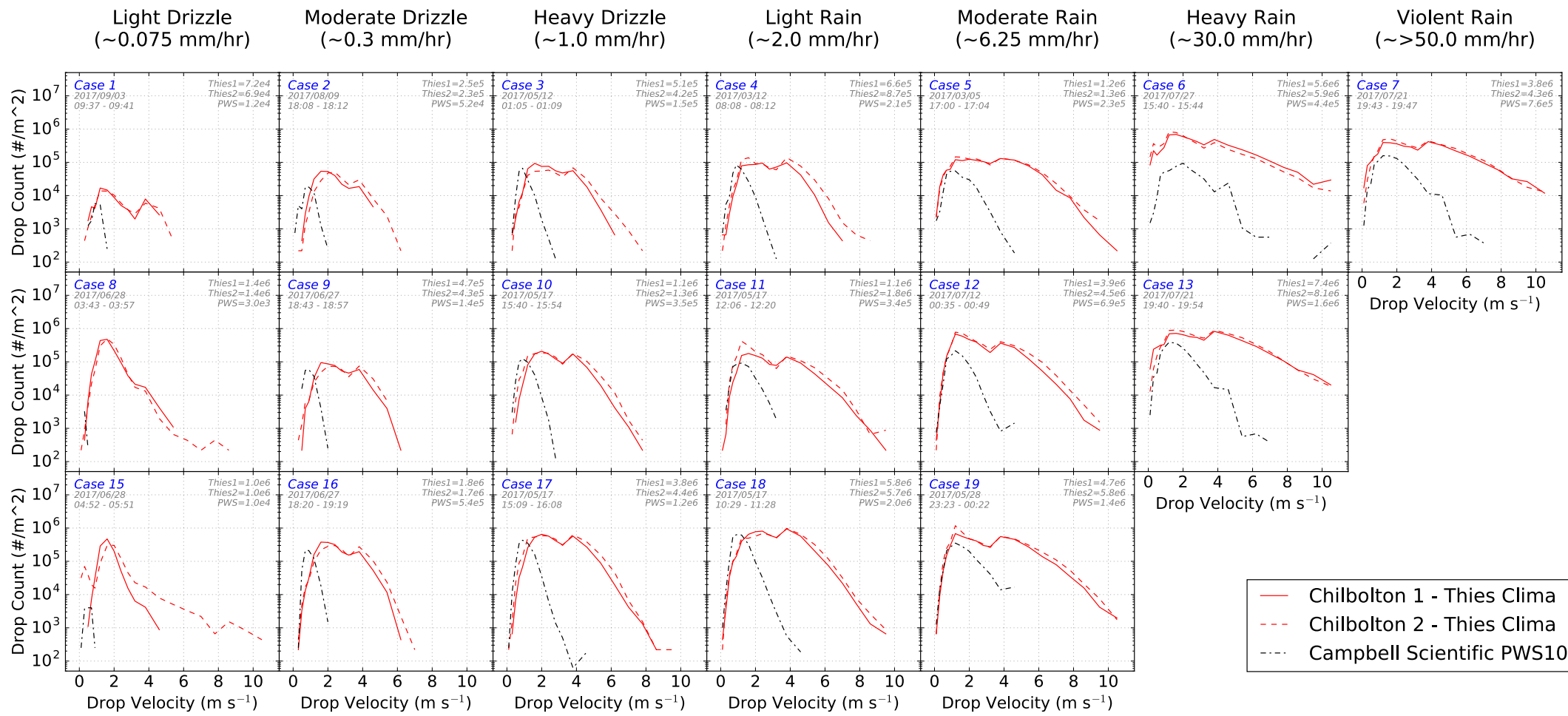
Thies 1 and 2 👌



Using Thies 1 as a baseline - r^2 values for each instrument over varying time periods.

TBR and PWD21 again poor performance. Resolution issues by design. All other sensors have similar r^2's.

Drop Velocity Distribution



Drop velocity distribution (DVD) from 3 instruments. Rows are time periods (5 min, 15 min, 1 hour) and columns are rain rate (0.075, 0.3, 1.0, 2.0, 6.25, 30.0, > 50.0 mm hr $^{-1}$).

