Understanding Seasonal variation plots

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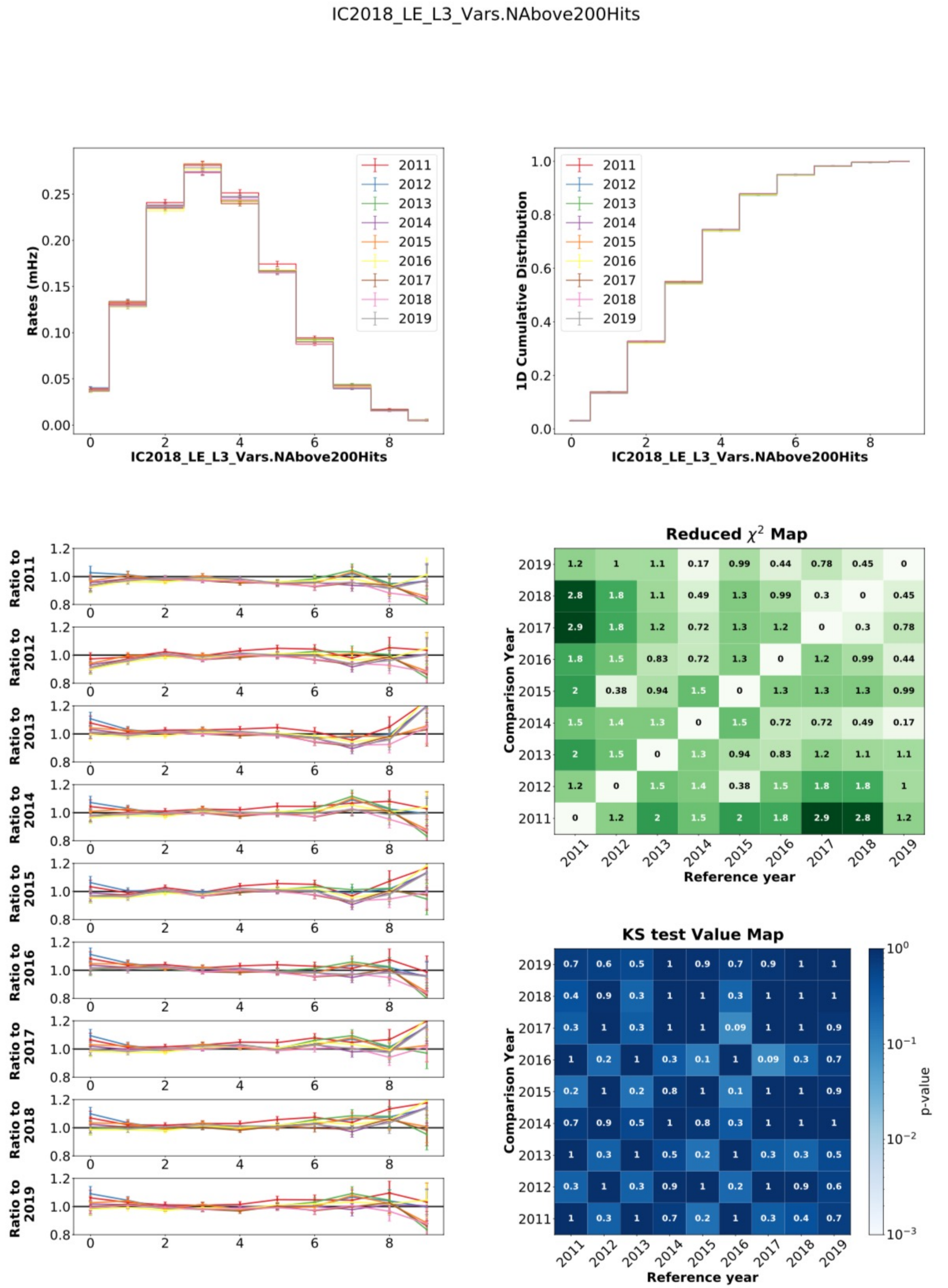
1D distribution plots

Every variable is looked at in five different ways:

