Observation of the Atmospheric Data in Steep Mountain Region Using UAV and Doppler-Lidar

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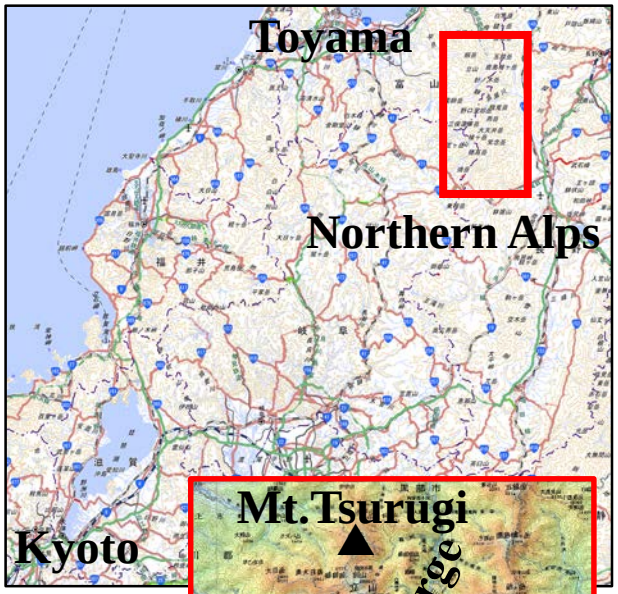
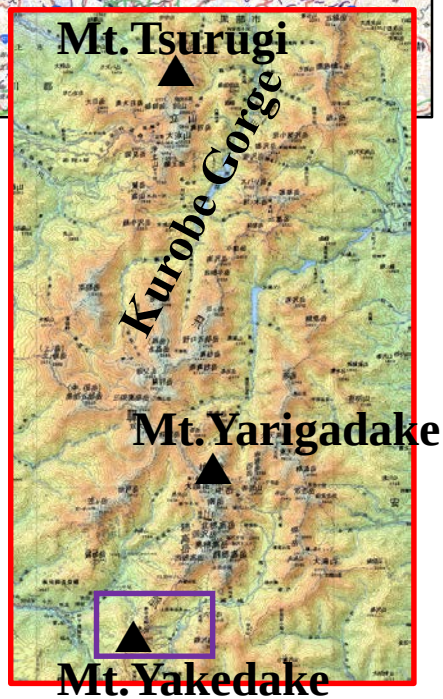
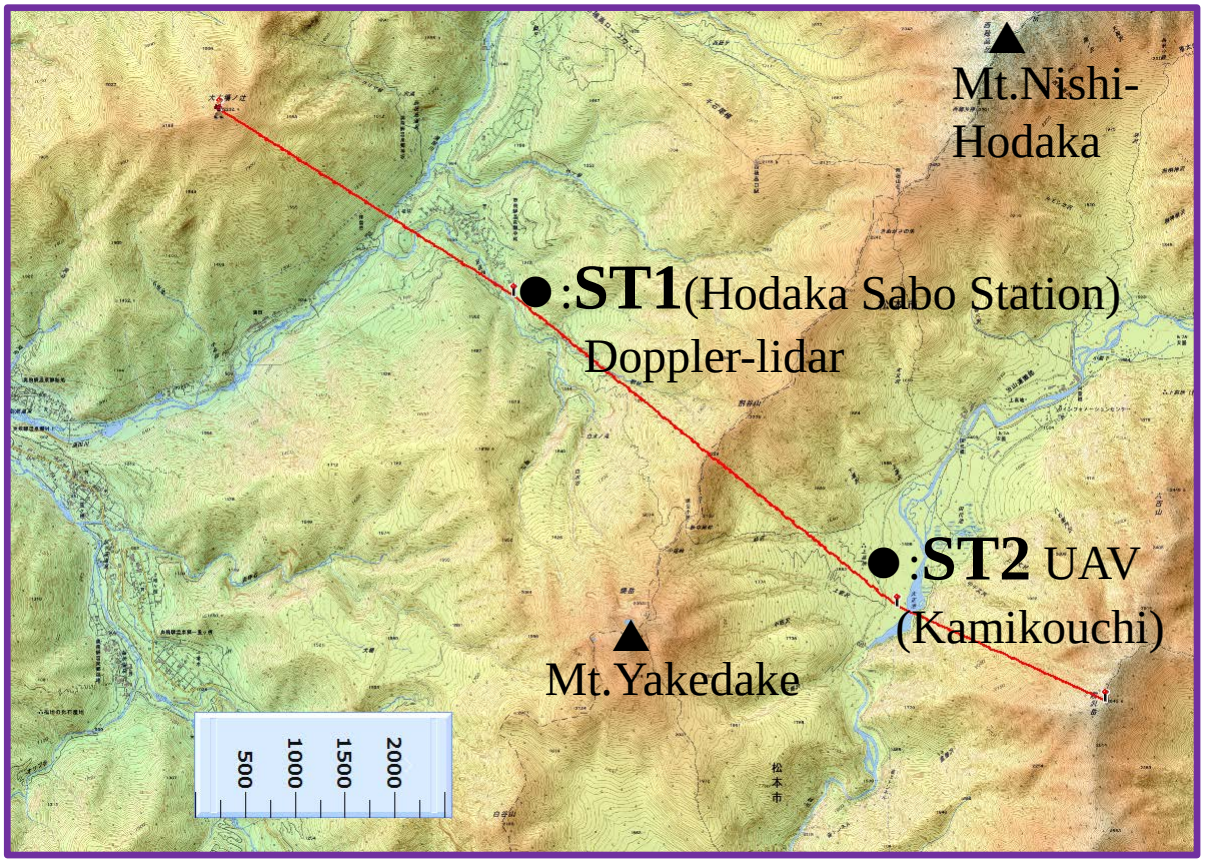
Key words of the research

- 山岳地域・急峻な地形
  (Mountain region, Steep topography)
- 風・気温・降水・浮遊物等の総合的な気象観測
  (Wind, Temperature, Rainfall, Suspended materials)
- リモートセンシング（遠隔観測）
  (Remote sensing)
- ドップラーライダー
  (Doppler lidar)
- UAV
  (Unmanned Aerial Vehicle)

