Replicating ZTF data : where are we ?

ZTF France meeting, 8-9th december 2021

-Mélissa Amenouche (speaker)
-Philippe Rosnet (LPC)
-Mat Smith (IP2I)

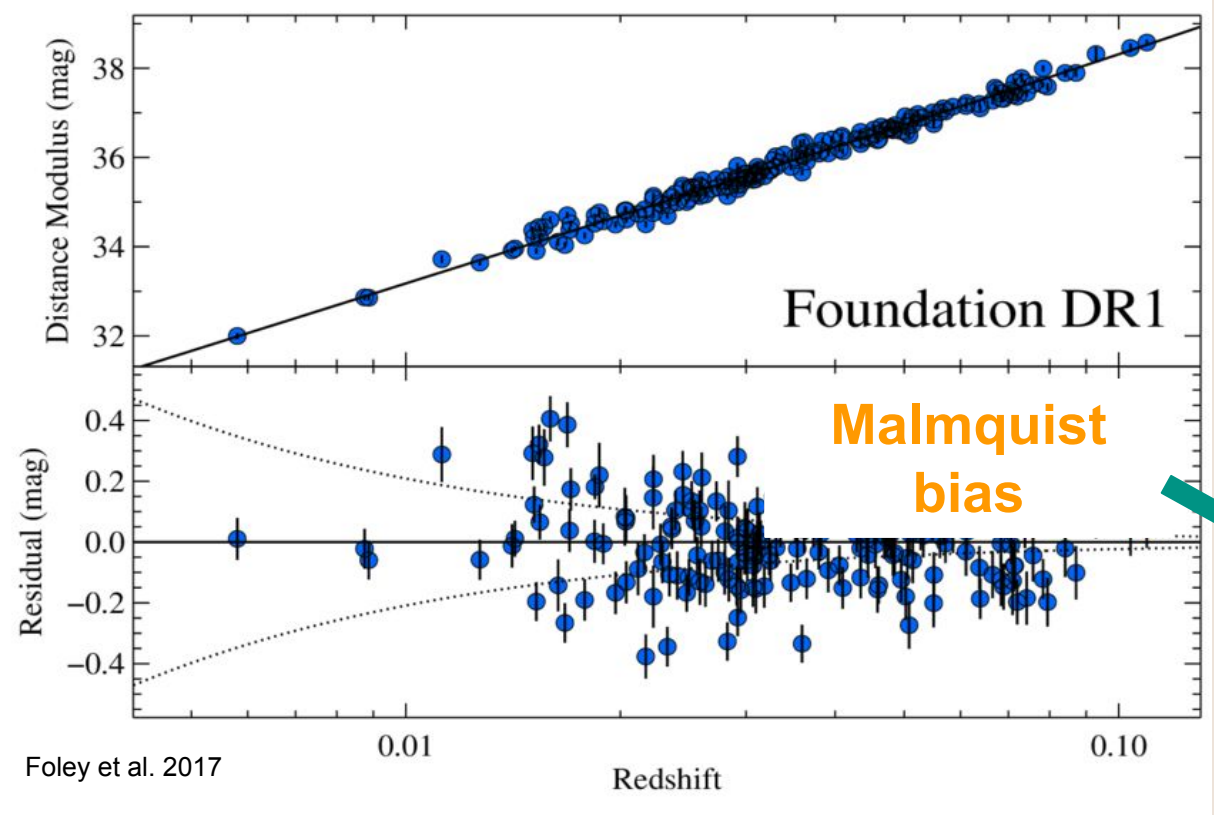
Bulk flows with SNe Ia

G. J. Mathews et al. (2016)

Reference	Obj. Type	No. Obj.	Redshift[a]	Distance[a] (h^{-1} Mpc)	v_{bf} (km s^{-1})	l (degree)	b (degree)
Kashlinsky et al. (2010)	kSZ	516	<0.12	<345	934 ± 352	282 ± 34	22 ± 20
		547	<0.16	<430	1230 ± 331	292 ± 21	27 ± 15
		694	<0.20	<540	1042 ± 295	284 ± 24	30 ± 16
		838	<0.25	<640	1005 ± 267	296 ± 29	39 ± 15
Dai et al. (2011)	SN Ia	132	<0.05	<145	188 ± 120	290 ± 39	20 ± 32
		425	>0.05	>145	...	...	...
Weyant et al. (2011)	SN Ia	112	<0.028	<85	538 ± 86	250 ± 100	36 ± 11
Ma et al. (2011)	galaxies and SN Ia	4536	<0.011	<33	340 ± 130	285 ± 23	9 ± 19
Colin et al. (2011)	SN Ia	142	<0.06	<175	260 ± 130	298 ± 40	8 ± 40
