Using the high-resolution observations for the precipitation forecast assessment: *benefits and difficulties*.

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- *What kind of observations do we have to assess results of a high resolution model?*
- *High resolution ground observations. How to process such data?*
- *How to match model forecast with observations?*
- *Evaluation radar data against ground observations.*

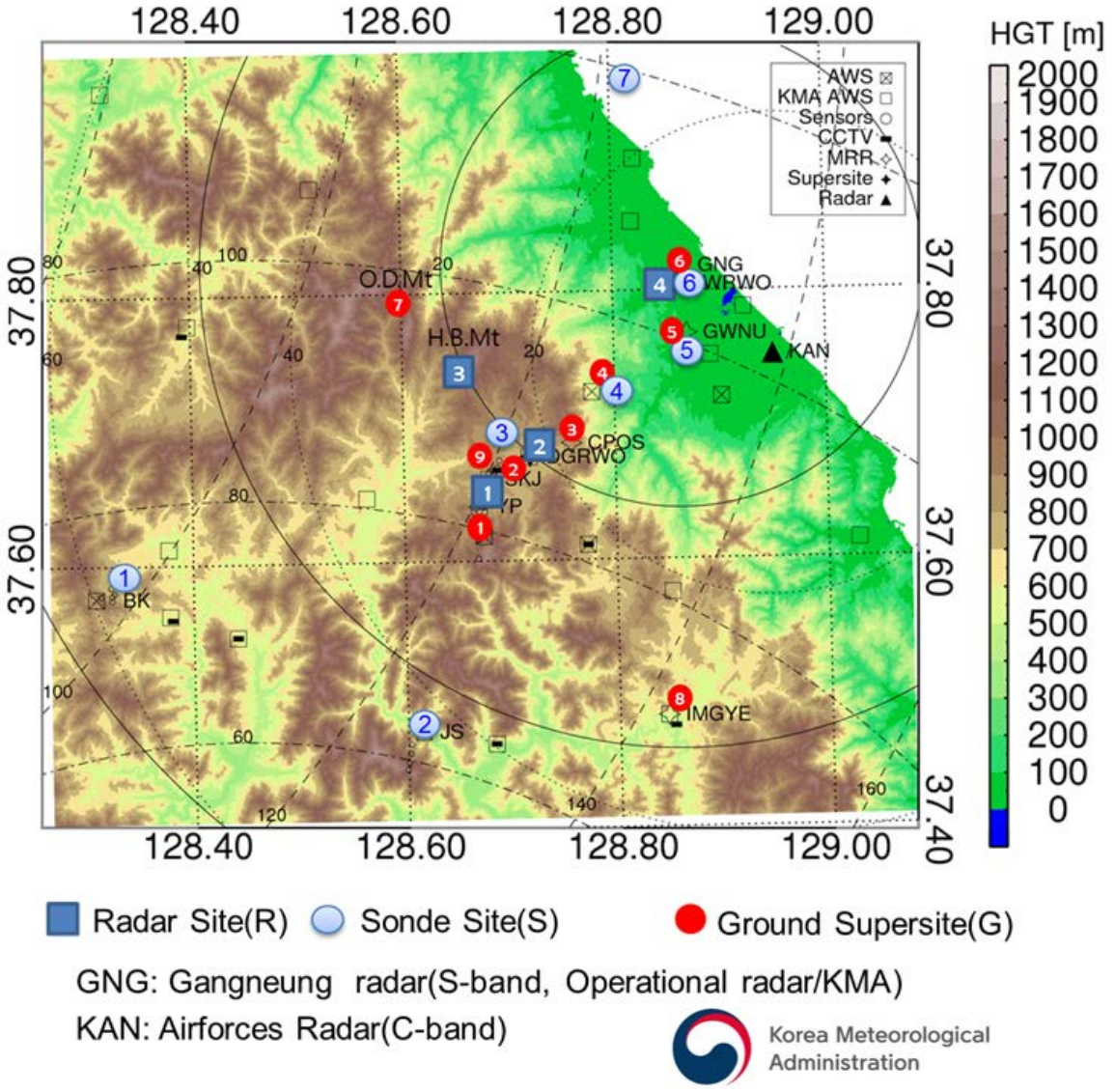
Overview of the ICE-POP observation campaign

From the project web-page:

"The goal of the ICE-POP 2018 is advancing seamless prediction from nowcasting to short-range forecast for winter weathers over complex terrains based on an intensive observation campaign."

- AWS network + additional AWS at sports venues
- Several supersites equipped with a set of different observational tools
- Radar network (operational radar + radars at supersites)

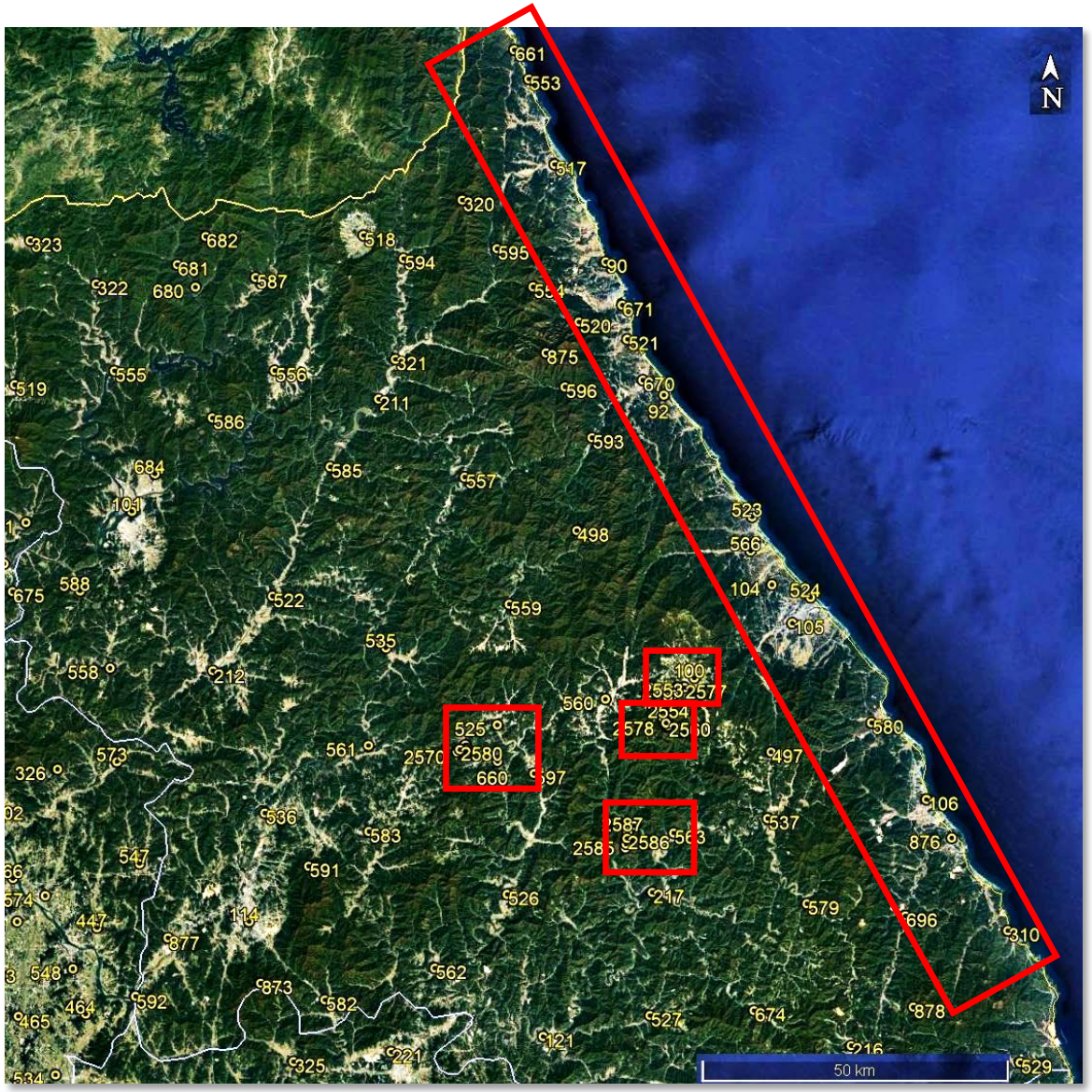
- Coastal cluster + 4 mountain clusters



AWS and clusters locations

Coastal cluster + 4 mountain clusters

In coastal cluster averaged distance between AWS is 10 km, it varies from 720 m to 23.2 km.