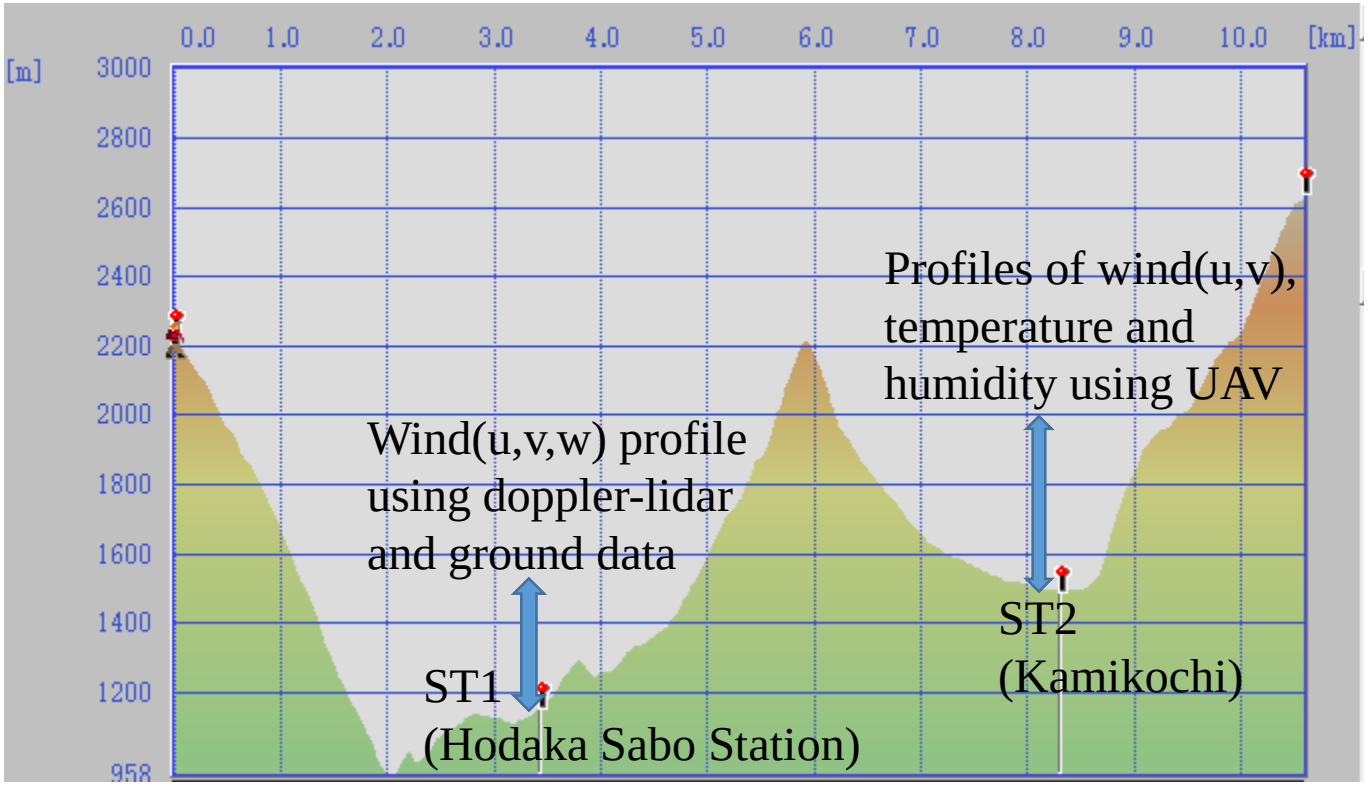
Research area and observation sites







Steep topography around the research area



UAV and Compact weather sensor (ST2)

Specification of UAV

Model	SPIDER CS-6　(ルーチェサーチ(株))
Weight	約3800g
Dimensions	950×950×400 mm
Max wind speed resistance	約15m/s
Max flight time	約25分（搭載重量による）
Max takeoff weight	約4000g

Specification of CWS

Model	WXT520　(Vaisala)
Weight	650g
Dimensions	Φ115mm×H238mm
Element	Wind speed Wind direction (U,V), Temperature, Relative humidity

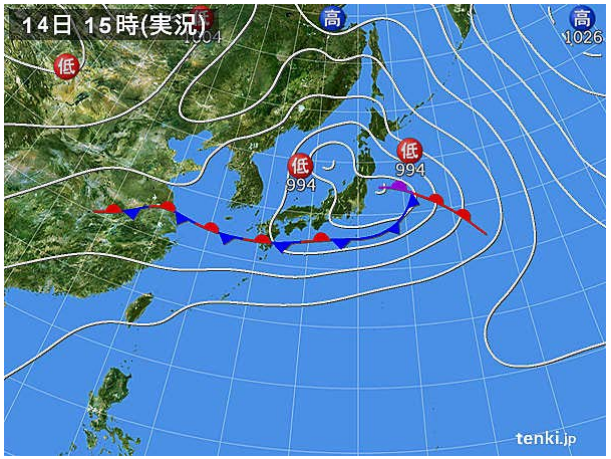
Doppler lidar (ST1)

Example of observed data (wind profile every 6sec.)

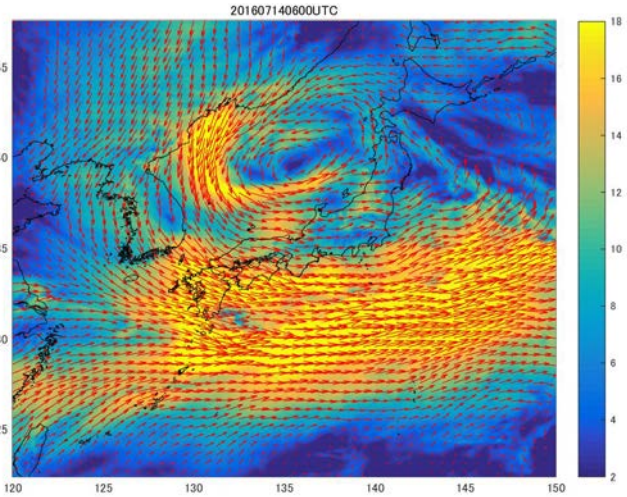
Range	data_num	h(m)	U(m/s)	V(m/s)	W(m/s)	Vel(m/s)	Dir(deg)
0	15	29.544	−3.232	0.91	−0.904	3.357	105.729
1	15	59.088	2.338	−0.947	−0.505	2.522	292.041
2	15	88.633	−0.295	0.254	−0.542	0.39	130.753
3	15	118.177	0.633	−0.057	−0.478	0.635	275.138
4	15	147.721	0.246	0.769	−0.719	0.807	197.76
5	15	177.265	−1.749	0.523	−0.634	1.825	106.639
6	15	206.81	−1.434	−0.024	−0.467	1.434	89.03
7	15	236.354	−1.026	0.712	−0.502	1.249	124.742
8	15	265.898	0.267	0.325	−0.529	0.42	219.428
9	15	295.442	−0.08	0.351	−0.562	0.36	167.206
10	15	324.987	0.057	1.178	−0.714	1.179	182.789
11	15	354.531	0.2	0.782	−0.826	0.807	194.329
12	15	384.075	0.199	1.019	−0.743	1.038	191.056
13	15	413.619	−0.075	1.345	−0.606	1.347	176.814
14	15	443.163	3.075	−1.752	−0.639	3.539	299.669
15	14	472.708	4.603	−1.629	−0.374	4.883	289.491
16	15	502.252	2.939	−0.06	−0.454	2.94	271.173
17	14	531.796	1.919	−1.799	0.028	2.63	313.157
18	14	561.34	−0.341	−0.085	0.186	0.351	76.017
19	15	590.885	1.546	0.169	−0.066	1.555	263.773