Turnbull et al. (2012)	SN Ia	245	<0.05	<145	245 ± 76	319 ± 18	7 ± 14
Feindt et al. (2013)	SN Ia	128	0.015–0.035	45–108	243 ± 88	298 ± 25	15 ± 20
		36	0.035–0.045	108–140	452 ± 314	302 ± 48	−12 ± 26
		38	0.045–0.060	140–188	650 ± 398	359 ± 32	14 ± 27
		77	0.060–0.100	188–322	105 ± 401	285 ± 234	−23 ± 112
Ma & Scott (2013)	galaxies	2404	<0.026	<80	280 ± 8	280 ± 8	5.1±6
Rathaus et al. (2013)	SN Ia	200	<0.2	<550	260	295	5
Appleby et al. (2015)	SN Ia	187	0.015–0.045	45–130	...	276 ± 29	20 ± 12
Planck Collaboration et al. (2014)	kSZ	95	0.01–0.03	30–90	<700	...	...
		1743	<0.5	<2000	<254	...	...

No consensus on the detection

Hubble diagram



Foley et al. 2017

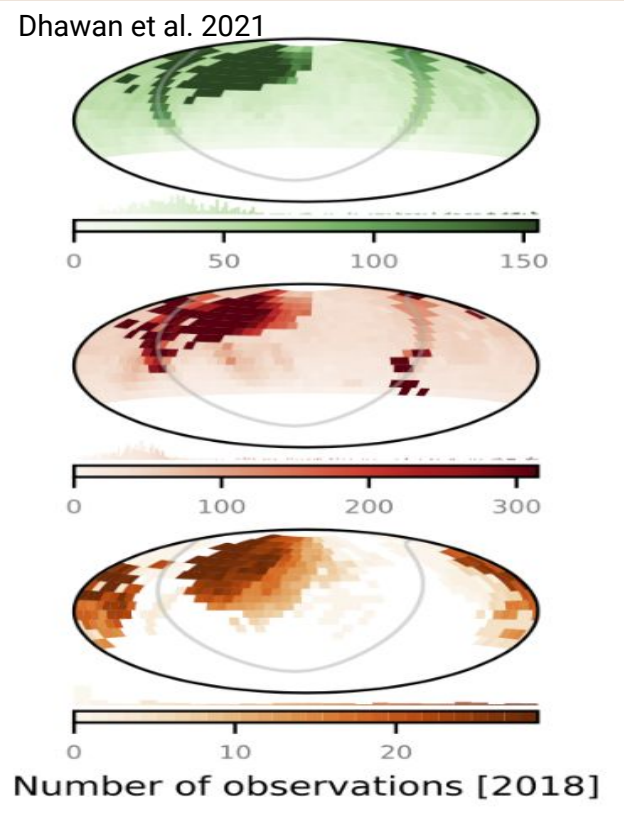
Hubble diagram with ZTF

How do we measure it for ZTF ?

We need simulations

to investigate ZTF imprint

- Biases
- Sky coverage and survey cadence
- Data quality



Simsurvey (Feindt et al. 2019)