Thies 1 & 2 consistently have much higher velocities than the PWS100. The PWS100 uses a more advanced observation technique (ask me) and should be trusted more. For high RR, Thies 1 & 2 record more particles overall which suggests splintering is occurring; could affect hydrometeor type accuracy.

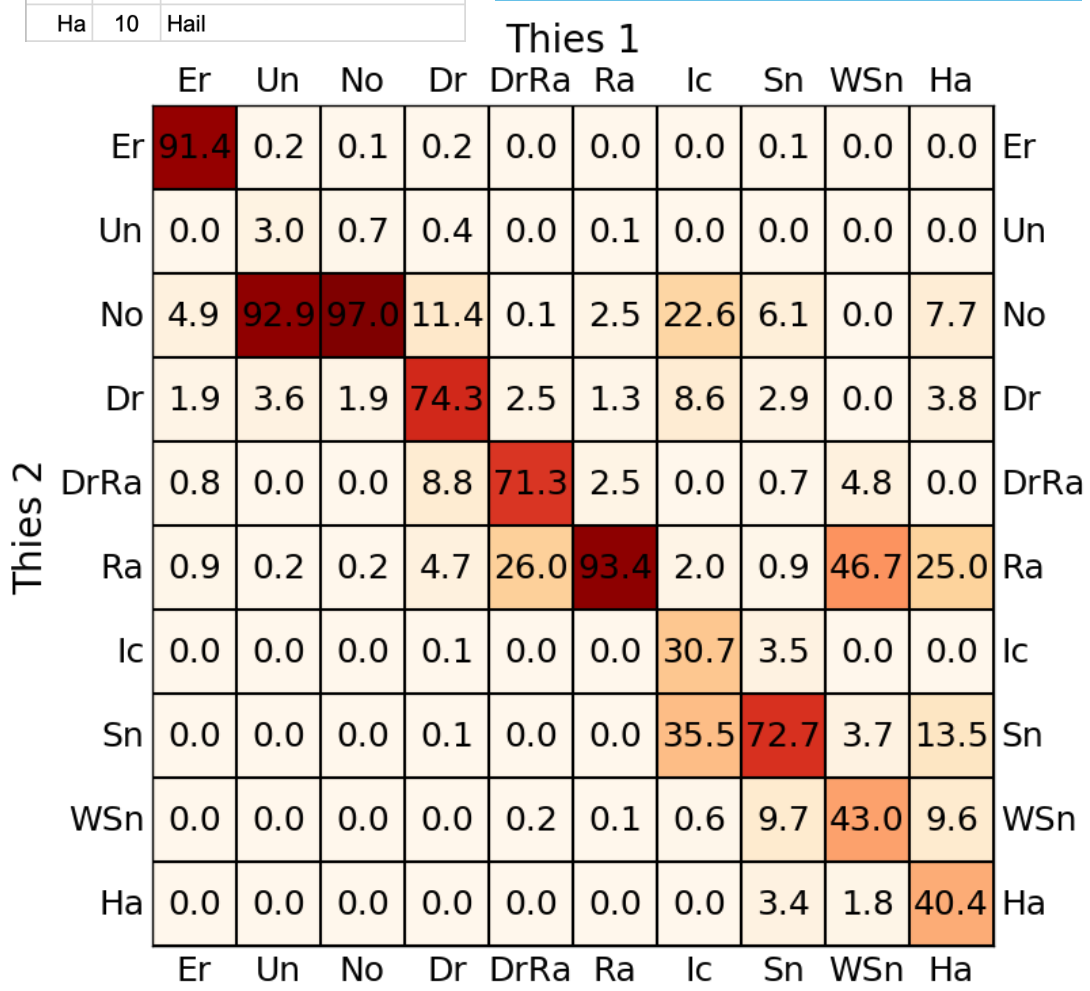
Preliminary: Hydrometeor Type / Present Weather Code