Meteorological condition

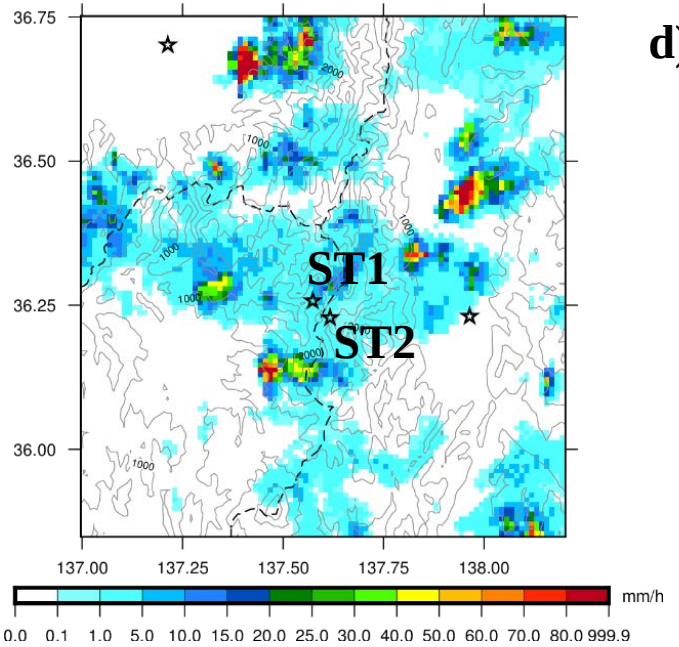
a)



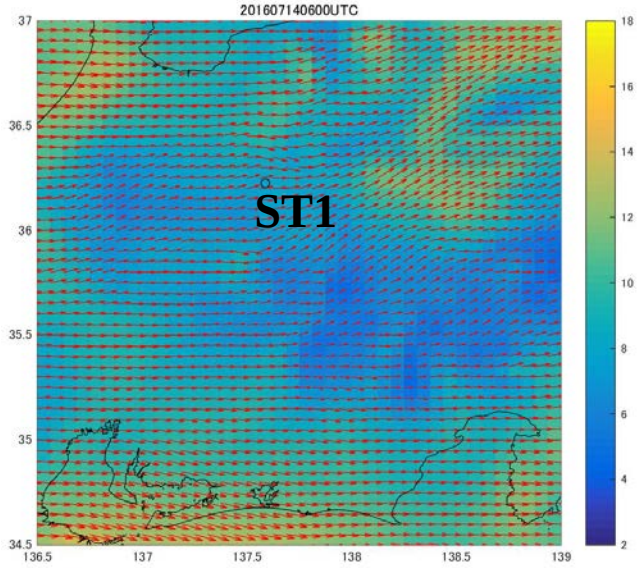
b)



c)



d)



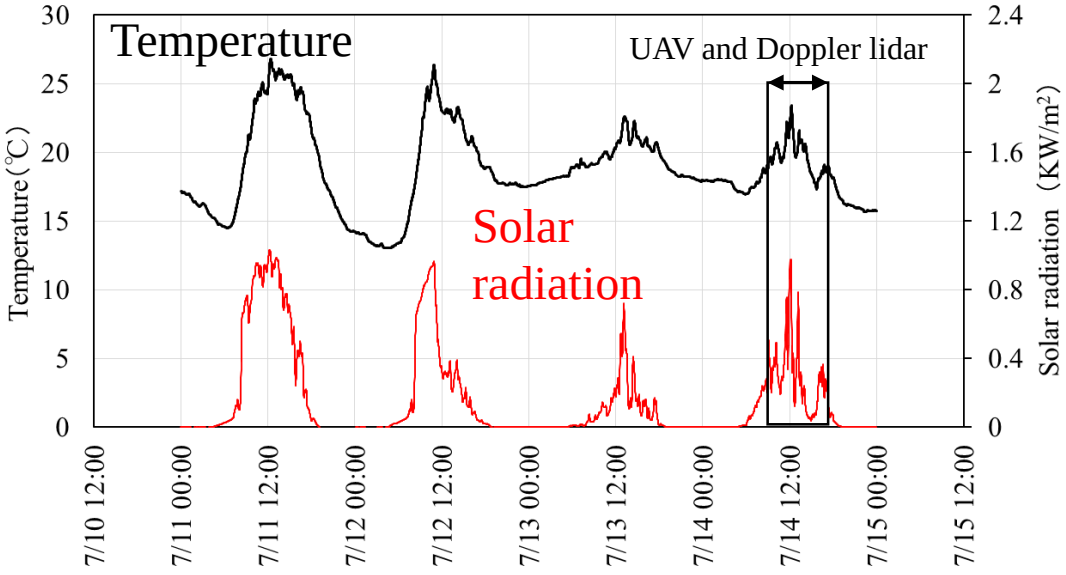
1500JST July 14, 2016

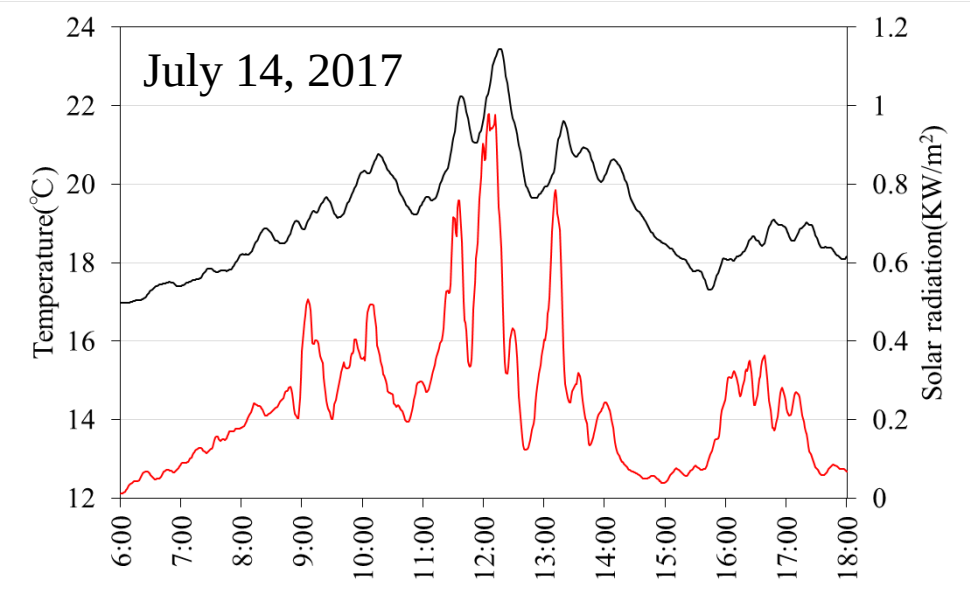
a) Weather chart

b),d) Wind speed(m/s) at 800hPa by Hourly atmospheric analyzed GPV(Japan, Tyubu)