github.com/ZwickyTransientFacility/simsurvey/

ZTF transient light-curves simulator based on an observing strategy

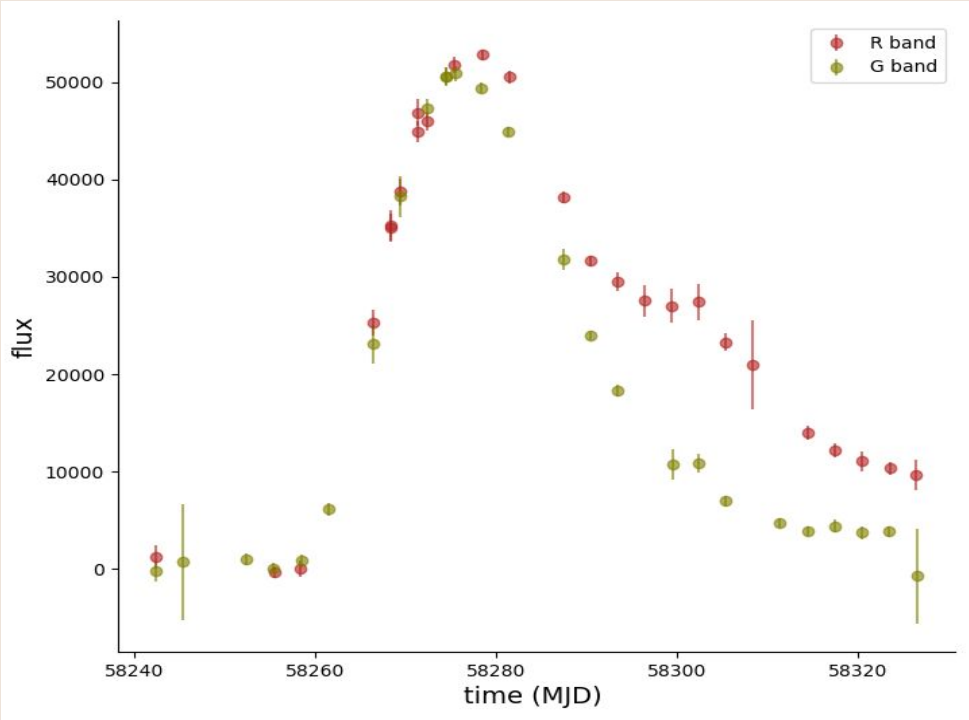
Observing strategy

- Dates of observations
- Observed fields
- associated skynoise

Transient generator

- SED template
- How many transients
- Redshift range ...

Example simsurvey output



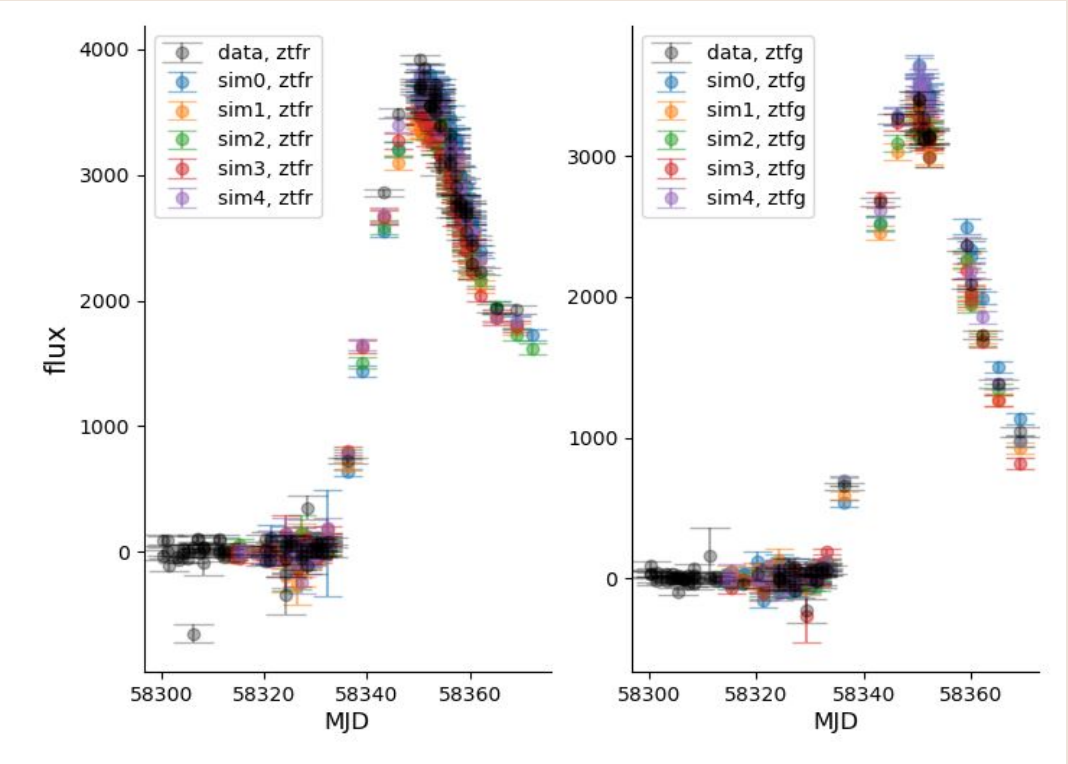
Simulating ZTF DR2

Targeted way to use simsurvey

Observing strategy :
focusing on objects (fixed coordinates)