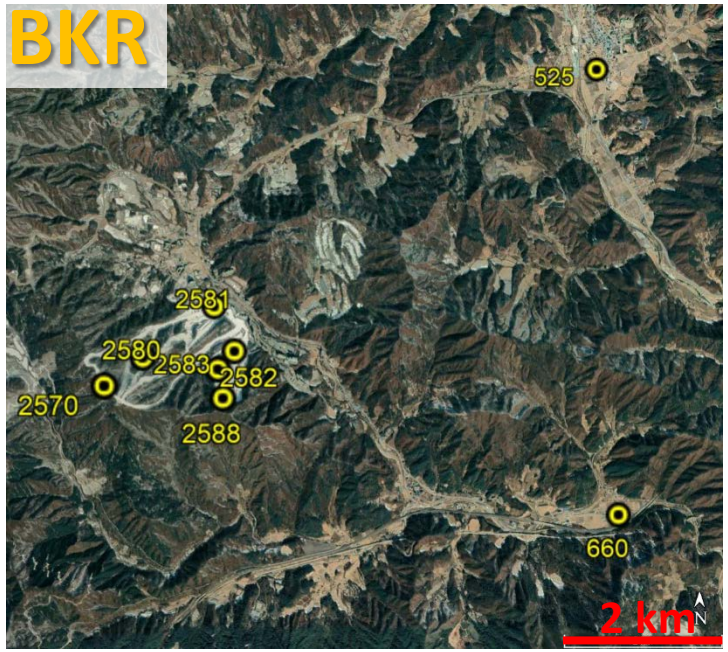


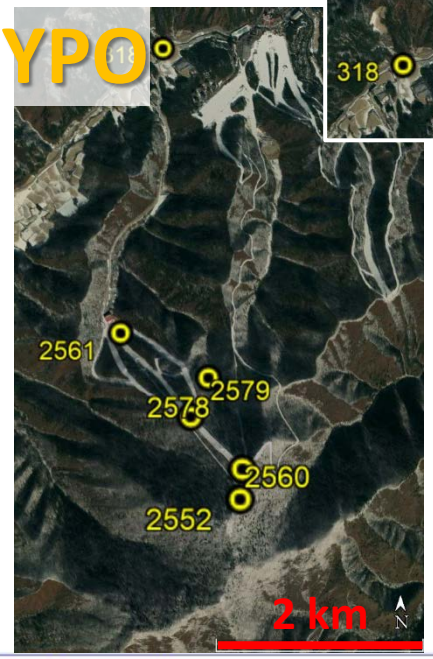
AWS at mountain clusters

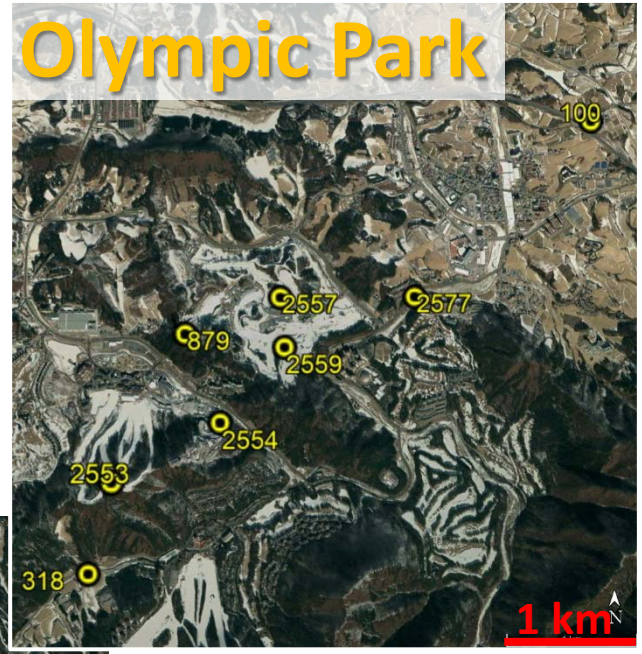
New AWS are located at sports venues at different altitude.

Distance between AWS within one cluster varies from 130 m to 3000 m.

Altitude difference is 200 m at OPk, ~500m for YPO and BKR, 980 m for JSC.

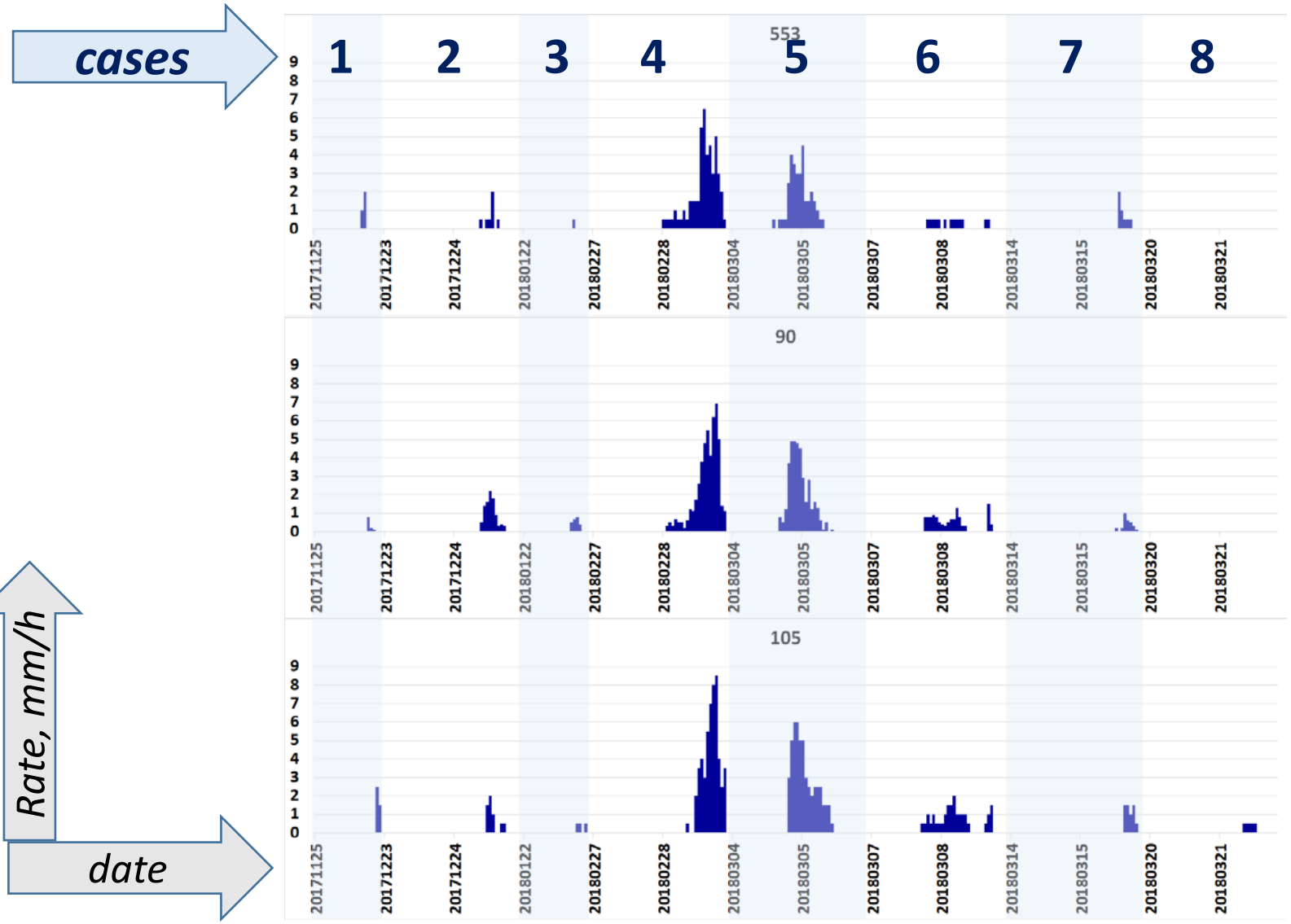






Several operational AWS are at a 5-6 km distance.

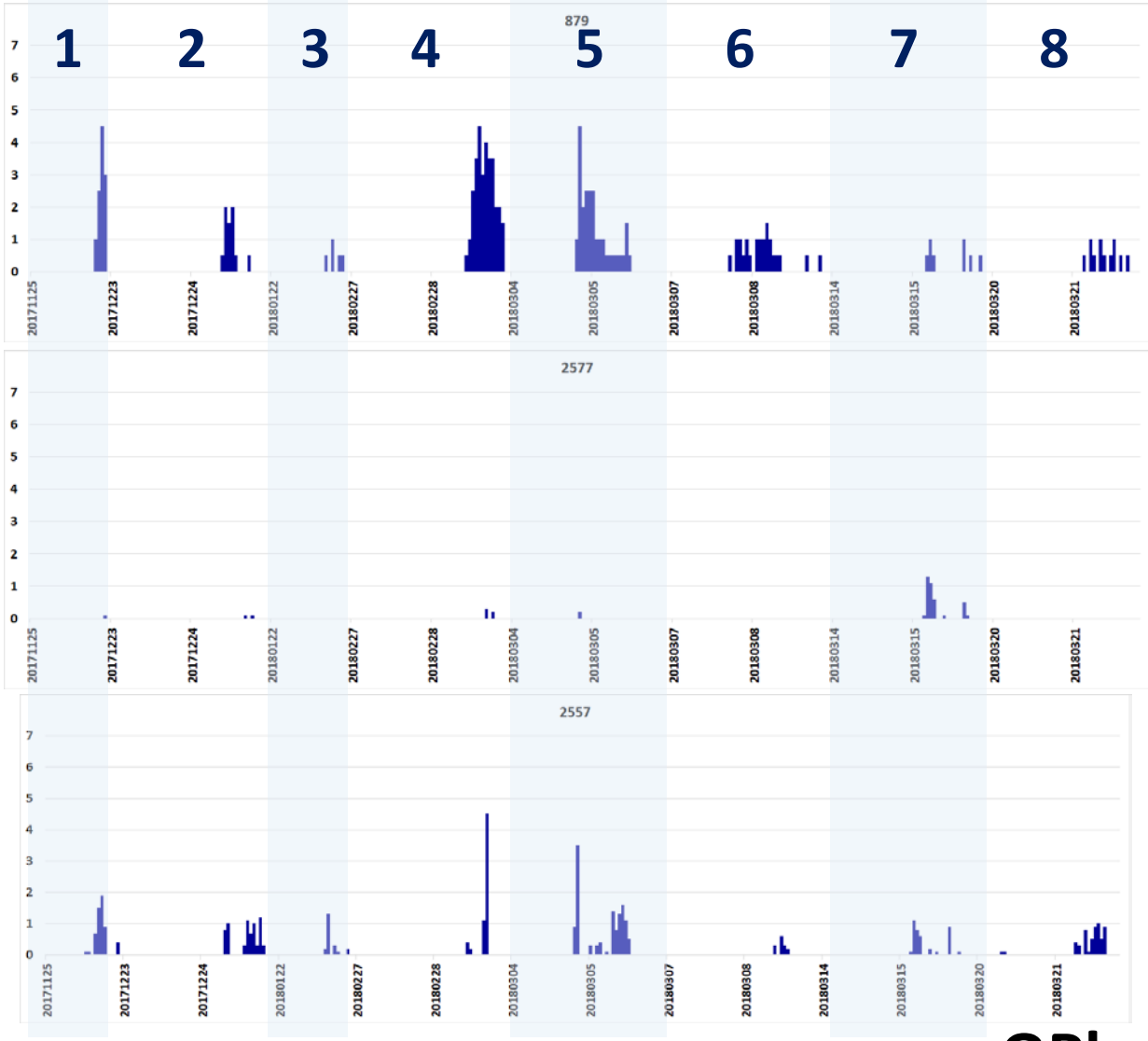
Time series of 1h accumulated precipitation for 8 precipitation events



At the coast precipitation rate and period vary slightly from station to station.