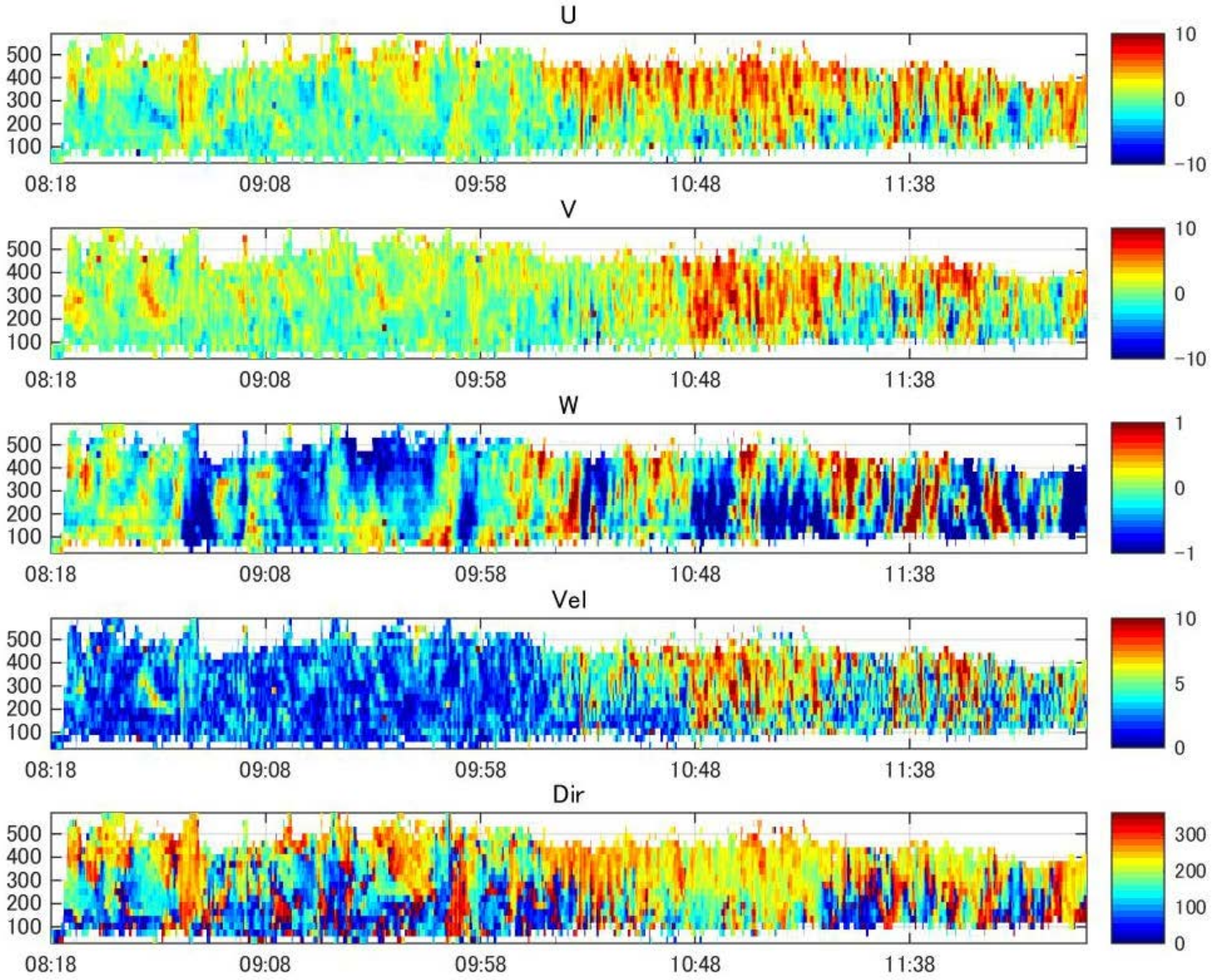
c) Radar rainfall(mm/h)