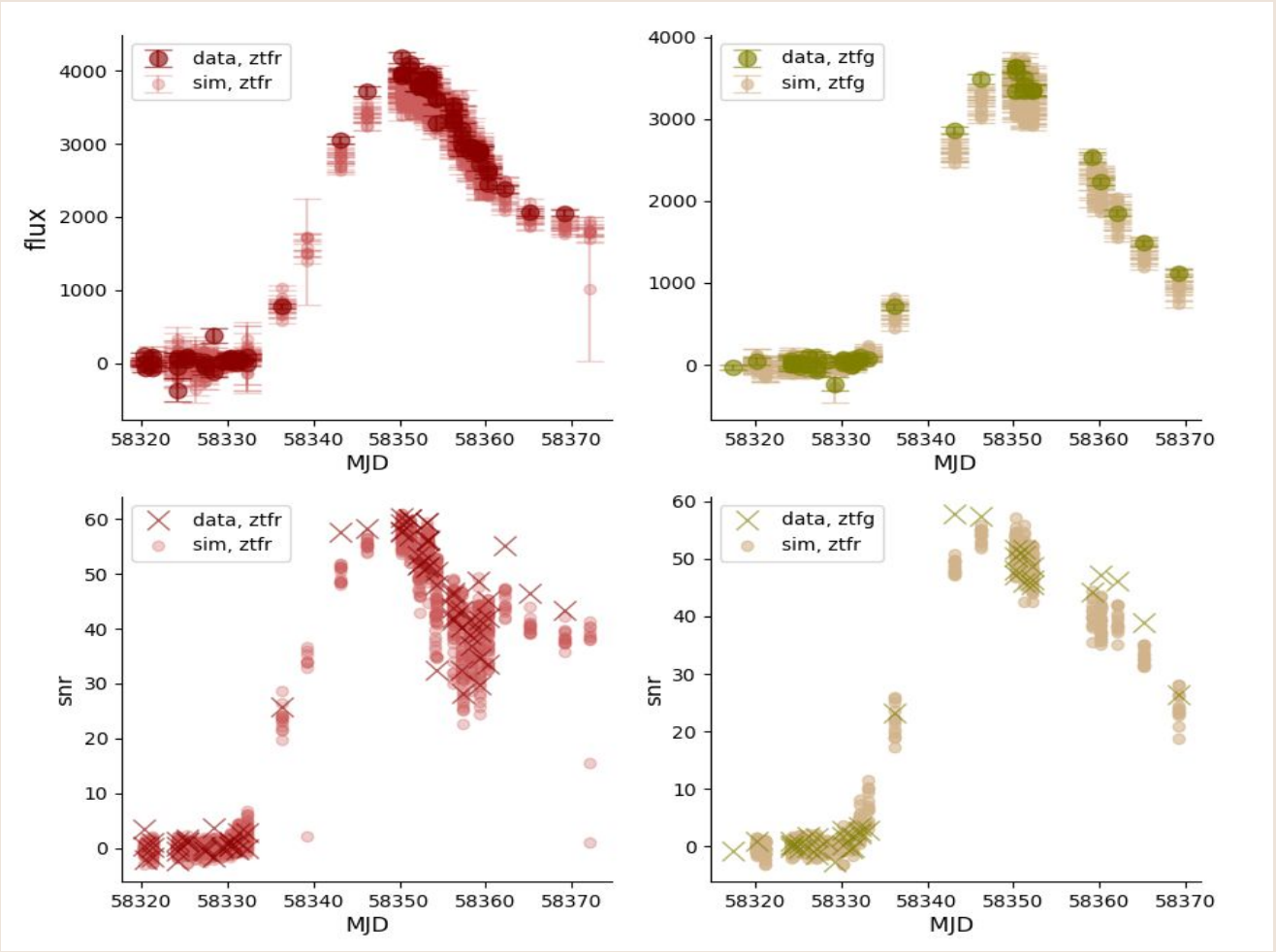
transient :
use the salt2 parameters of the object