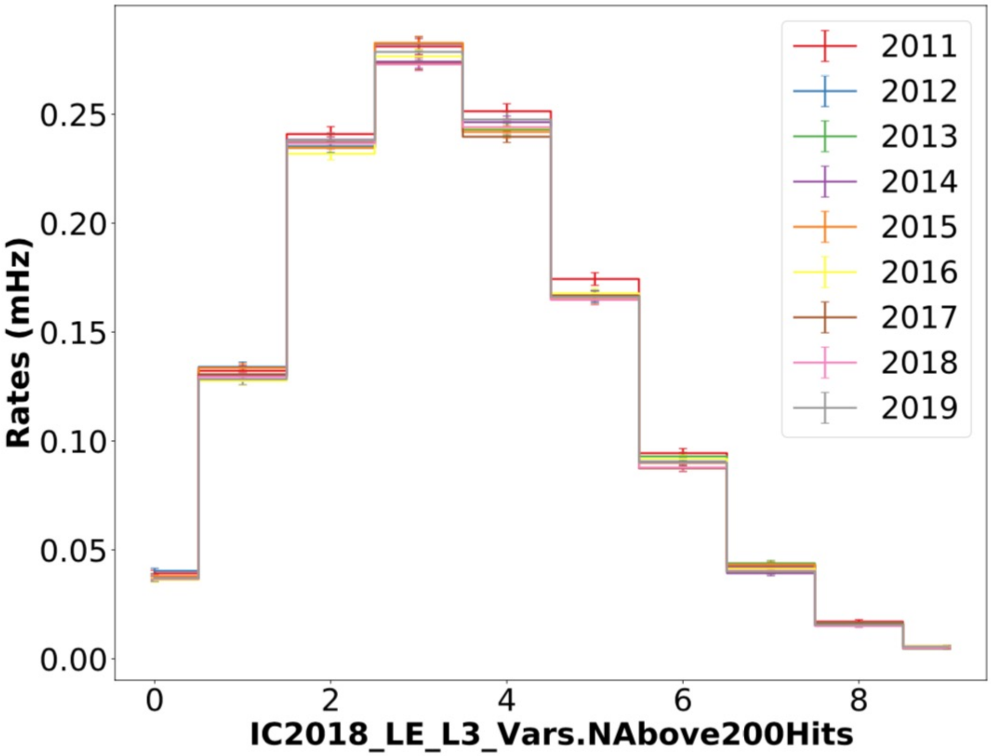


IC2018_LE_L3_Vars.NAbove200Hits

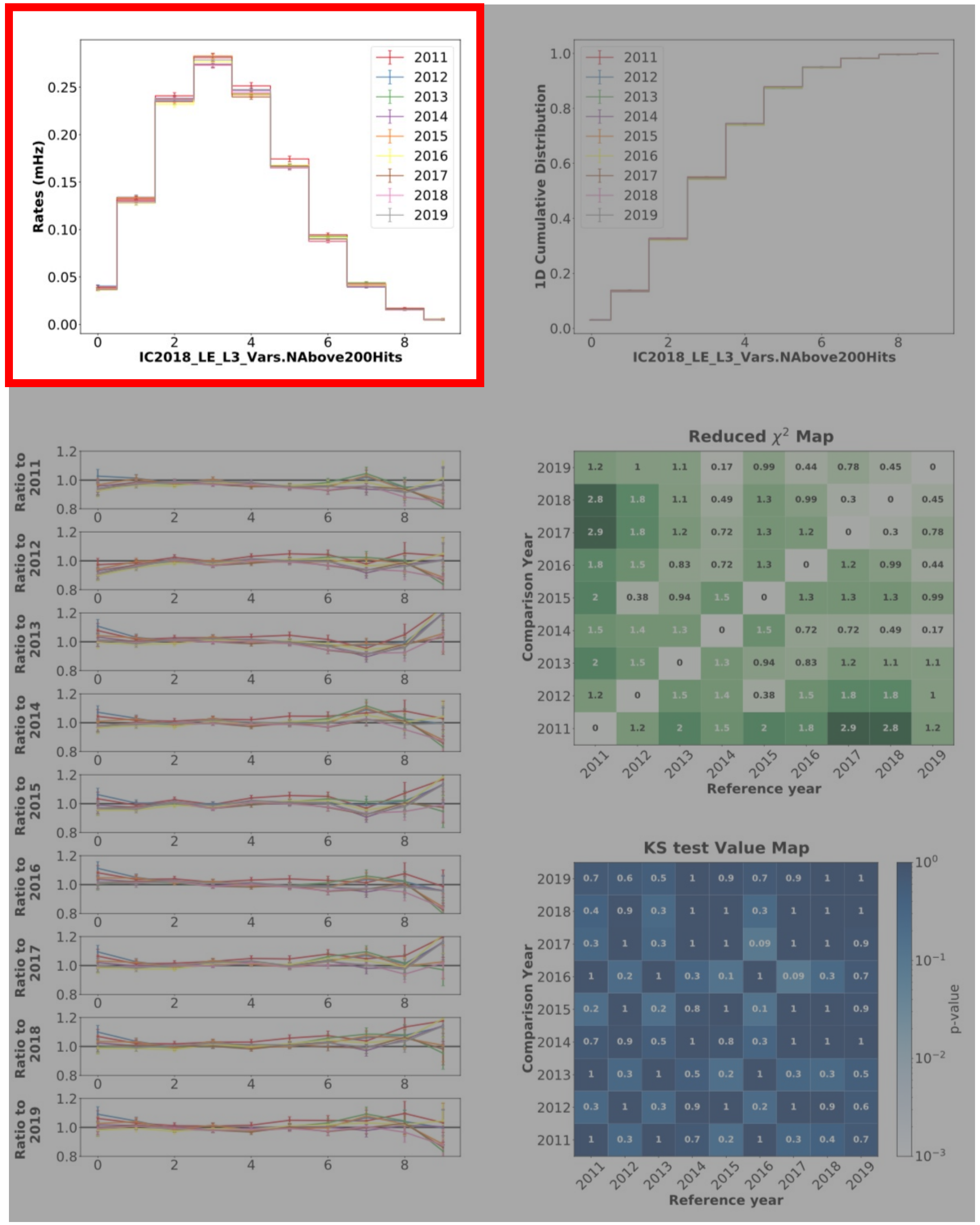
1D Distribution

Every variable is looked at in five different ways:

1. **1D distribution of the variable**



- *Good first glance at distribution*
- *Can check the rates make sense*



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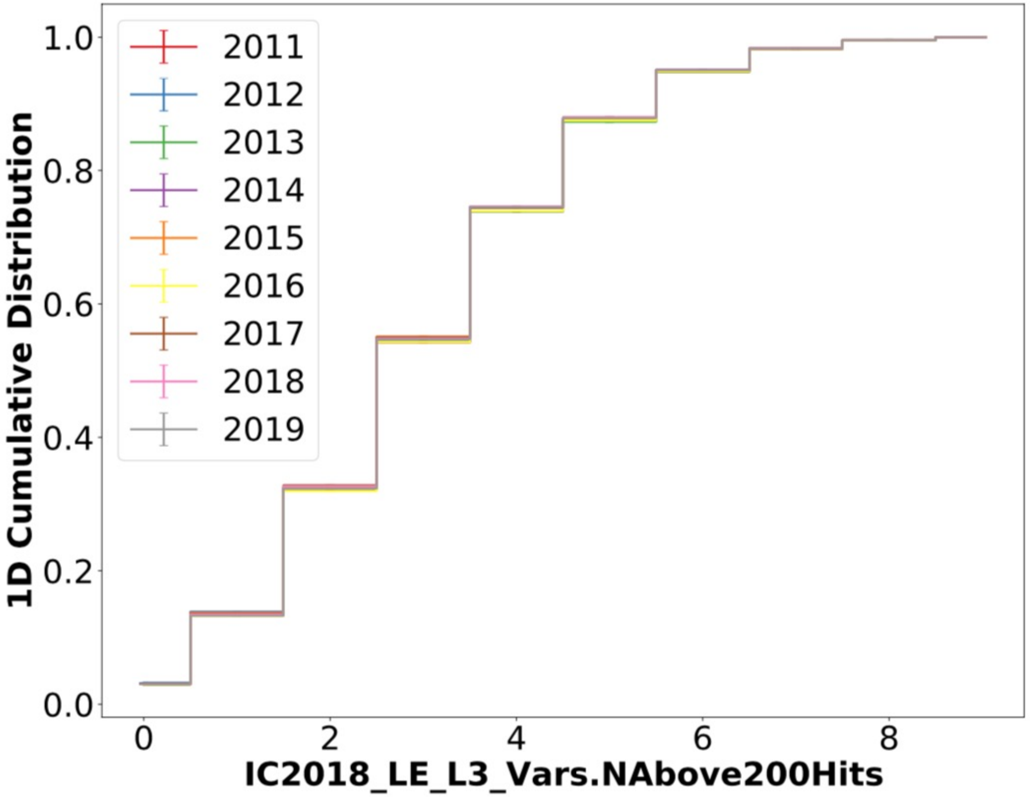
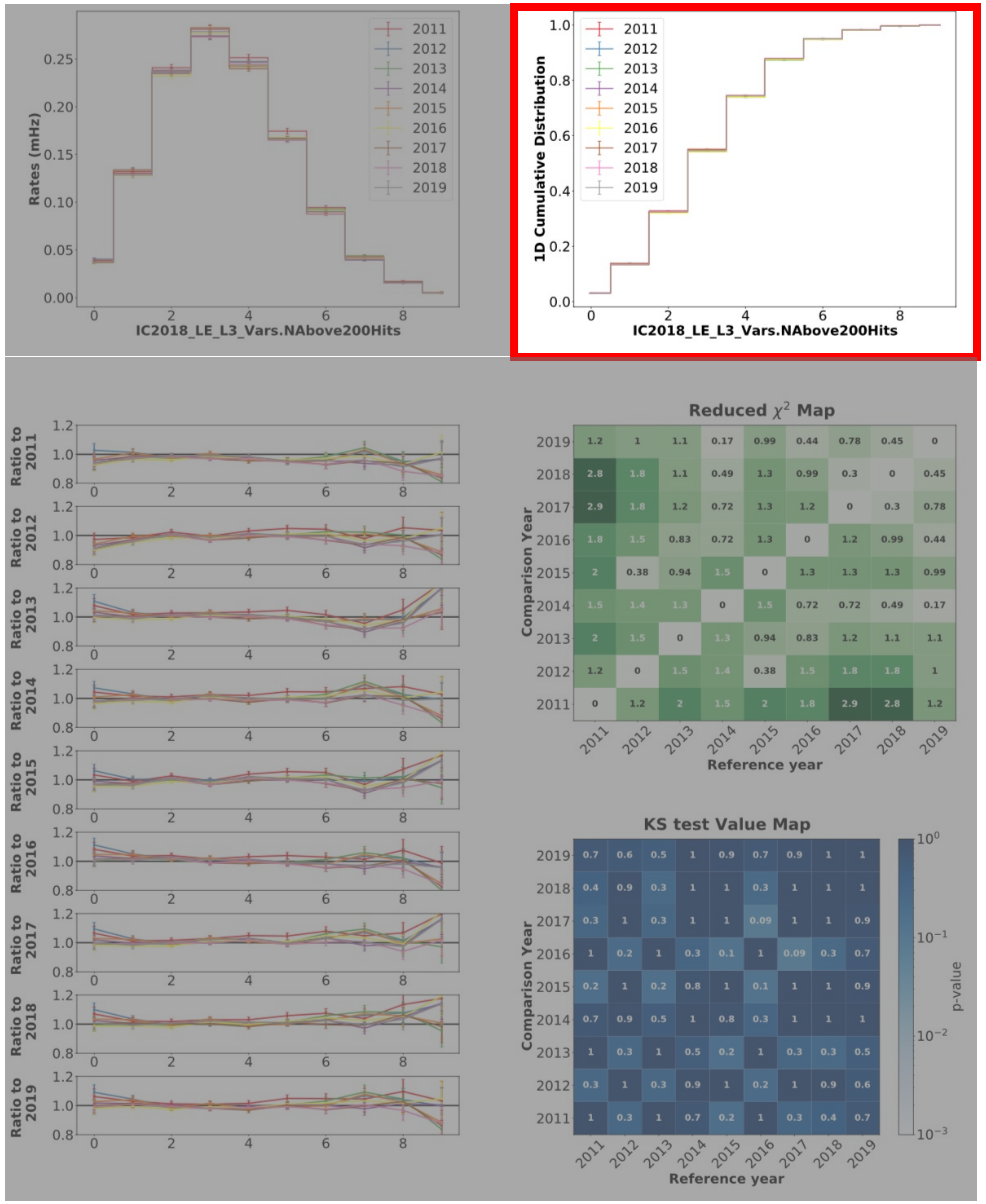
1D distributions

Every variable is looked at in five different ways:

2. 1D CDF distributions for each year



Ensure we cover full range of the variable



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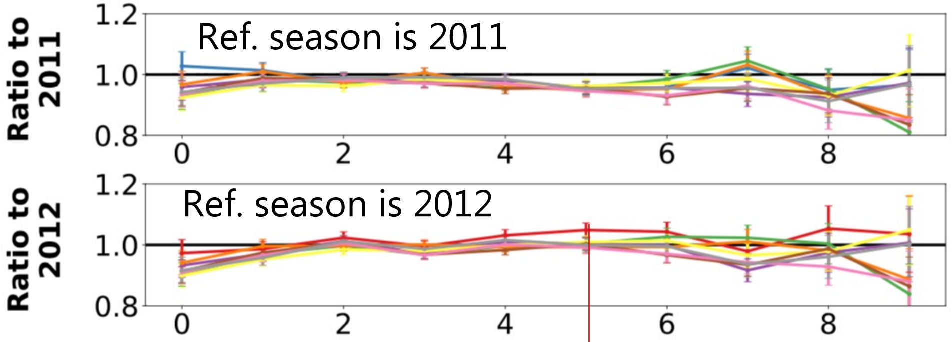
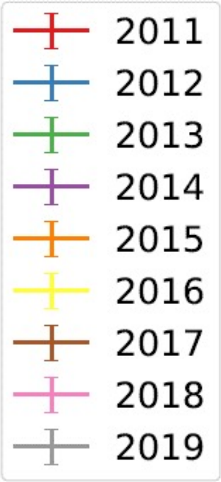
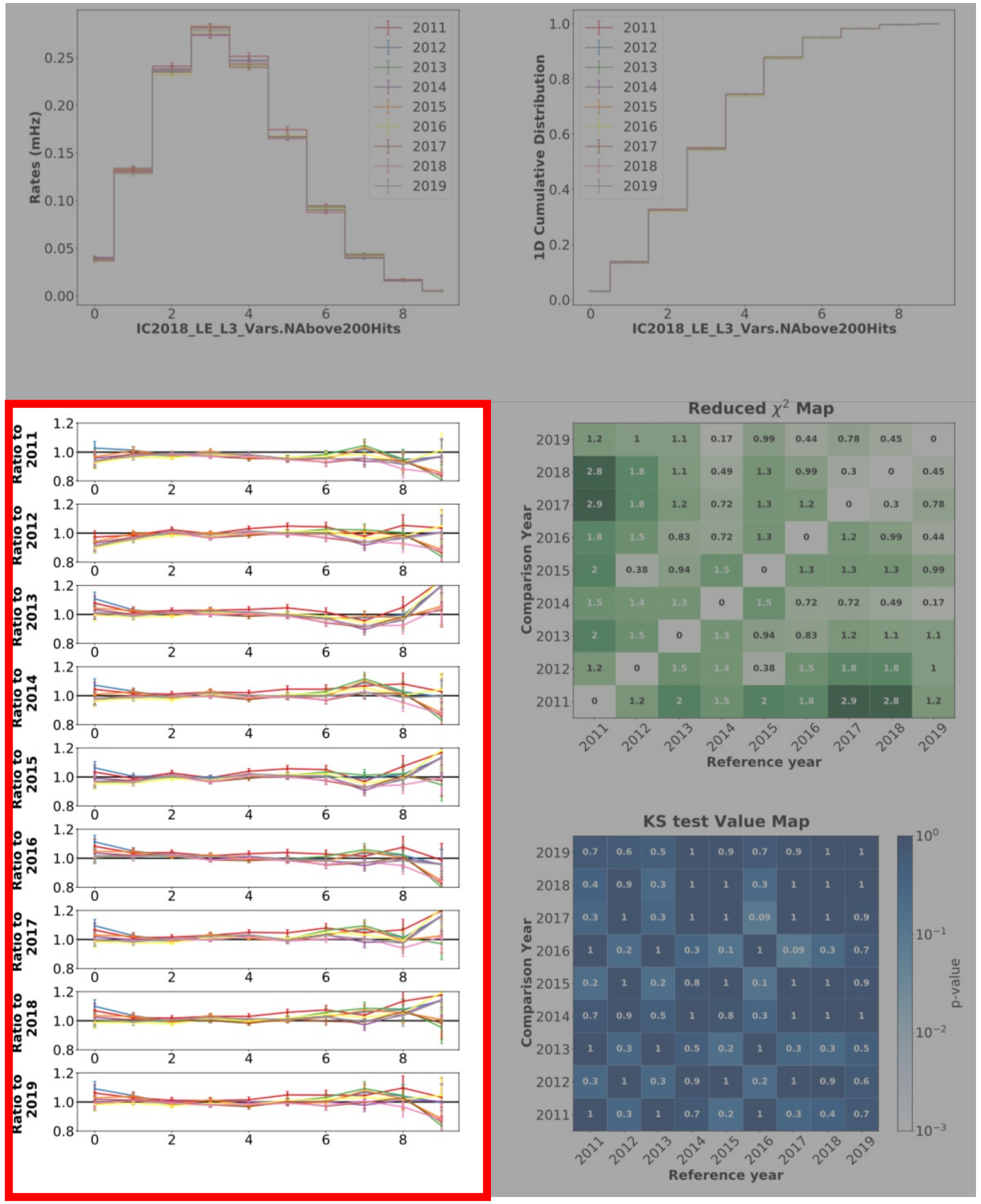
1D Distributions