Ground data at ST1





Observation results: Wind profile at ST1



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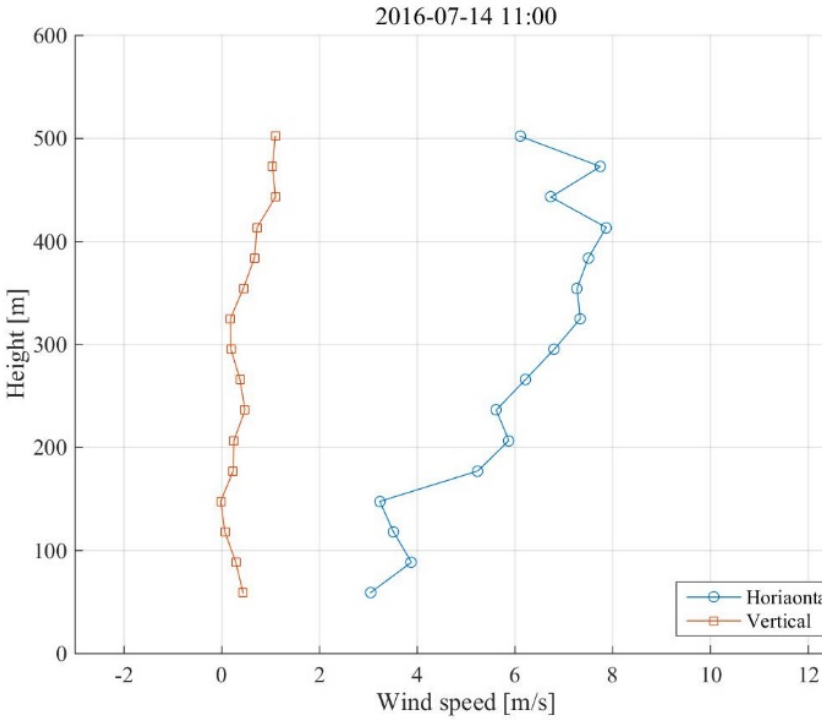
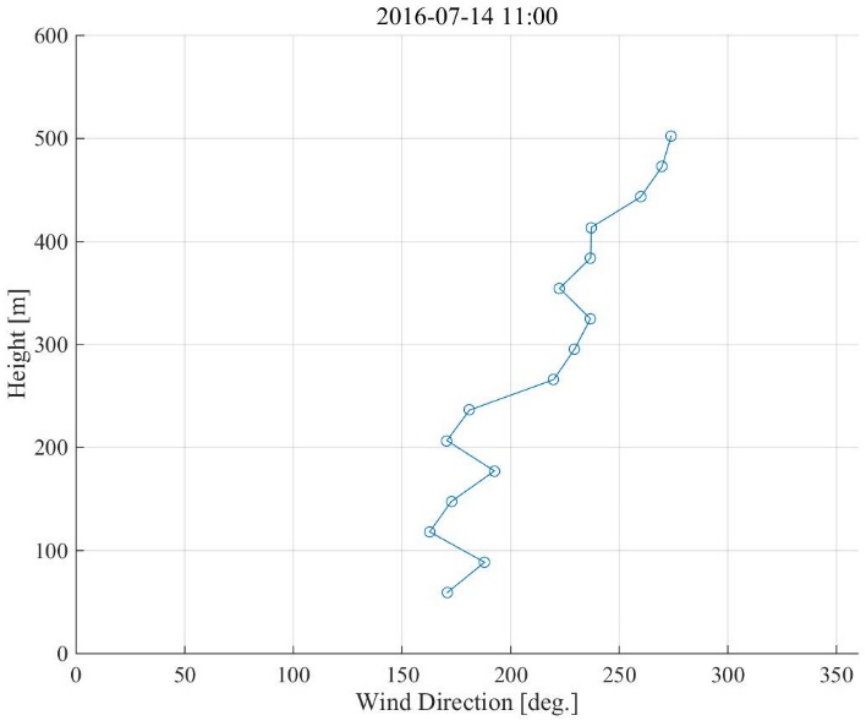
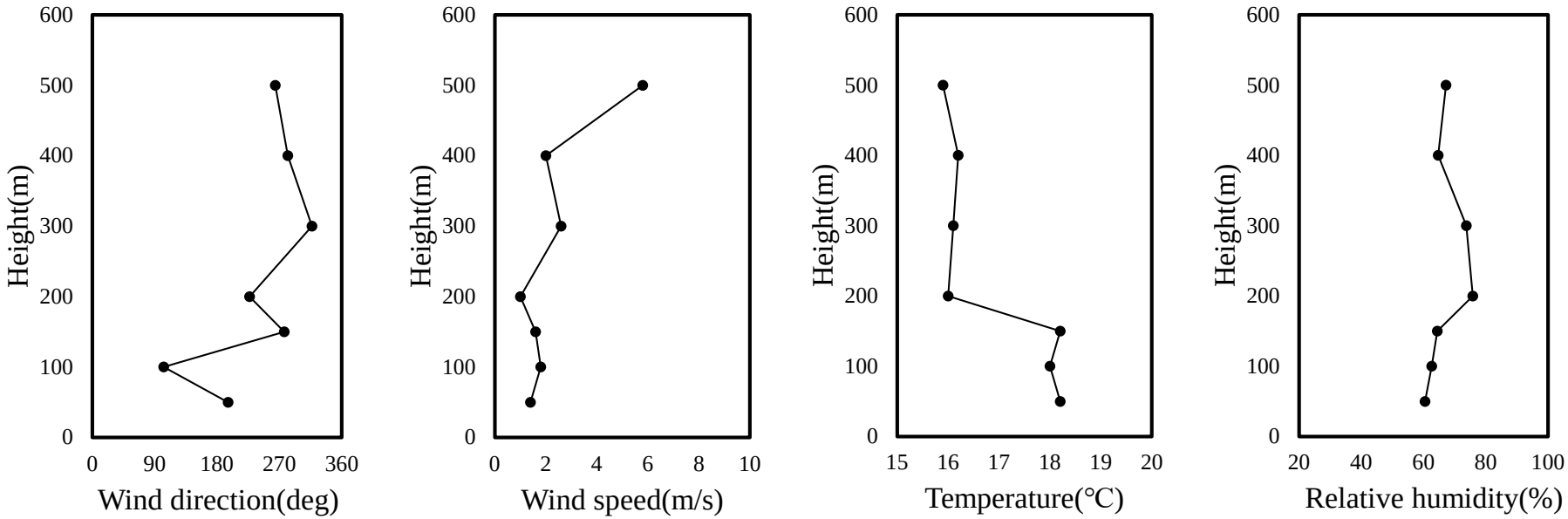