Time series of 1h accumulated precipitation for 8 precipitation events

At mountain clusters large difference in precipitation rate (and total amount) was noticed between neighbor AMS.

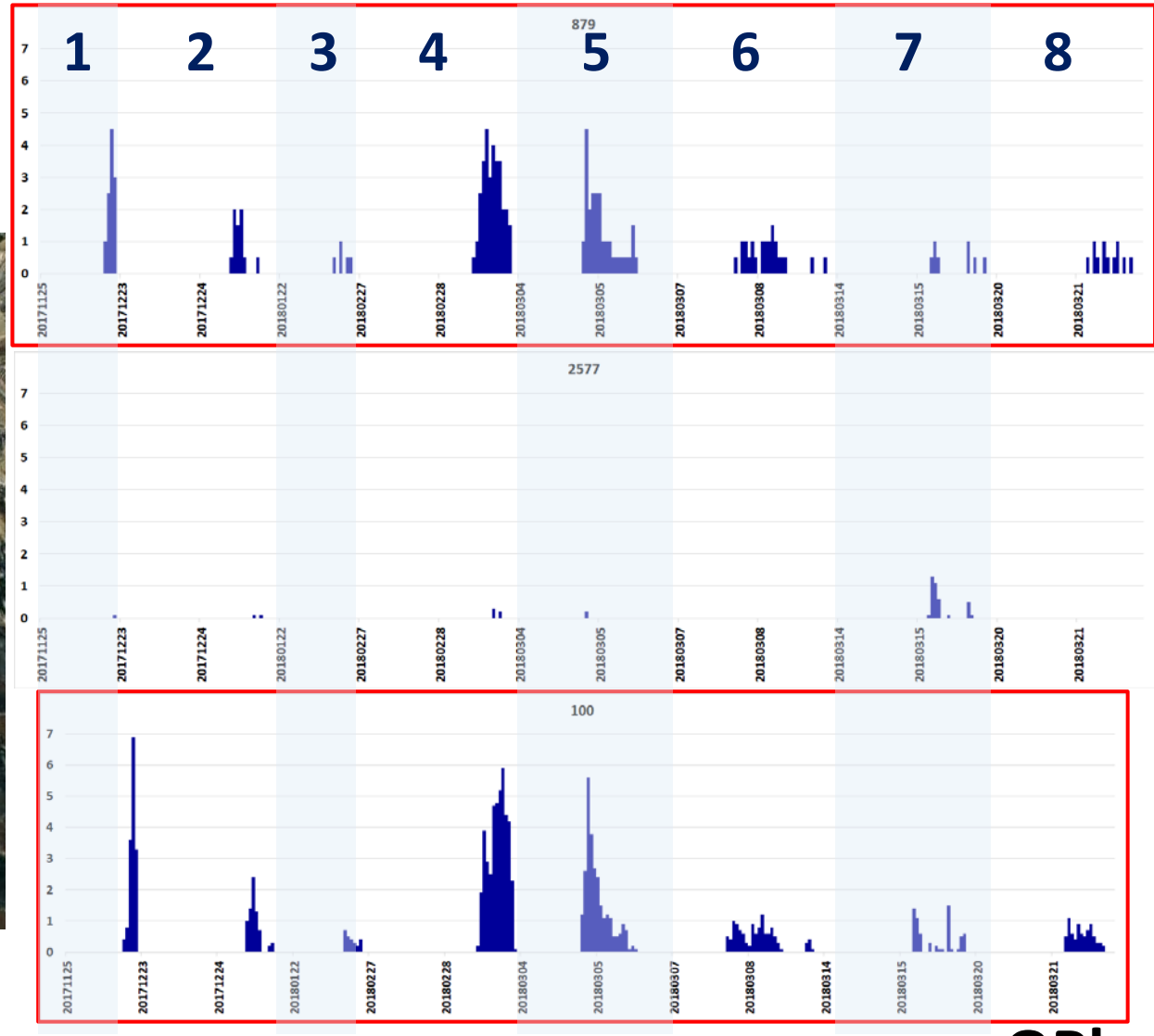


Time series for underlined # AWS are presented.

OPk

Time series of 1h accumulated precipitation for 8 precipitation events

Will it be useful to compare with the nearest operational AMS (data assumed to be reliable)?