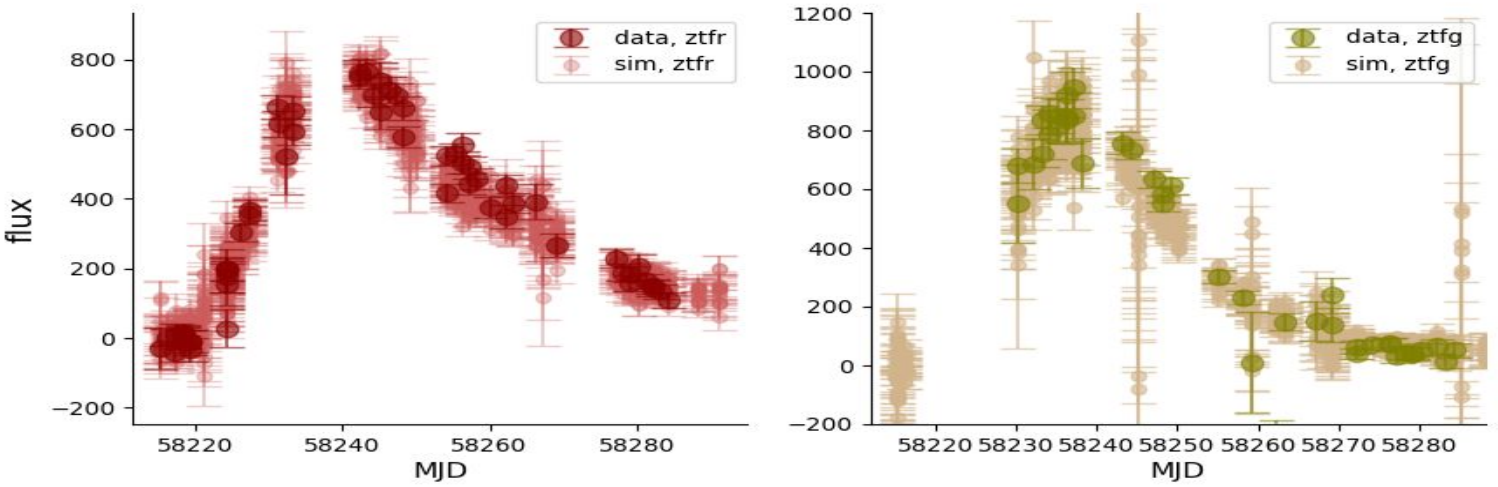
ZTF18ablqlzp, z= 0.0413

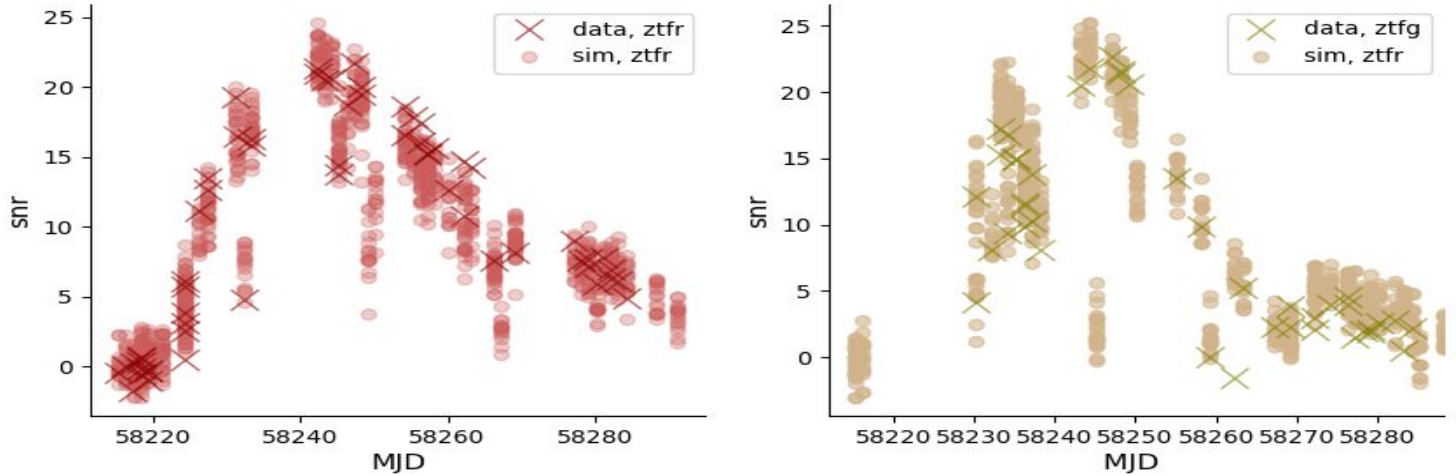


Focus on the errors

ZTF18ablqlzp, z= 0.0413







ZTF18aakoylt