Observation results : Wind profile at ST2

Observation results using UAV

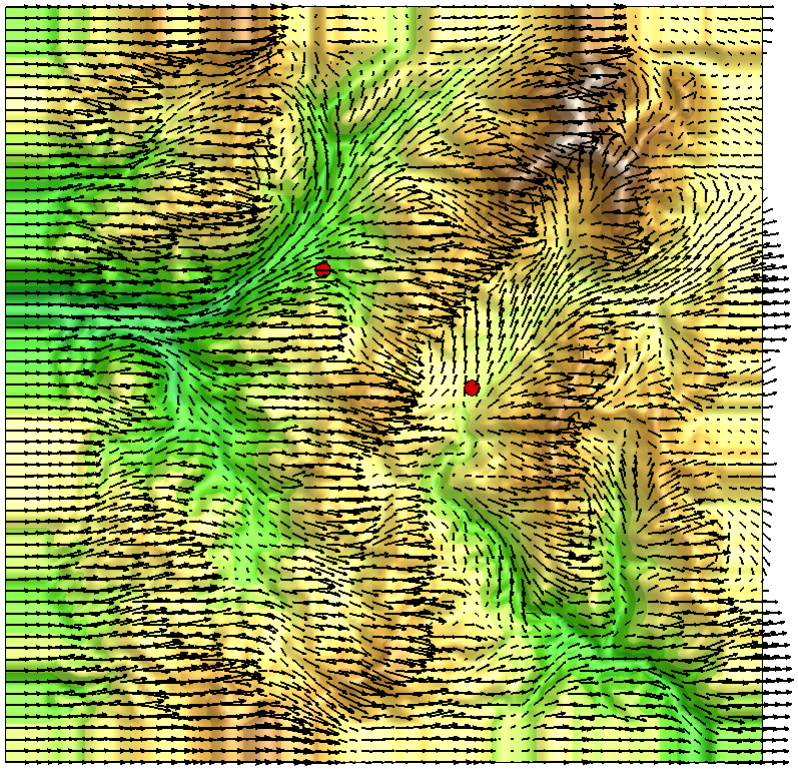


Wind profiles

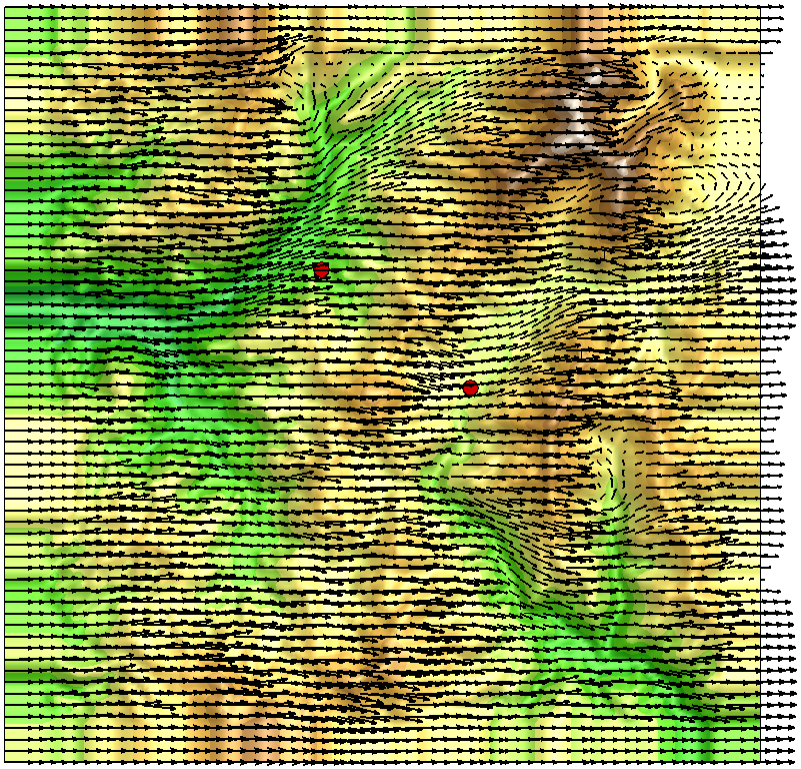
Temperature & humidity profiles