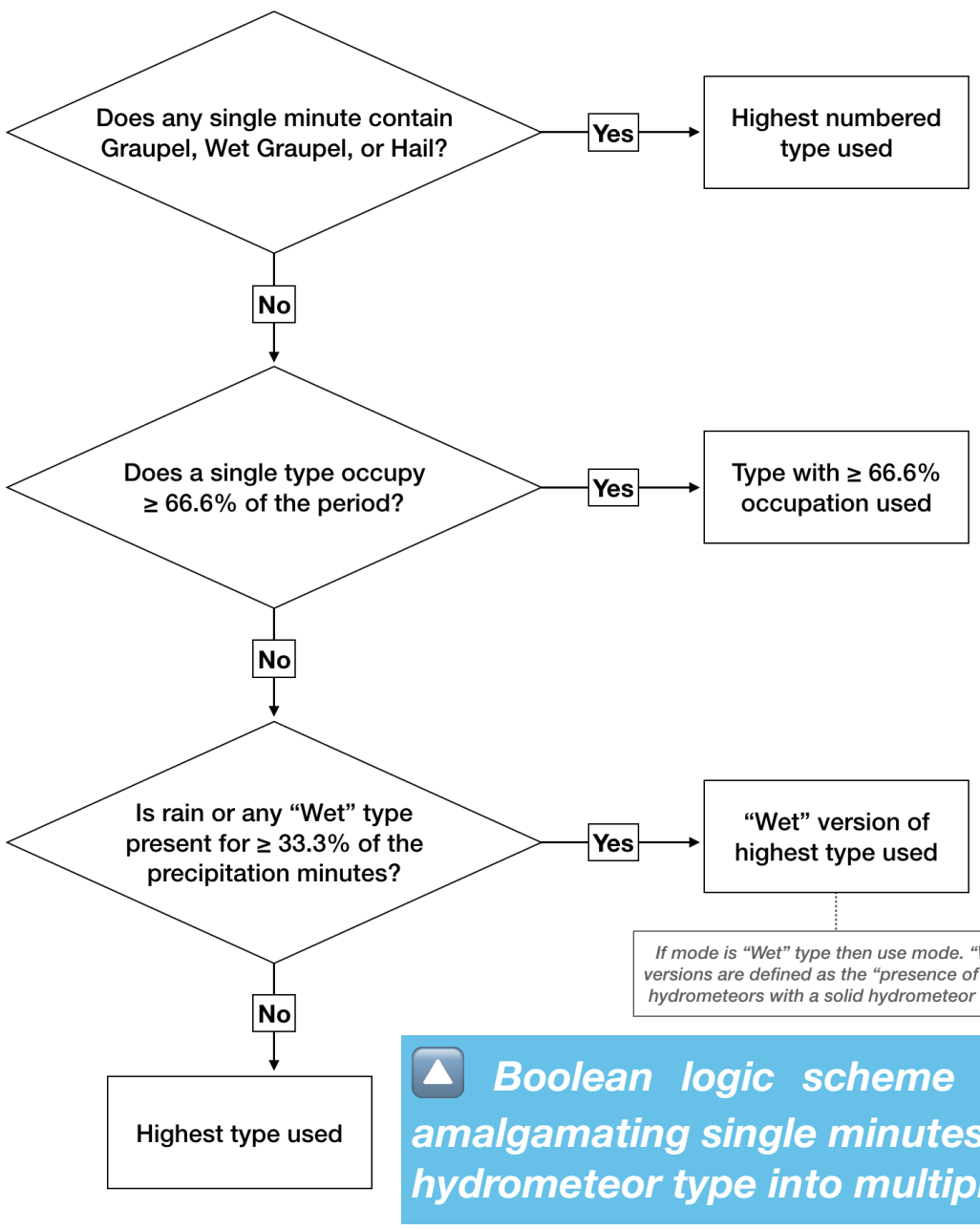
ABC	Code	Description
Er	-2	Instrument Error
Un	-1	Unidentified Hydrometeor
No	0	No Hydrometeor
Dr	1	Drizzle
DrRa	2	Drizzle and Rain
Ra	3	Rain
Ic	4	Ice
WIc	5	Wet Ice
Sn	6	Snow
WSn	7	Wet Snow
Gr	8	Graupel
WGr	9	Wet Graupel
Ha	10	Hail

Master look-up-table (LUT) to translate between WMO Tab.4680 PW Codes to hydrometeor type. Can also be used to translate radar / FAAM / crowdsourced.

1-minute hydrometeor type confusion matrix

Initial results show some disagreement between the identical sensors.





Boolean logic scheme for amalgamating single minutes of hydrometeor type into multiple.

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