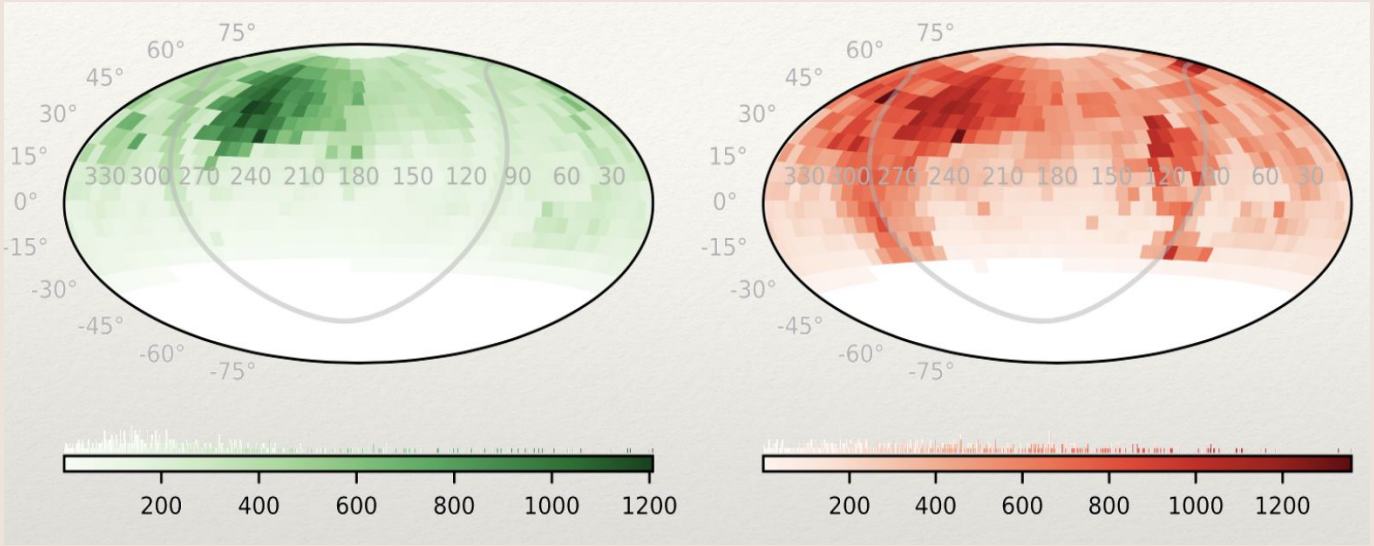
z=0.0876

Good news : the simulations replicate the data

Now :

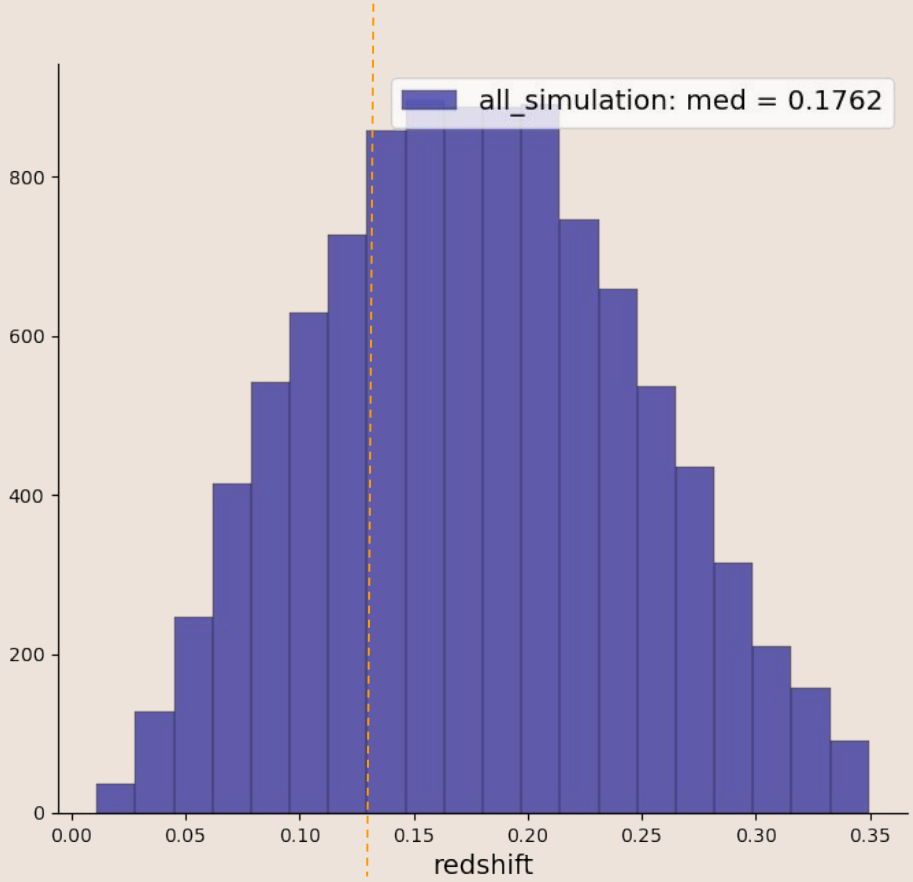
- How well ZTF is doing for **any** SN ?
- Is it biased ?