Computational results

(a) z≒70m

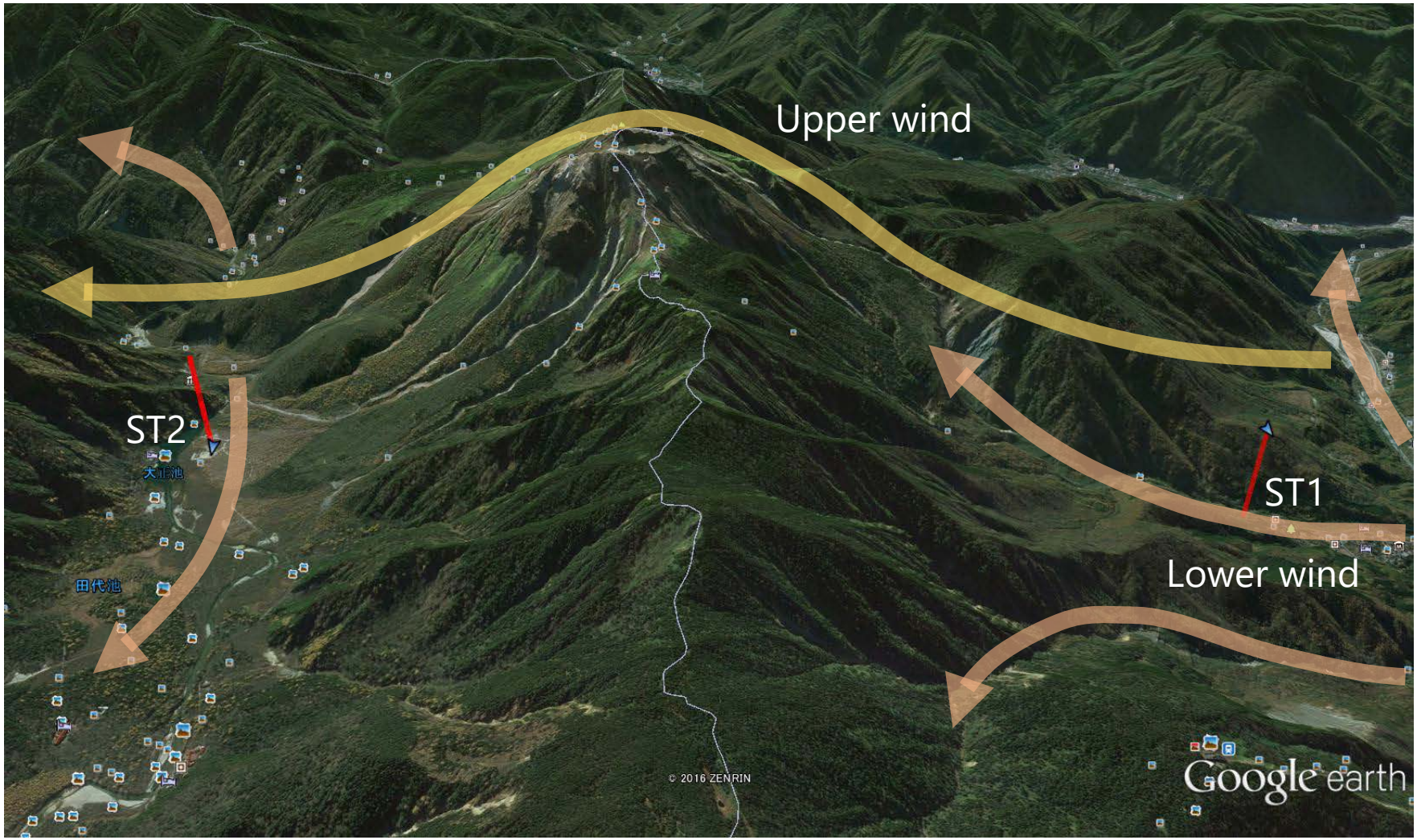


(b) z≒480m



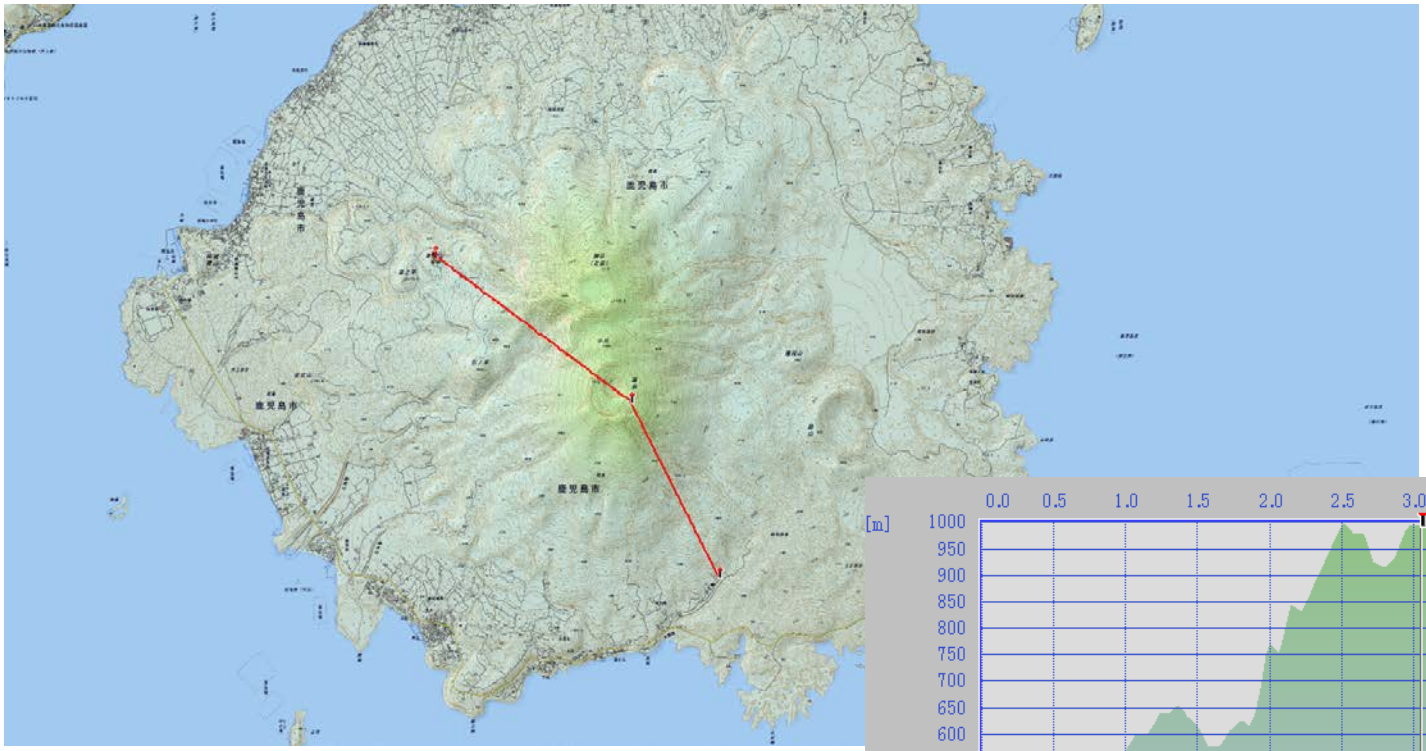
Velocity vector fields at (a) z≒70m and (b) z≒480m