3. Ratio Plots





Red line here means : $\dfrac{\text{2011 Rates x 2012 Livetime}}{\text{2012 Counts}}$



C: Event count in season
T: Livetime of the season

- *Main plots used to gauge the variation*
- *Ratio is computed as follow:* $R = \dfrac{C_i \cdot r_{i,ref}}{C_{ref}}$ where $r_{i,ref} = \dfrac{L_{ref}}{L_i}$

2D plots

4. Reduced Chi2 Tables

Reduced χ^2 Map

Comparison Year \ Reference year	2011	2012	2013	2014	2015	2016	2017	2018	2019
2019	1.2	1	1.1	0.17	0.99	0.44	0.78	0.45	0
2018	2.8	1.8	1.1	0.49	1.3	0.99	0.3	0	0.45
2017	2.9	1.8	1.2	0.72	1.3	1.2	0	0.3	0.78
2016	1.8	1.5	0.83	0.72	1.3	0	1.2	0.99	0.44
2015	2	0.38	0.94	1.5	0	1.3	1.3	1.3	0.99
2014	1.5	1.4	1.3	0	1.5	0.72	0.72	0.49	0.17
2013	2	1.5	0	1.3	0.94	0.83	1.2	1.1	1.1
2012	1.2	0	1.5	1.4	0.38	1.5	1.8	1.8	1
2011	0	1.2	2	1.5	2	1.8	2.9	2.8	1.2

- *Sensitive to statistically significant differences in **normalisation***

Sum over non-empty bins i (comparison year)

$$\chi^2_{y,ref} = \frac{1}{n_{dof}} \sum_i \frac{\left(C_{i,y} - C_{i,ref}\right)^2}{C_{i,ref} + C_{i,y}}$$