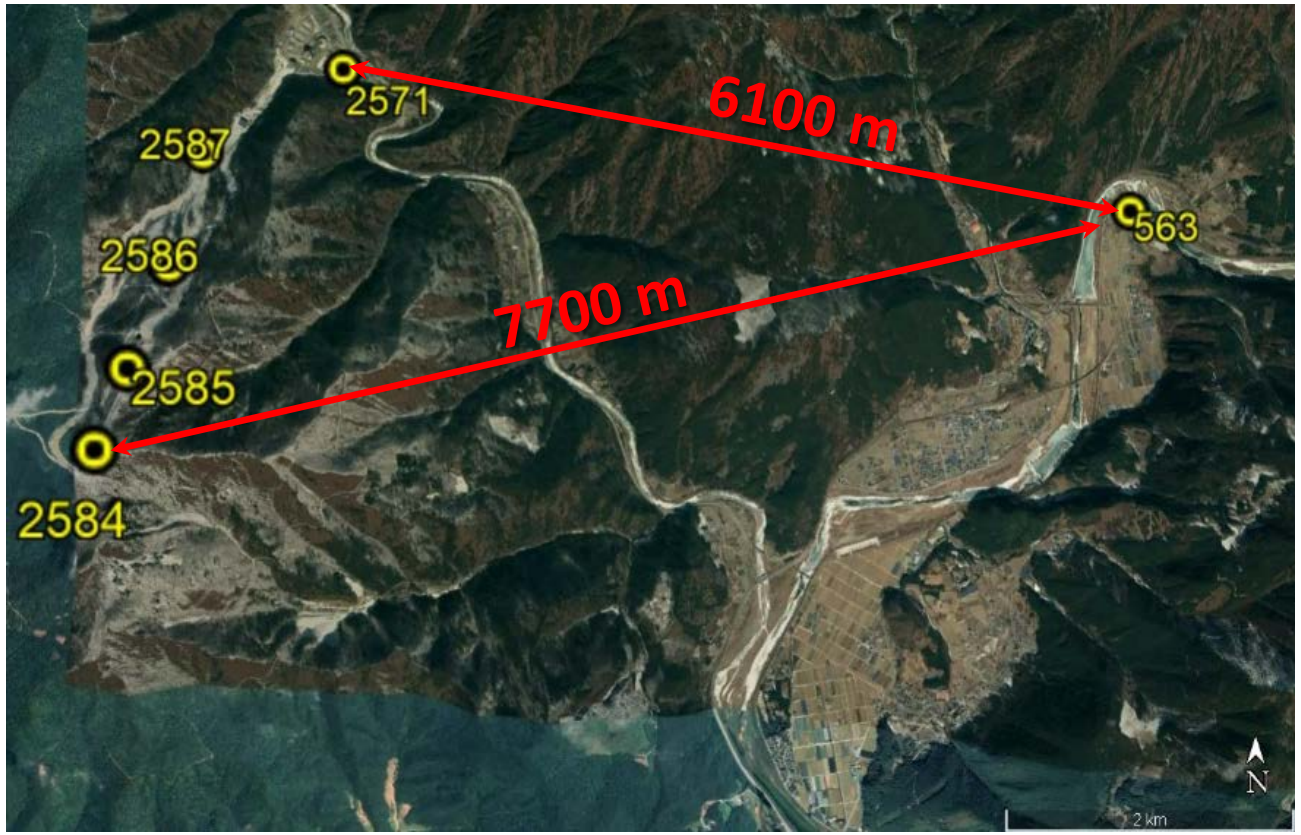


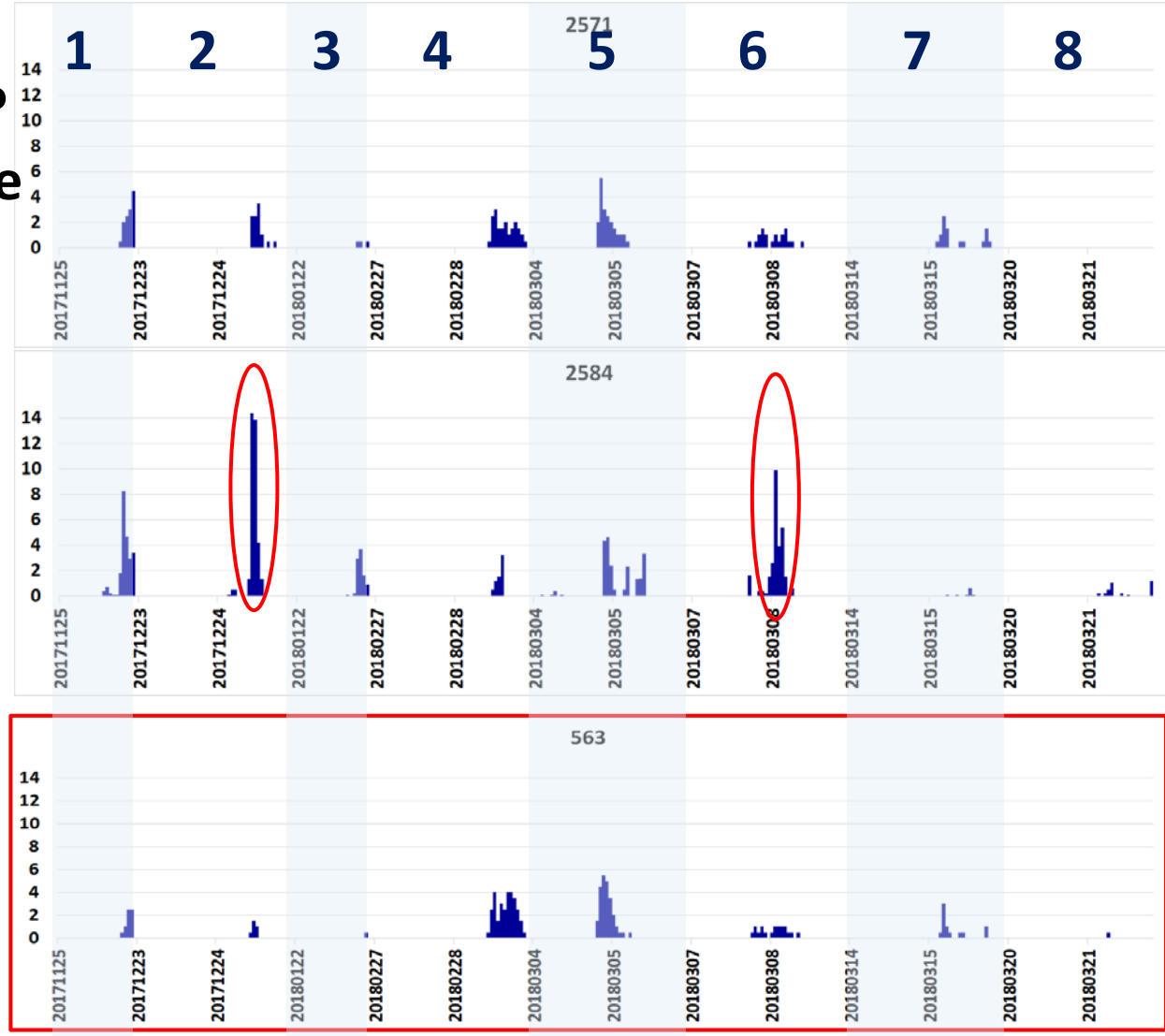
#879 (upper chart) and #100 (bottom chart) are long-running stations.

OPk

Time series of 1h accumulated precipitation for 8 precipitation events

Will it be useful to compare with the nearest operational AMS (data assumed to be reliable)? Should we filtered data or we may miss extreme value?





JSC

Model and observations comparison

Observations

- To define observational “cluster” whose area equivalent to the resolving scale of the model

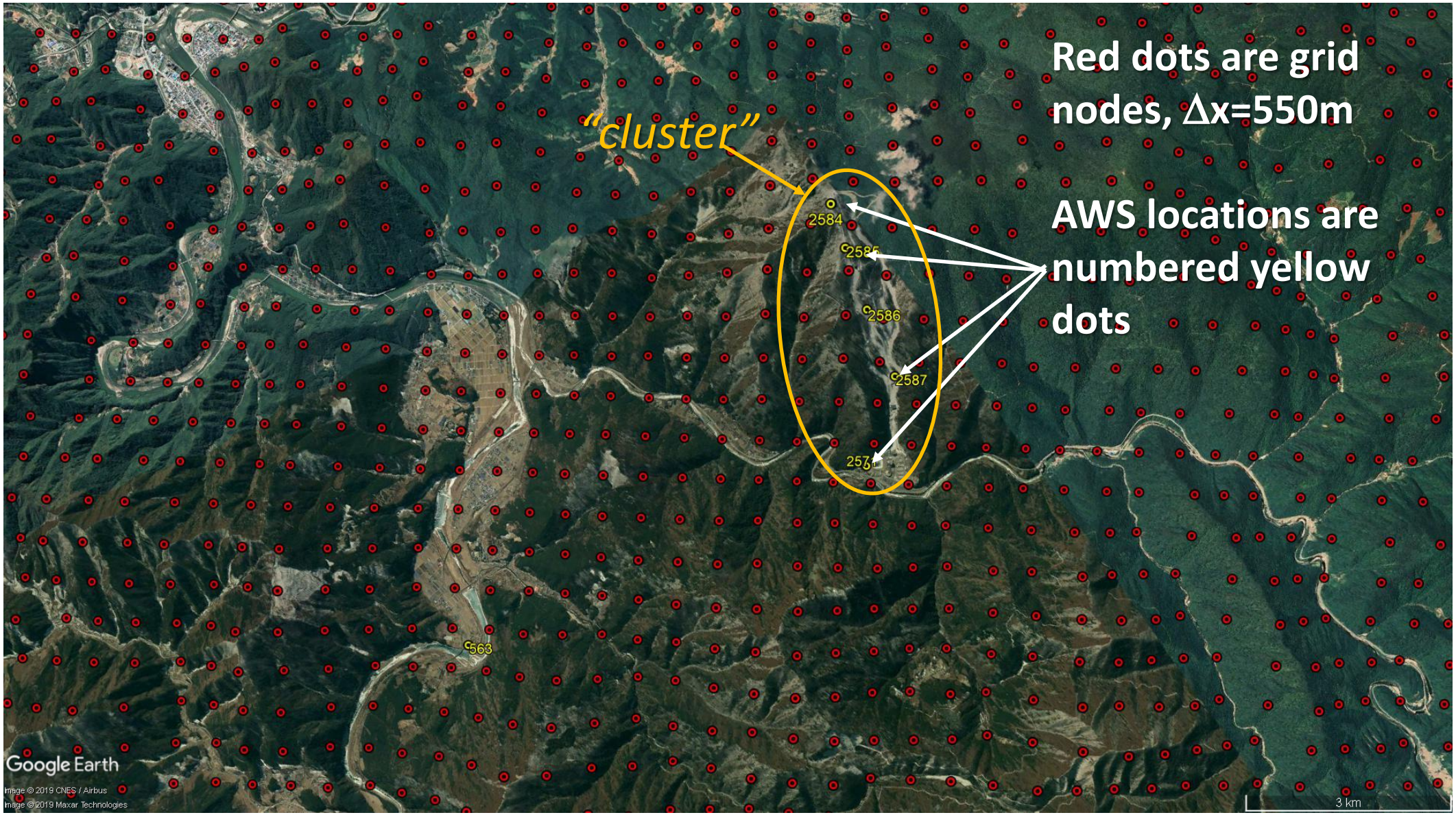
↓

  - to average data
  - to calculate range, σ and maximum
  - to filter data (?)