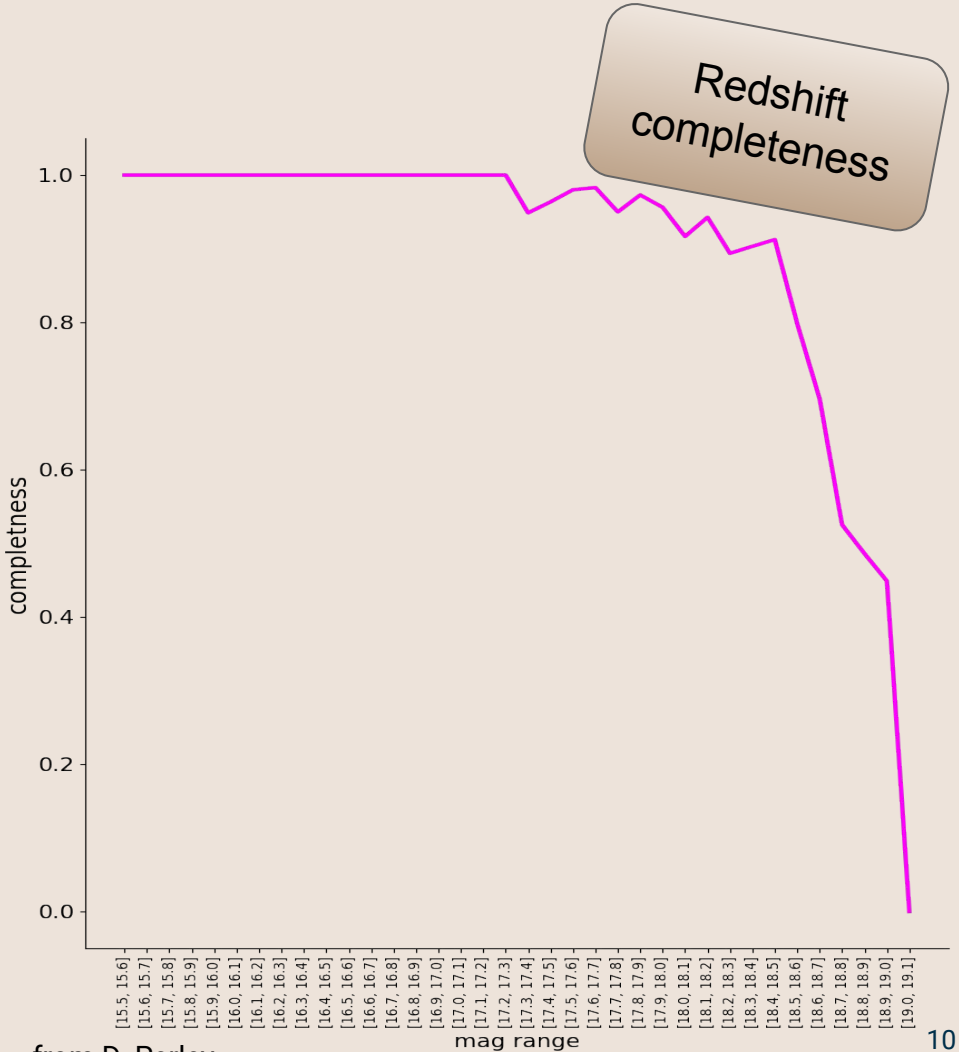
from M. Rigault



What if we observed in a specific patch of the sky than in another ?