for $C_{i,y} > 10$ and $C_{i,ref} \neq 0$

occasional disagreements fine, several high χ^2 regions need more scrutiny

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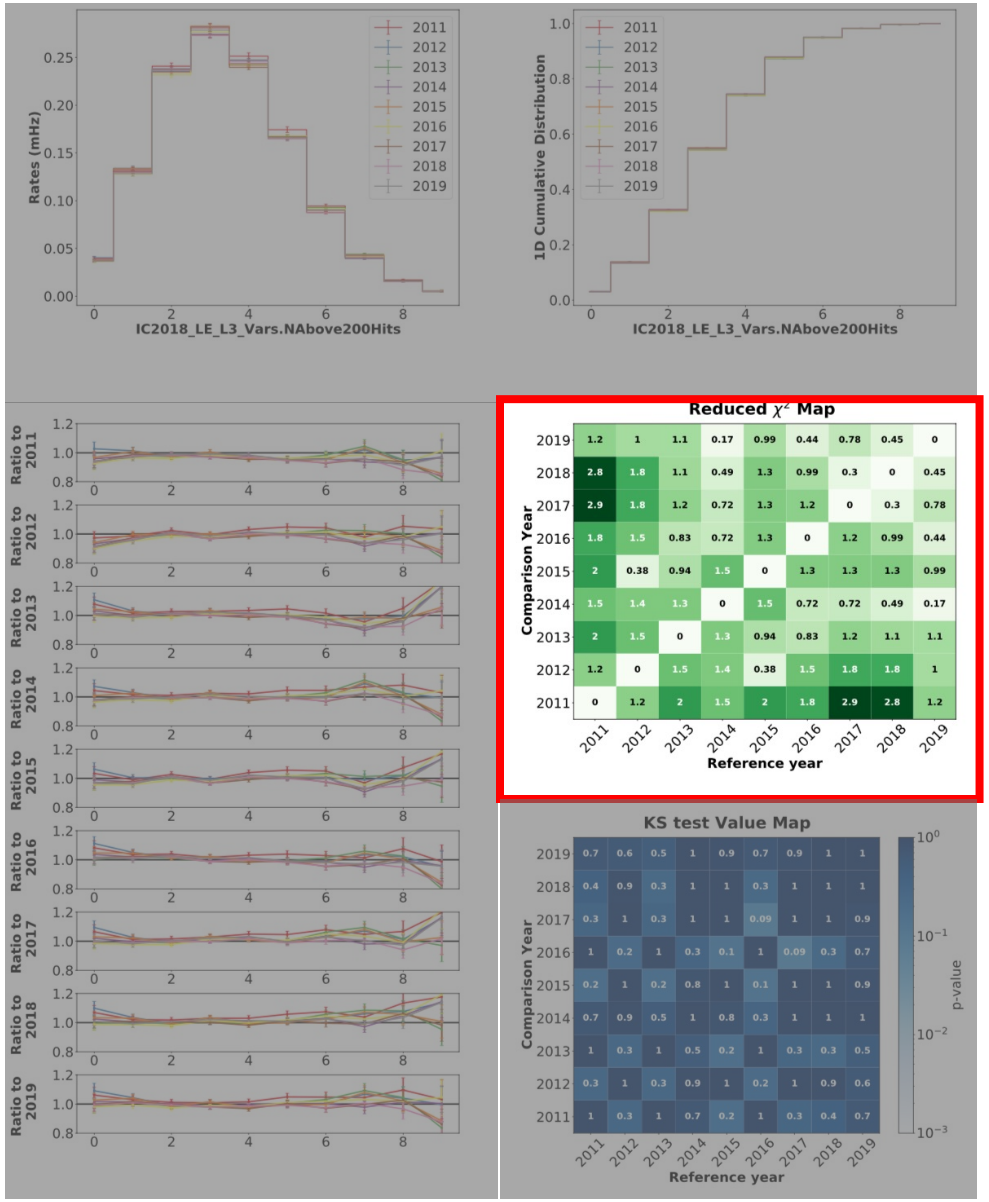