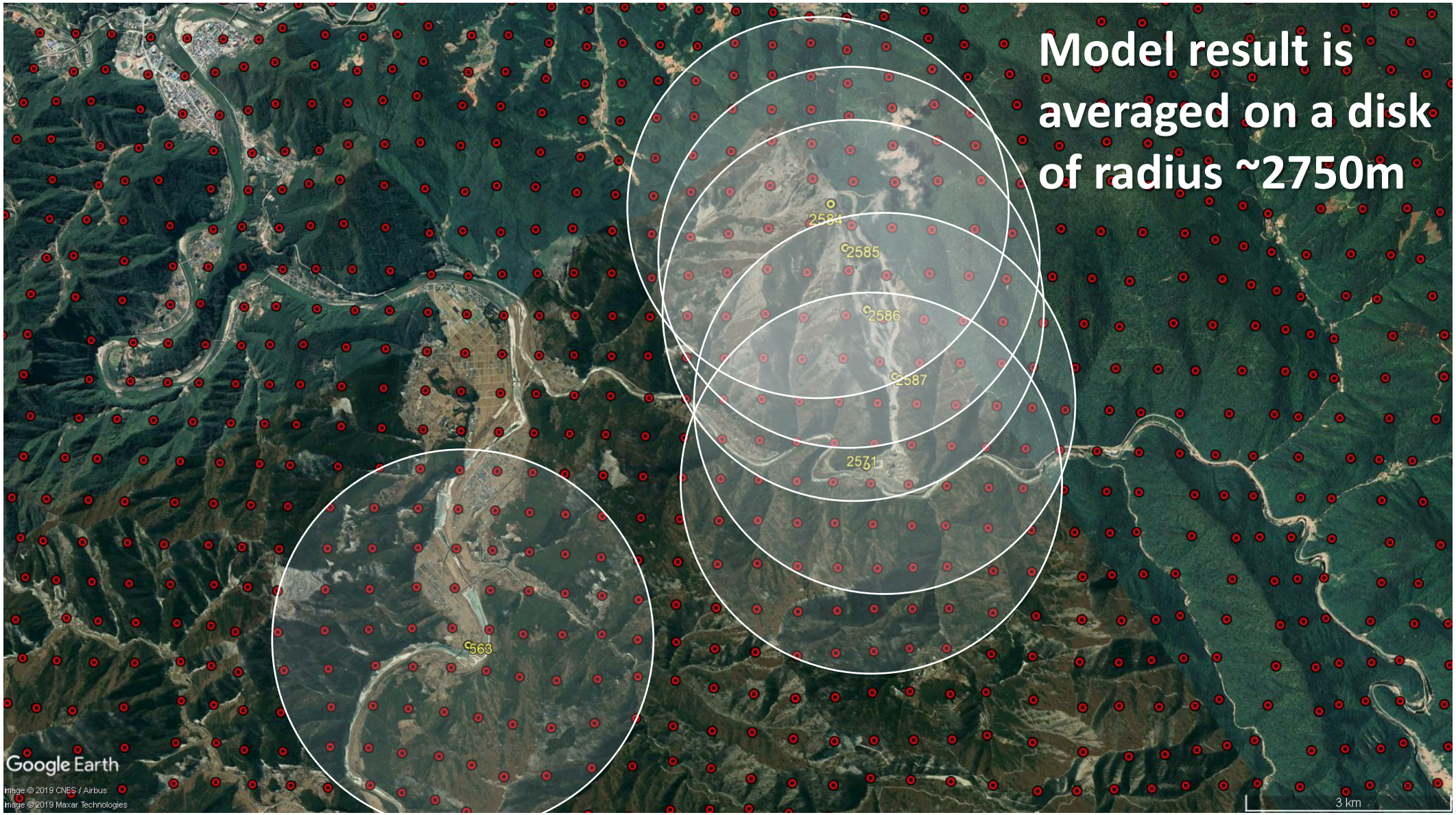
Model results

- (Nearest) Grid point value
- Mean value on a square (disk, etc.)
- Maximum value on a square (disk)

Model with 0.55 m grid spacing can resolve properly 5000-6000 m scale phenomena. We can analyze simulation results for the ***nearest grid points*** and ***averaged on a disk*** of radius of 2750 m.


Red dots are grid nodes, Δx=550m
"cluster"
AWS locations are numbered yellow dots
2584
2585
2586
2587
2574
563
Google Earth
Image © 2019 CNES / Airbus
Image © 2019 Maxar Technologies
3 km

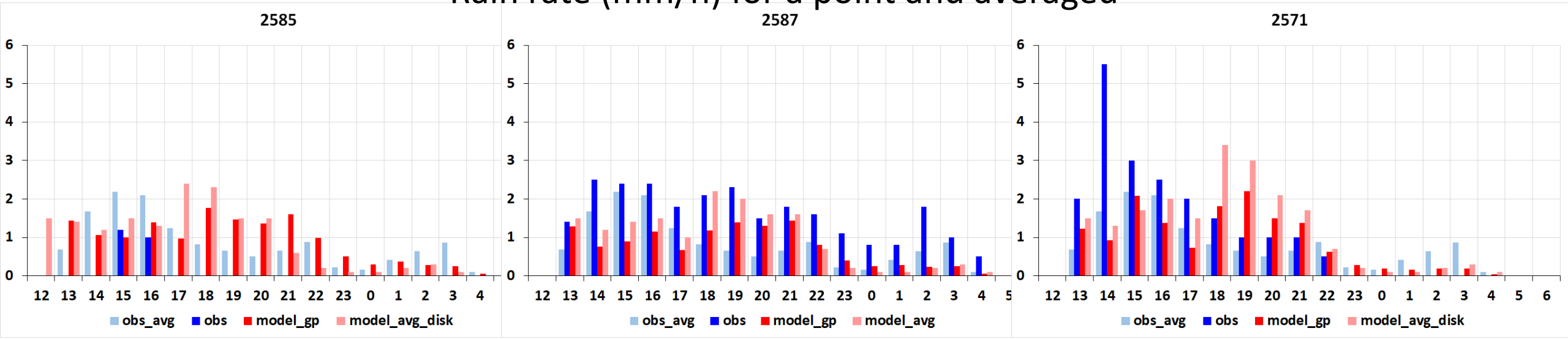
JSC


Model result is averaged on a disk of radius ~2750m
2584
2585
2586
2587
2571
563
Google Earth
Image © 2019 CNES / Airbus
Image © 2019 Maxar Technologies
3 km

JSC

Model and observations comparison

Rain rate (mm/h) for a point and averaged



Total accumulated precipitation (mm)

point	2584	2585	2586	2587	2571	Avg
Obs	20.6	2.2	0.4	25.8	20	**13.8**
Model_gp	16.7	14.8	13.3	12.3	14.9	**14.4**
Model_avg	18.0	16.2	14.4	15.7	19.9	**16.8**