Free simulations

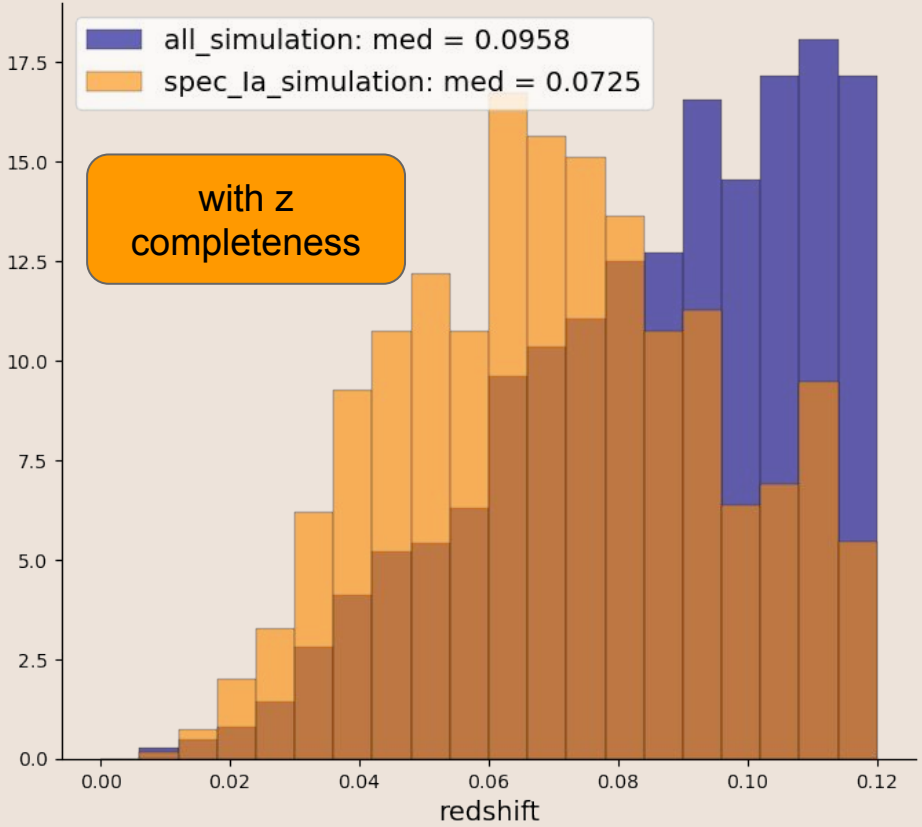


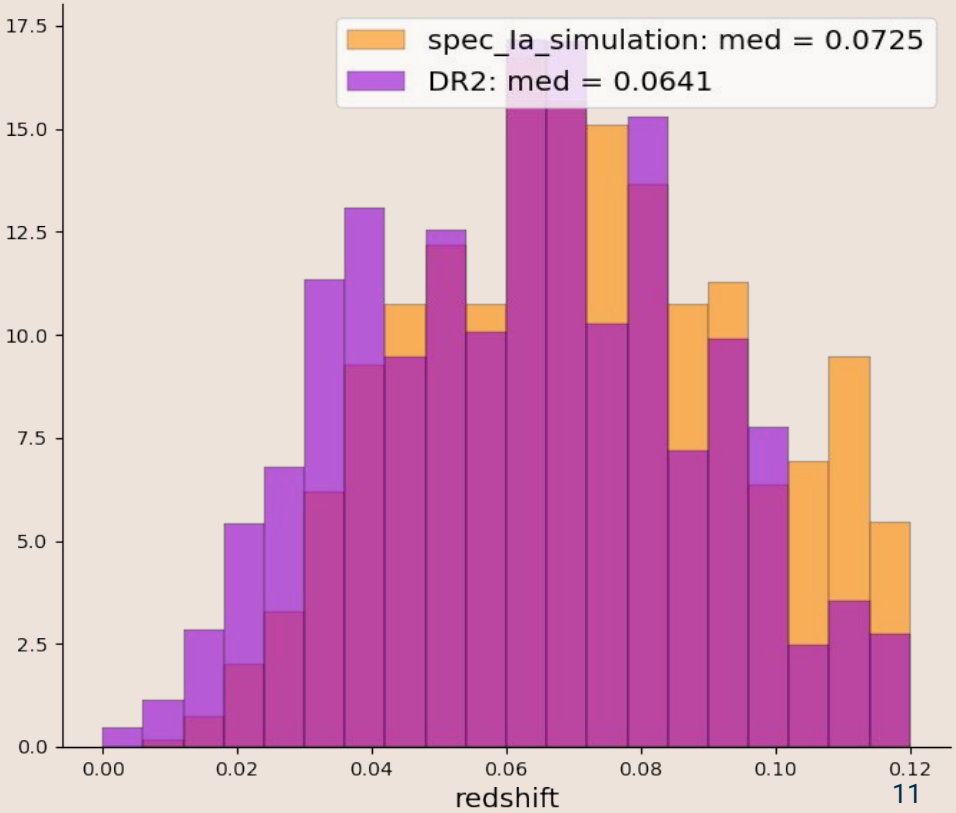


from D. Perley

Free simulations

Preliminary





Conclusion

- ZTF SNe constitute a unique low-z sample for measuring bulk flows
- Bulk flows measurements are important to test LCDM
- The simulations match the data for individual objects

Ongoing work

- Targeted simulations over all DR2
- Fit the LC of the confirmed objects then compare input output parameters (and do in function of ra dec)
- Input realistic population in the simulations