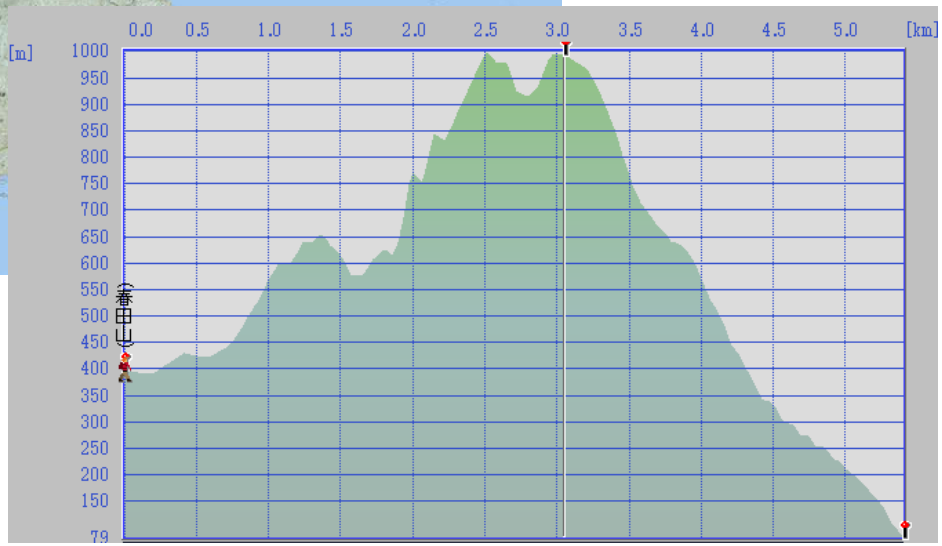
Schematic diagram of wind field



Schematic diagram of wind field

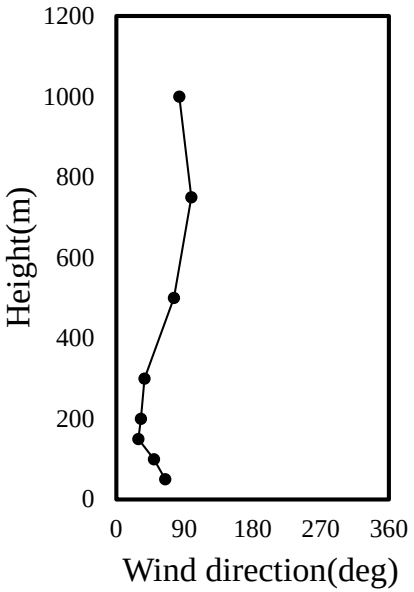
Next challenge; Sakurajima Volcano

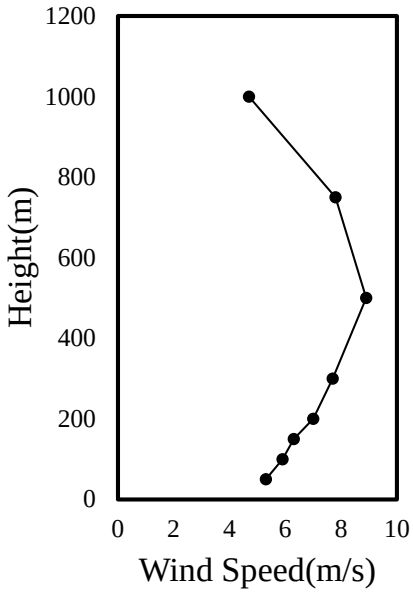




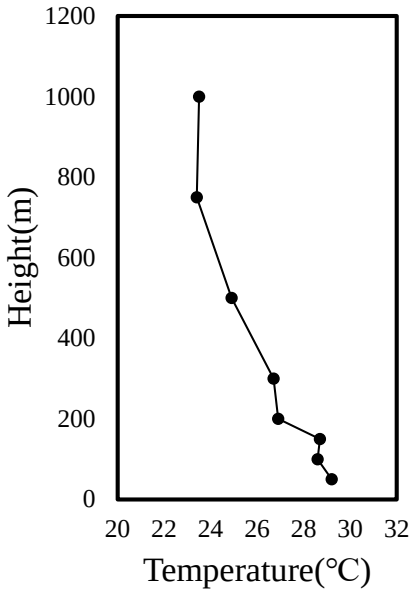
Observation results : Sakurajima

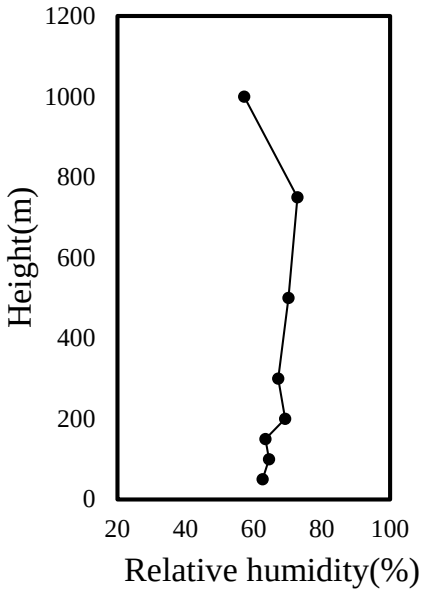
Observation results using UAV

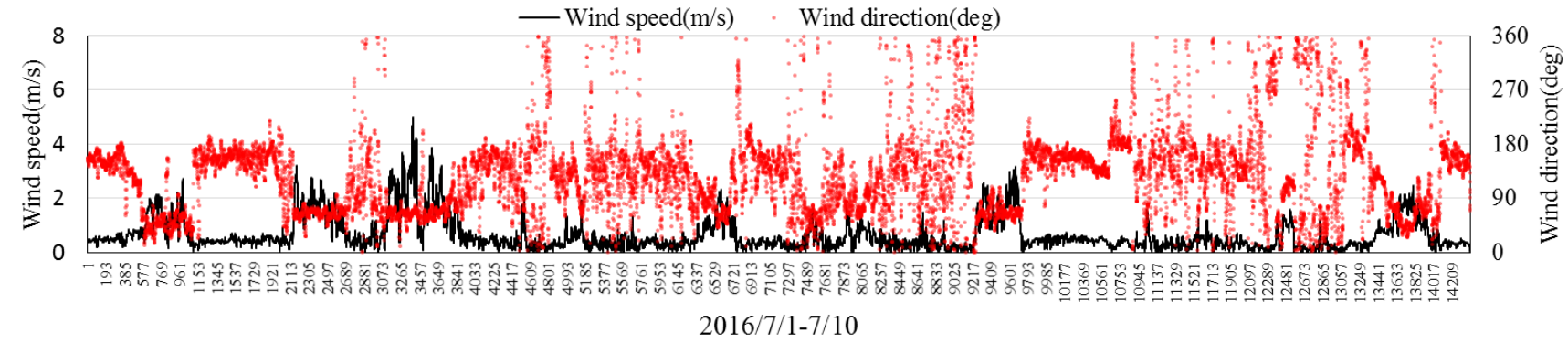
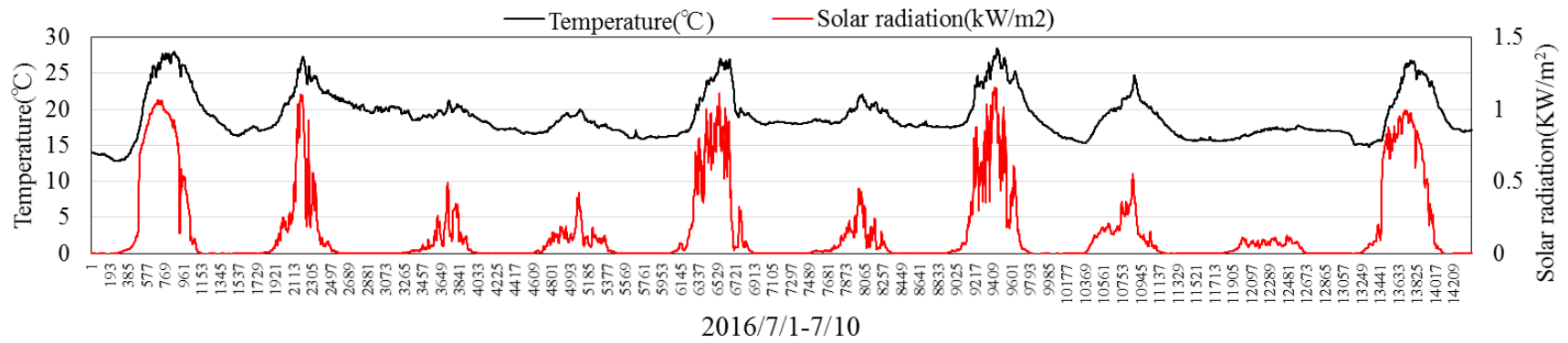
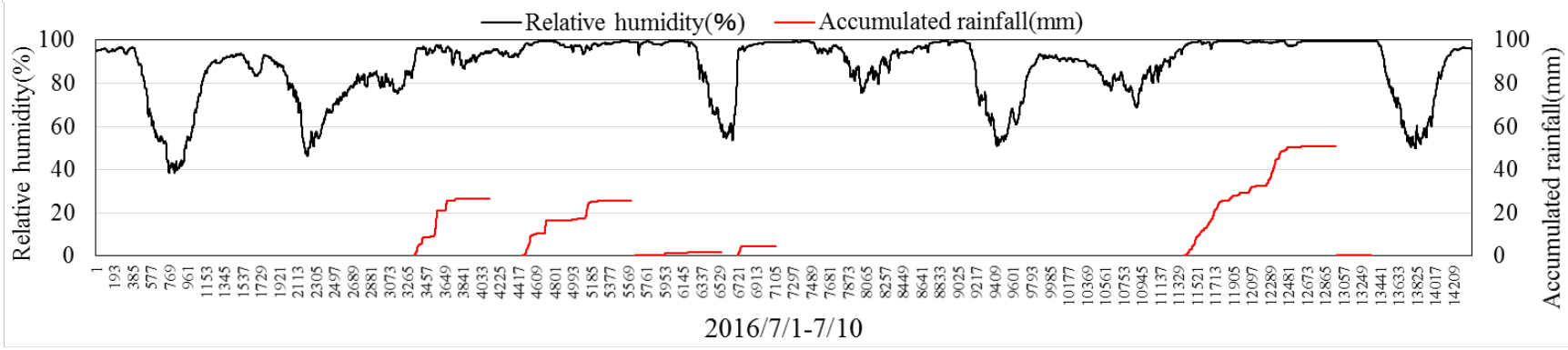




Wind profiles





Temperature & humidity profiles

Ground data at ST1