averaged obs. for cluster

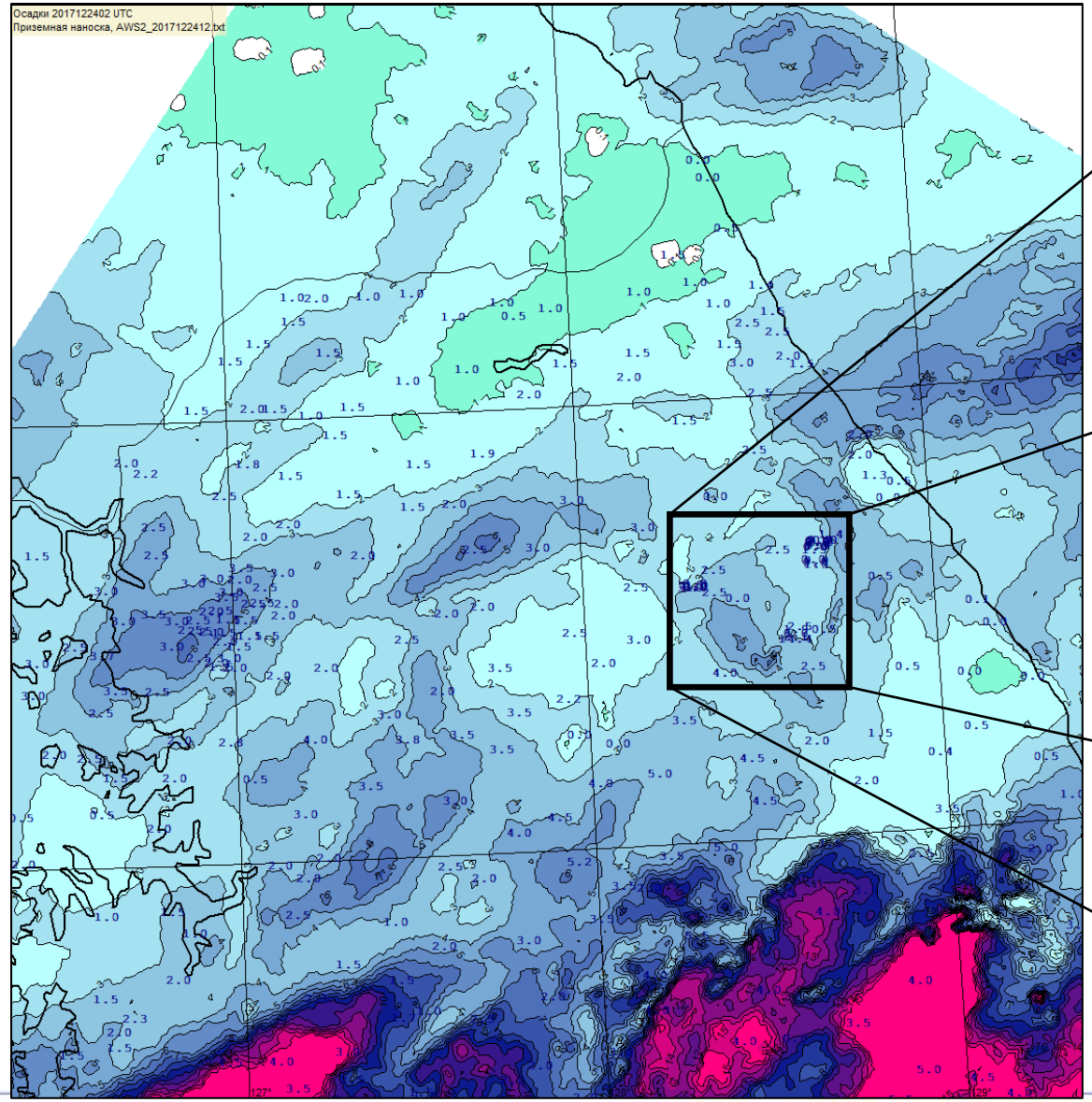
observations

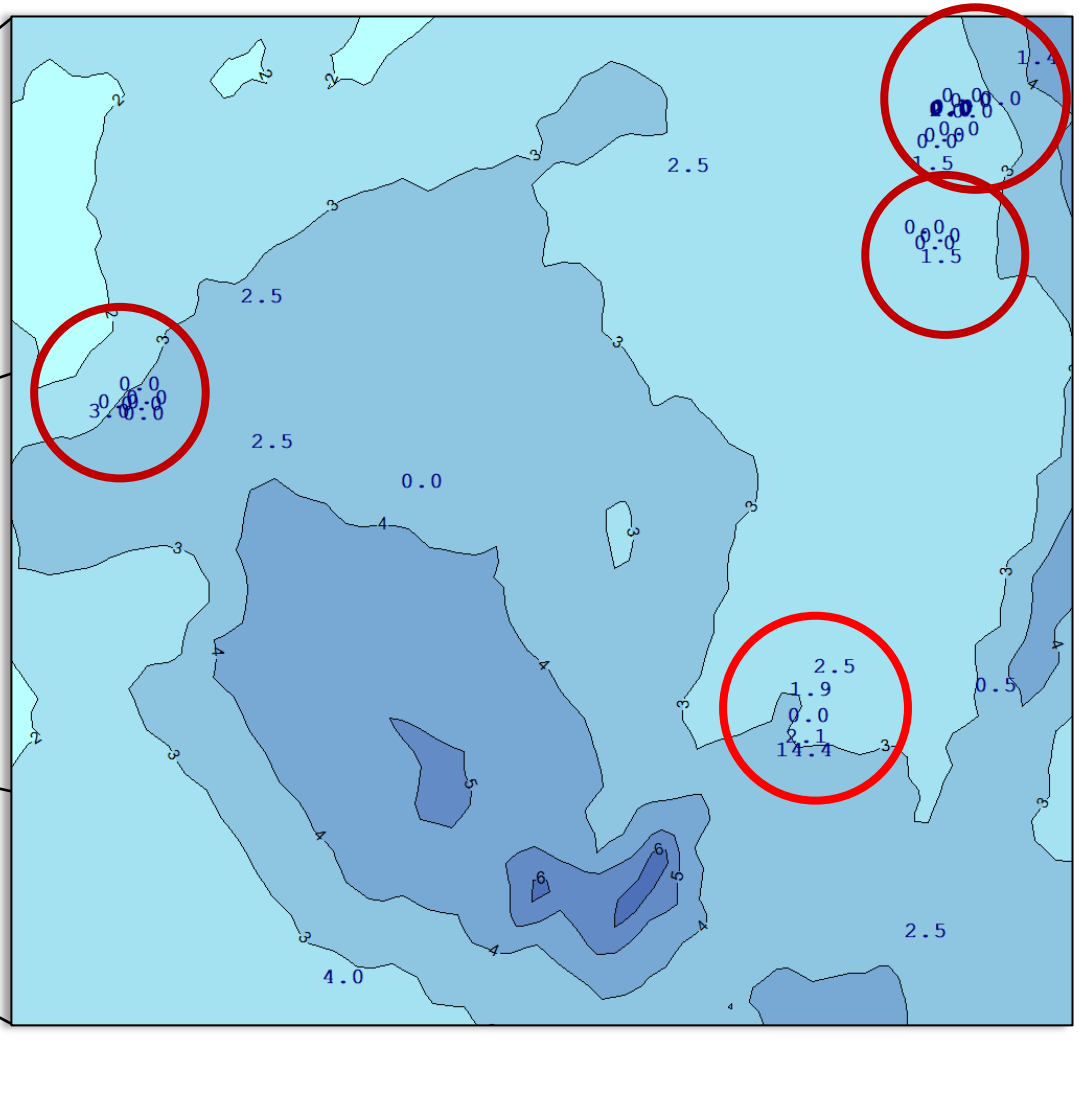
modeled for nearest grid point

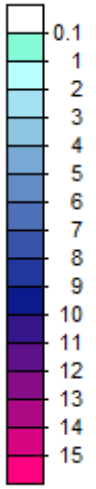
modeled averaged on disk

Radar data and ground observations comparison

24.12.2017, 02 UTC

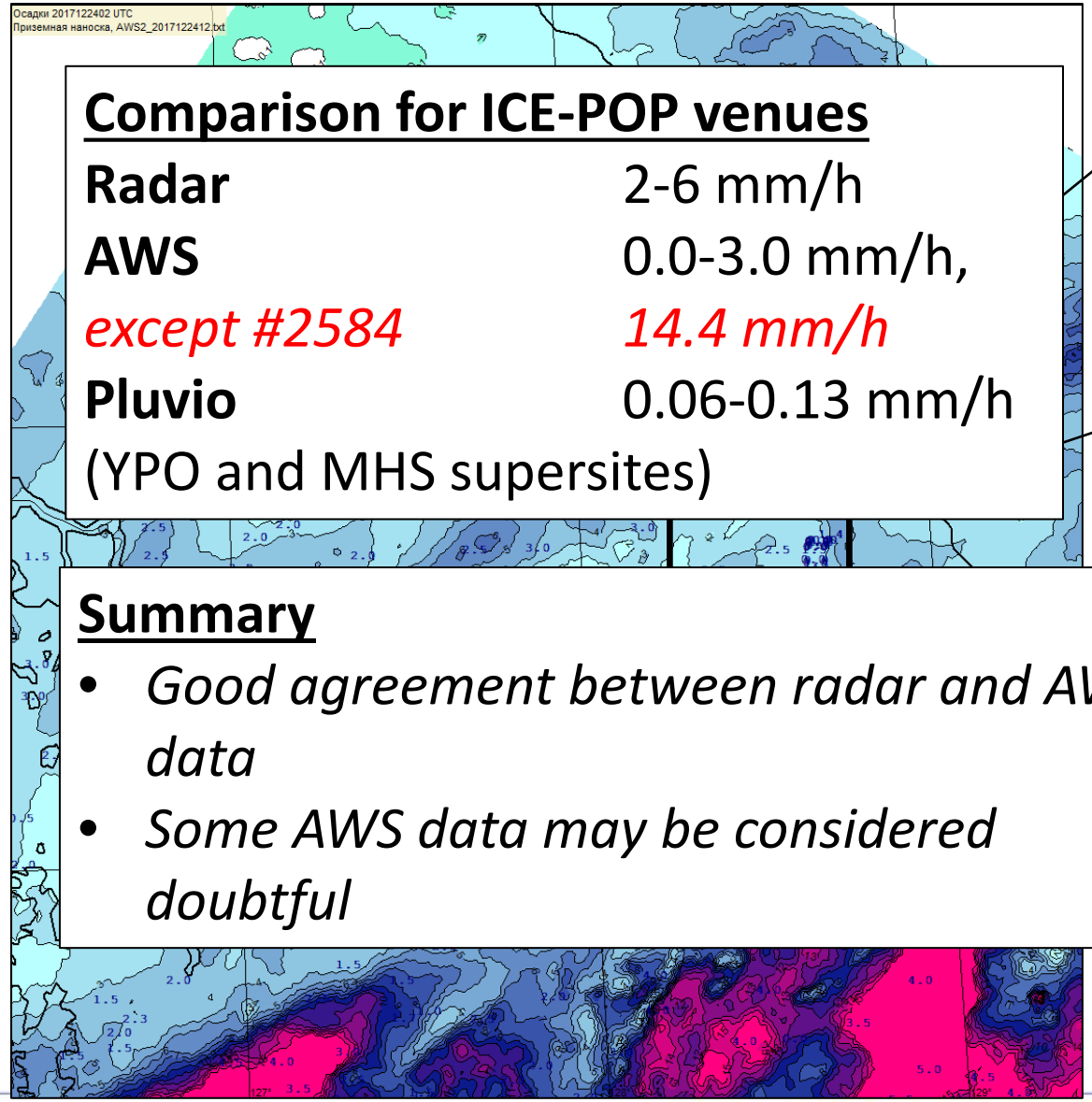






Radar data and ground observations comparison