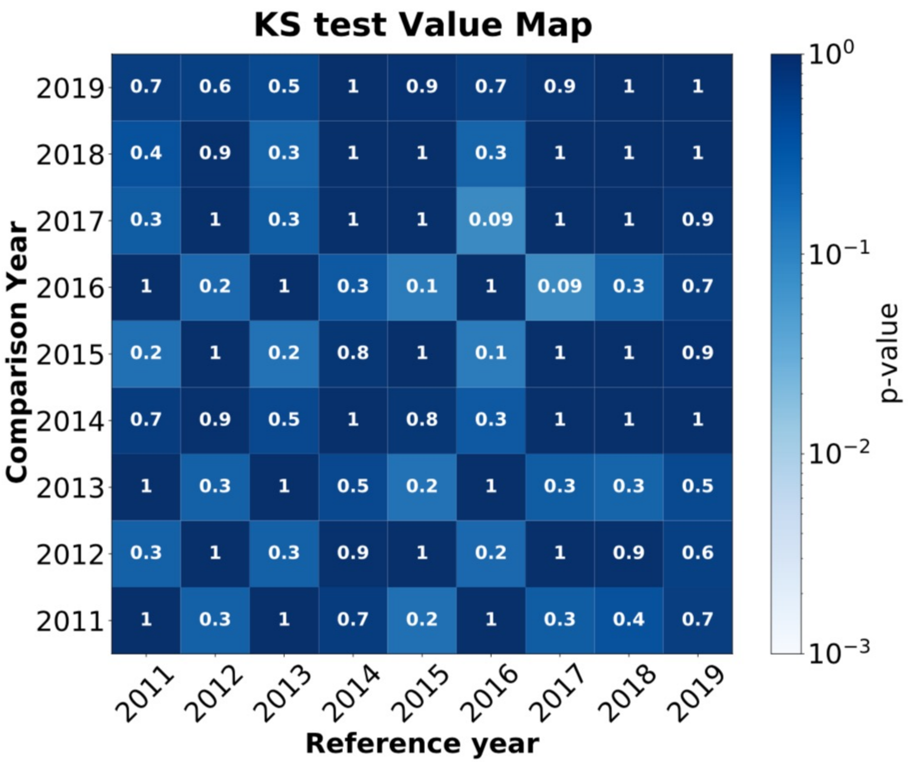
IC2018_LE_L3_Vars.NAbove200Hits

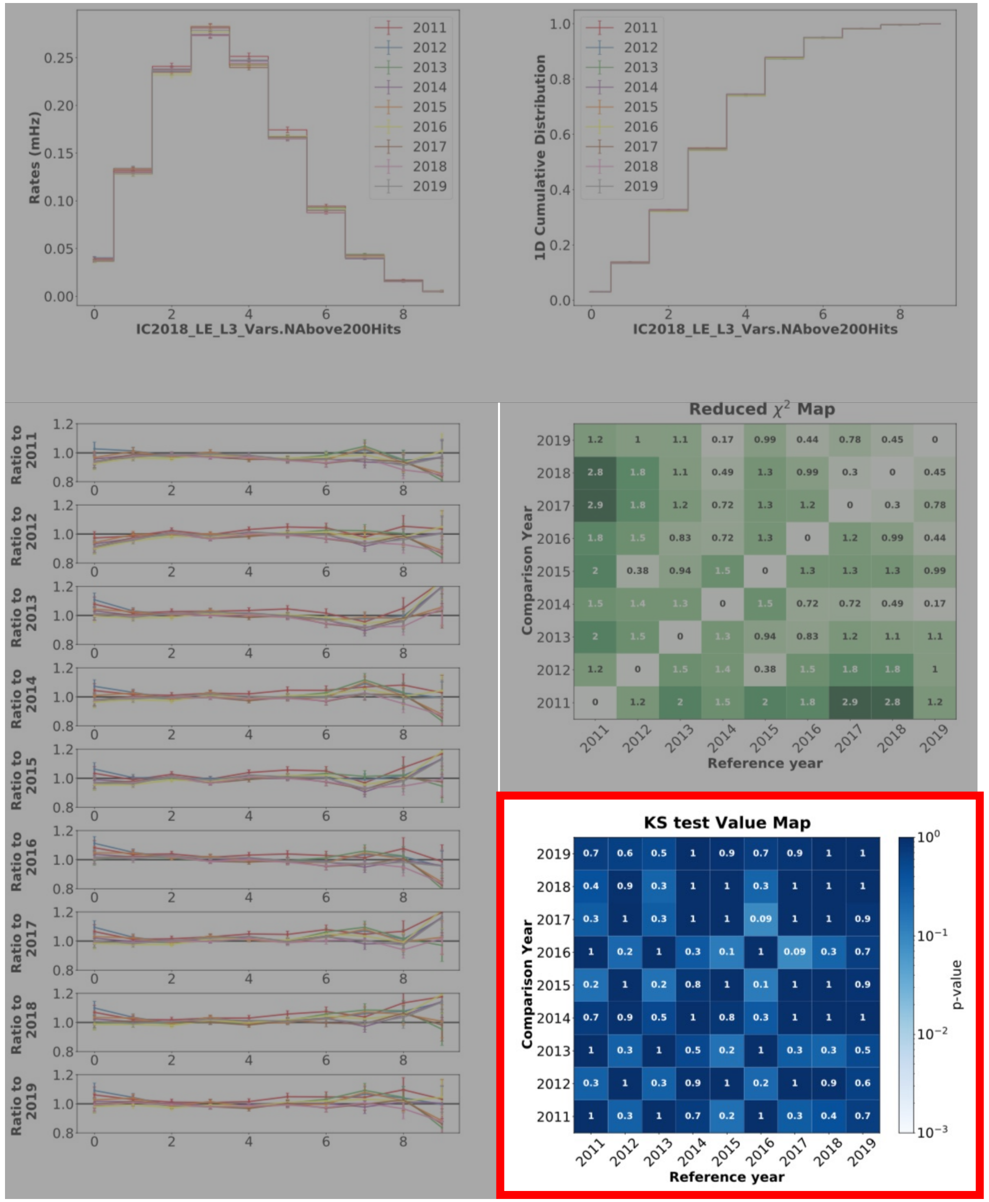
2D plots

5. Kolmogorov-Smirnov Test

- *Sensitive to statistically significant differences in* ***distribution shapes***

- ***Main plots for making decisions***





we want high p-values