24.12.2017, 02 UTC



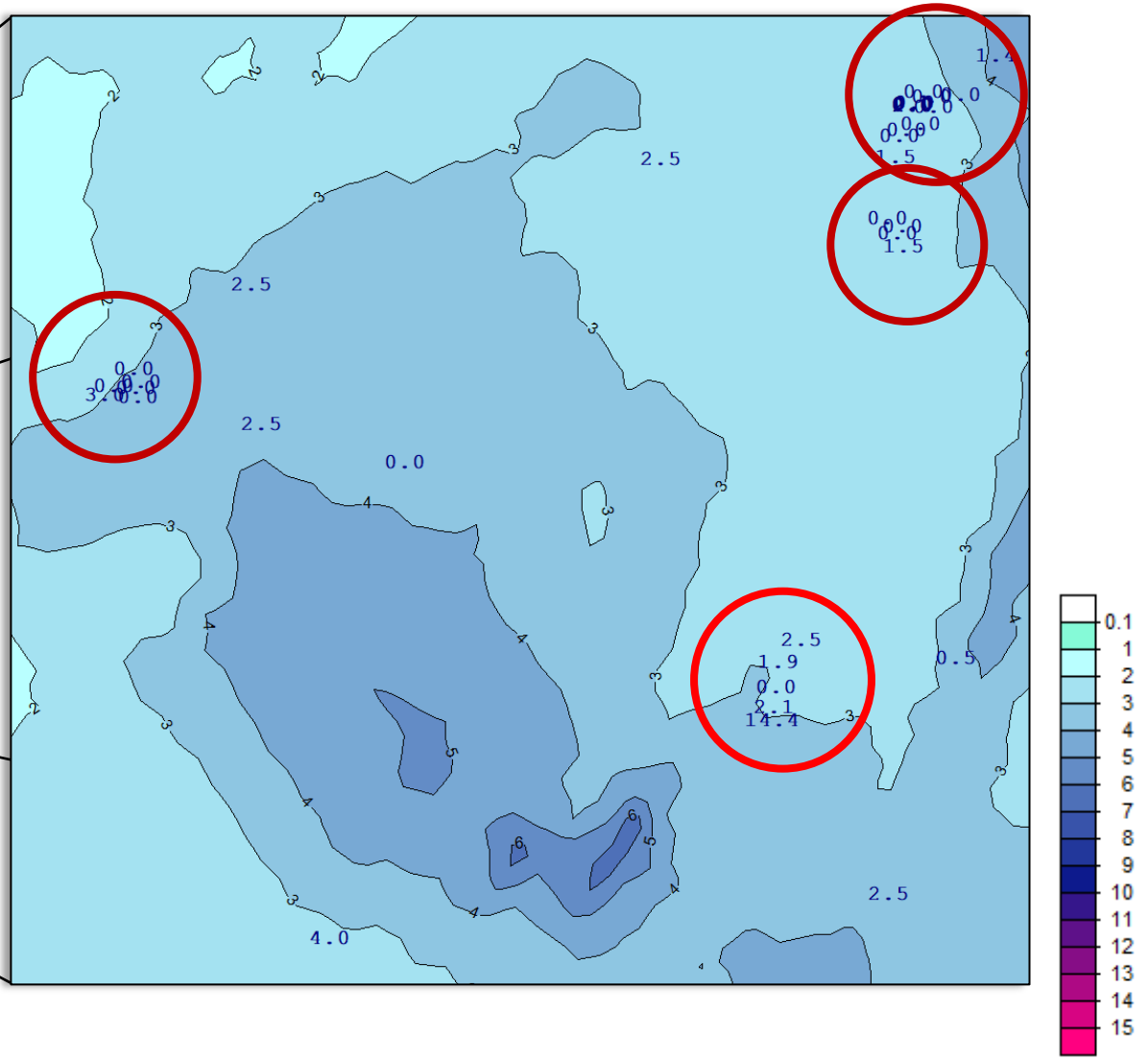
Comparison for ICE-POP venues

Radar	2-6 mm/h
AWS	0.0-3.0 mm/h,
except #2584	*14.4 mm/h*
Pluvio	0.06-0.13 mm/h

(YPO and MHS supersites)

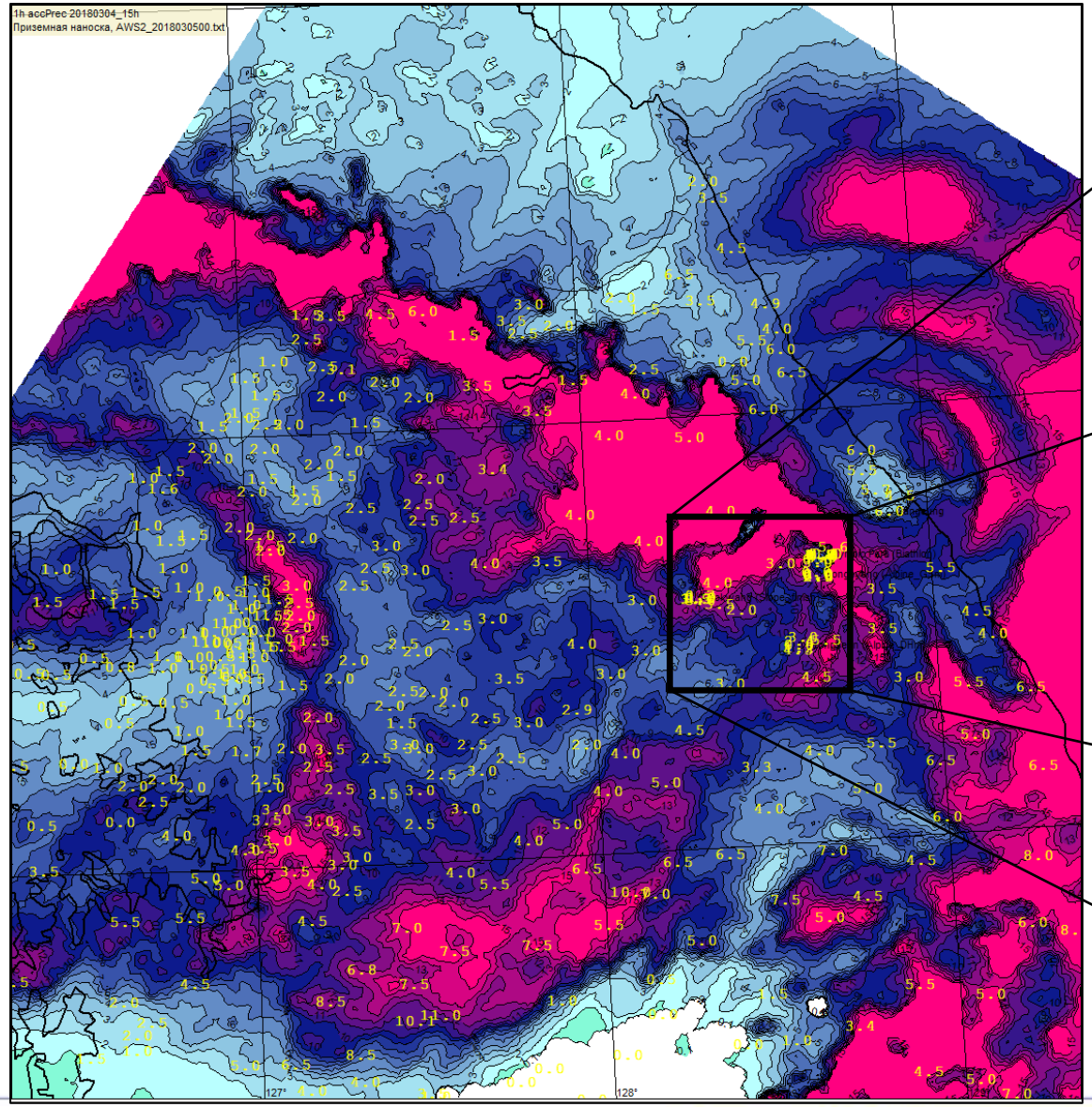
Summary

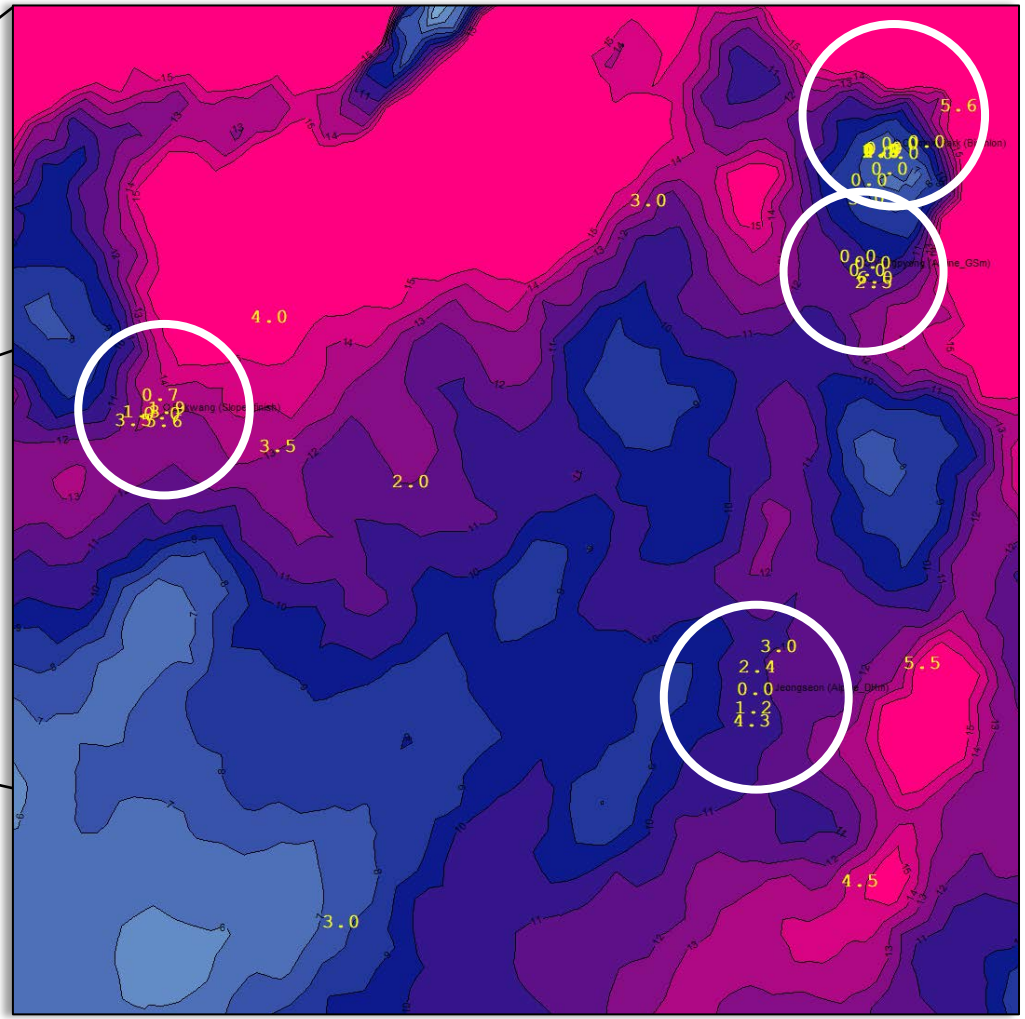
- *Good agreement between radar and AWS data*
- *Some AWS data may be considered doubtful*

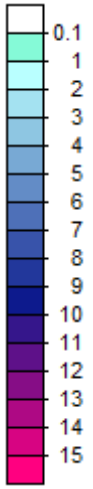


Radar data and ground observations comparison

04.03.2018, 15 UTC

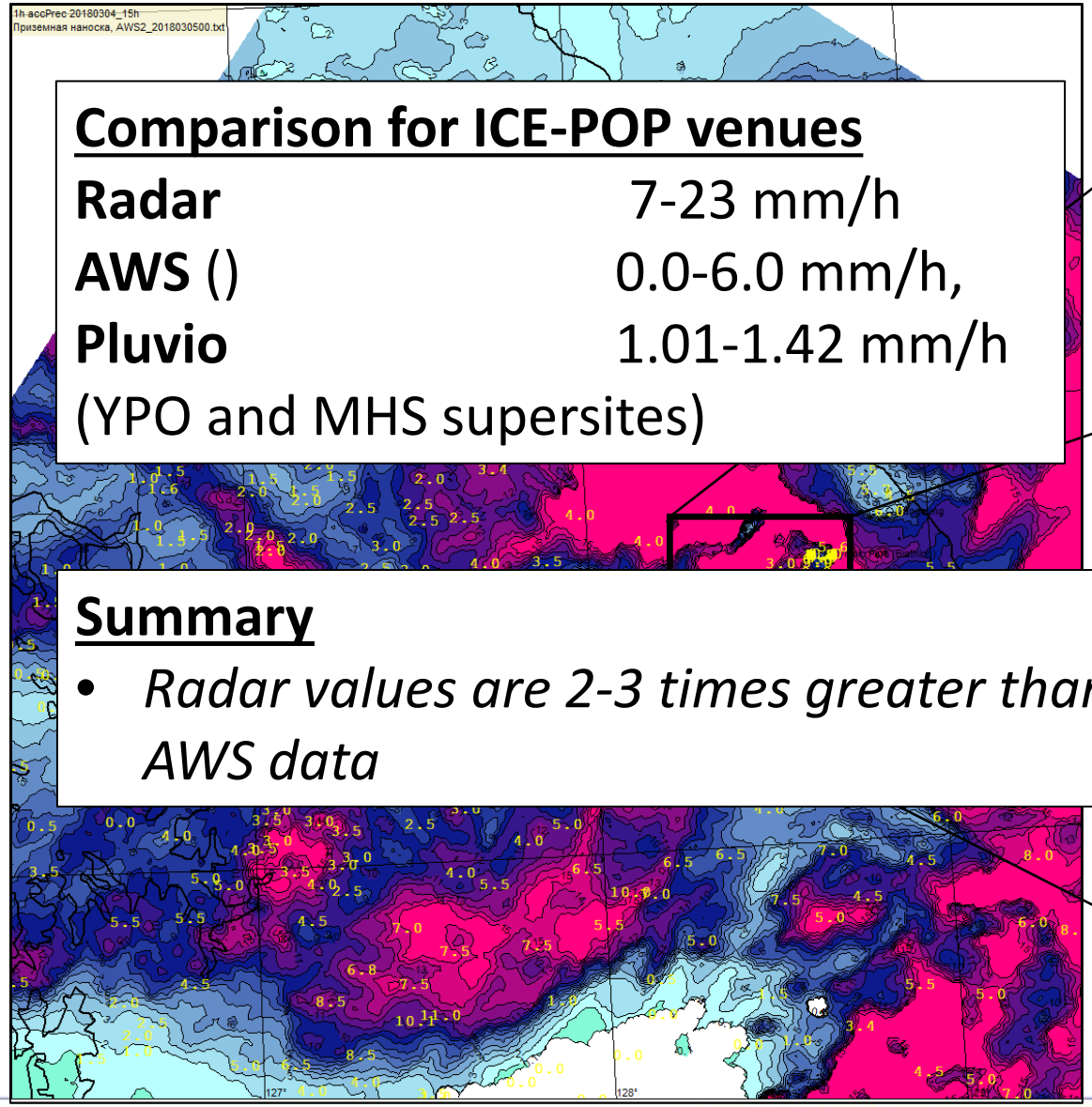






Radar data and ground observations comparison

04.03.2018, 15 UTC



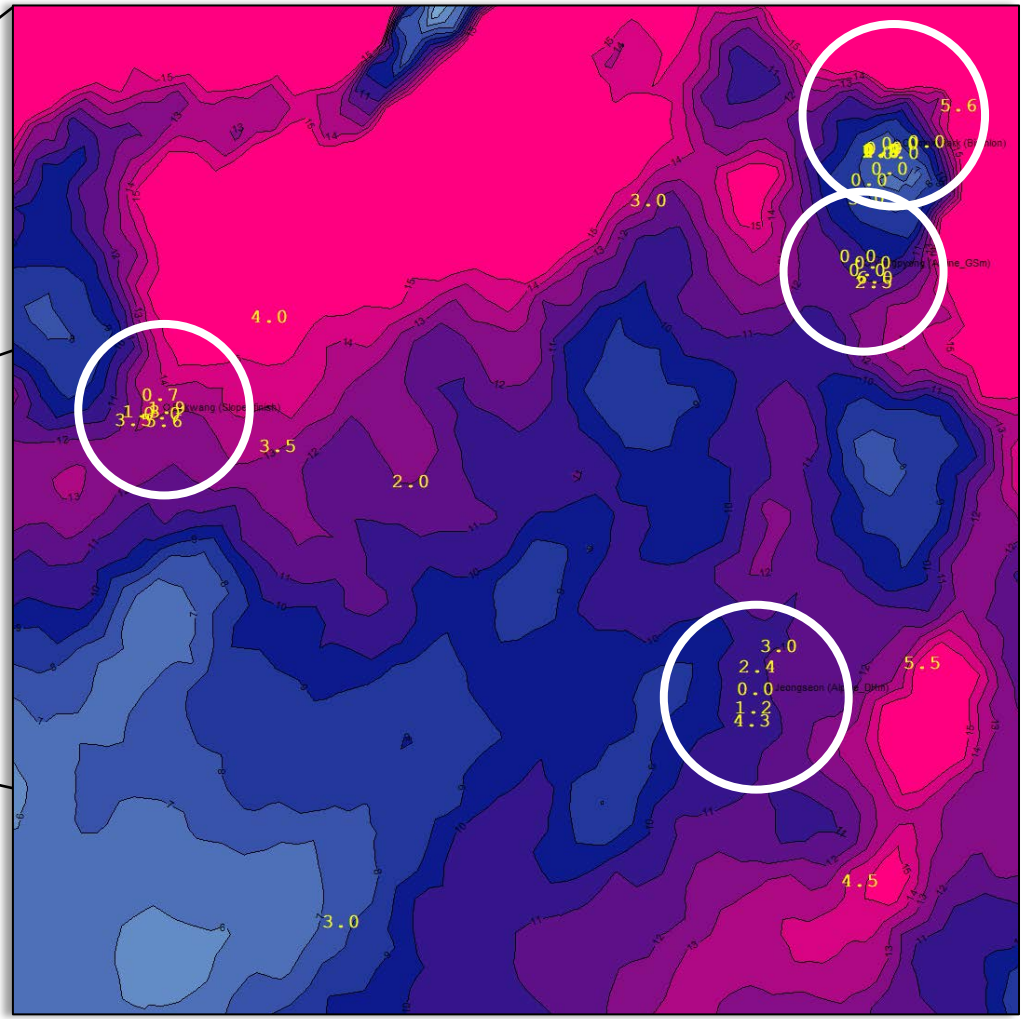
Comparison for ICE-POP venues

Radar	7-23 mm/h
AWS ()	0.0-6.0 mm/h,
Pluvio	1.01-1.42 mm/h

(YPO and MHS supersites)

Summary

- *Radar values are 2-3 times greater than AWS data*



Conclusions

- No one observations could be considered as “truth”
- For the observations within one “cluster” mean and dispersion should be calculated. Data filter could be applied if needed.
- “Cluster” area should be equivalent to the resolving scale of the model
- Radar data (precipitation amount) should be evaluate against ground observations for the various weather conditions (say nothing about the intercomparison of the ground observations of different type)
- Since precipitation is a derived radar product it makes sense to assess radar reflectivity (base product)

Thank you for your attention!

Mean rain rate (mm/1h) over cluster during Snow events

	Events	coast	OlympicPark	YPO	JSC	BKR
1	25.11.17	0.9	1.5	1.1	1.6	**1.8**
2	24.12.17	1.1	0.8	0.5	**1.7**	0.9
3	22.01.18	0.5	0.5	0.6	**0.8**	0.6
4	28.03.18	**2.0**	1.2	0.8	1.0	1.0
5	4-5.03.18	**2.6**	1.5	1.8	1.8	1.6
6	7-8.03.18	0.7	0.6	0.5	**1.1**	0.8
7	15-16.03.18	0.7	0.6	0.8	0.5	**1.7**
8	21.03.18	0.6	0.5	0.6	0.5	0.1

Maximum 1h precipitation sum over cluster during Snow events

	Events	coast	OlympicPark	YPO	JSC	BKR
1	25.11.17	2.5	6.9	6.5	**8.3**	6.5
2	24.12.17	3.0	2.5	3.0	**14.4**	3.0
3	22.01.18	1.0	1.3	1.0	**3.7**	1.7
4	28.03.18	**8.5**	5.9	2.5	4.2	7.0
5	4-5.03.18	6.5	5.6	**9.3**	5.5	5.6
6	7-8.03.18	2.5	1.7	1.5	**9.9**	2.5
7	15-16.03.18	2.0	2.6	2.0	3.0	**8.5**
8	21.03.18	**1.5**	1.1	1.0	1.2	0.1