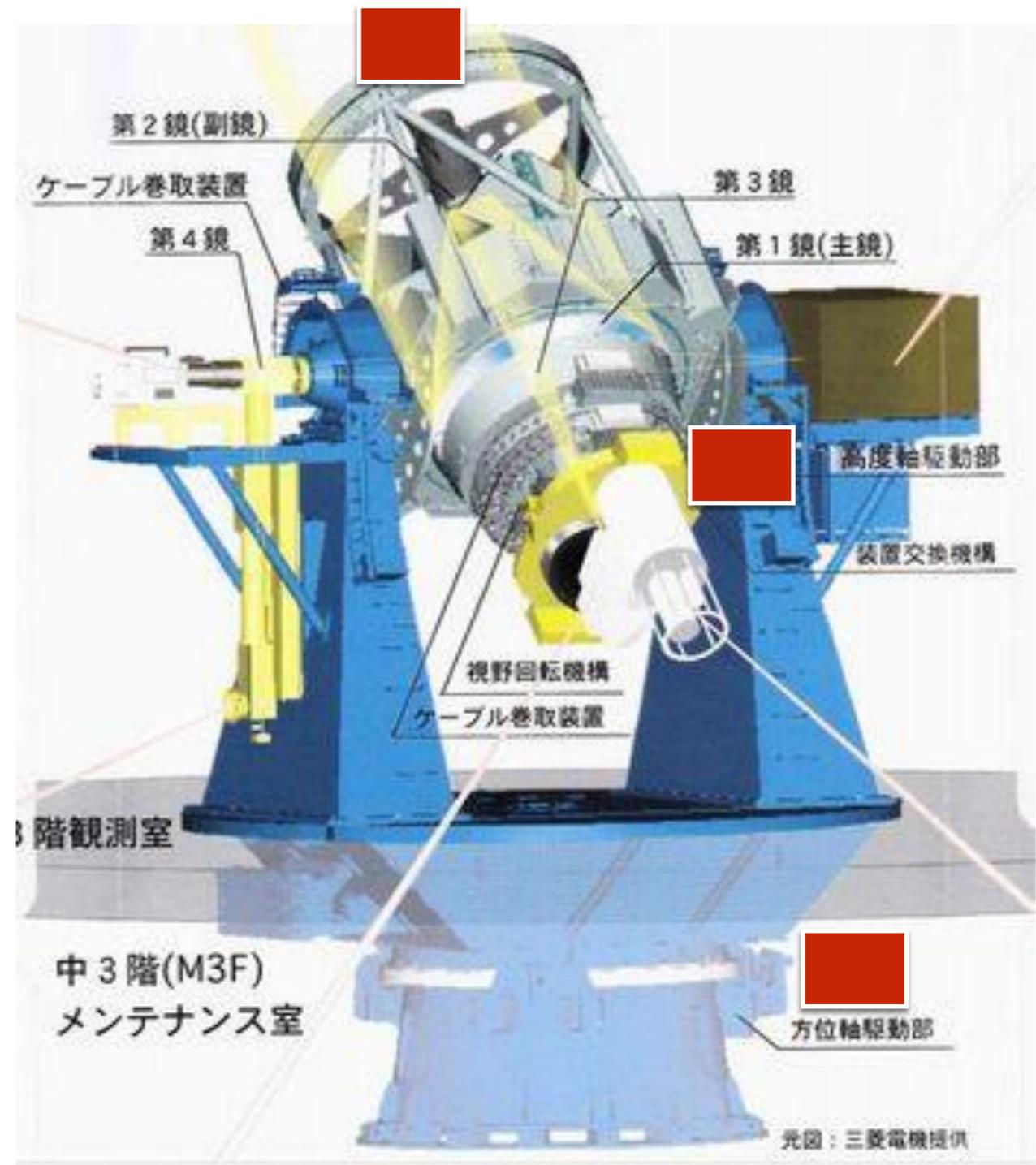


- 雷警報システム
 - 動機
 - 地域の予測
- スカイモニター
 - システム
 - ソフト
 - 応用

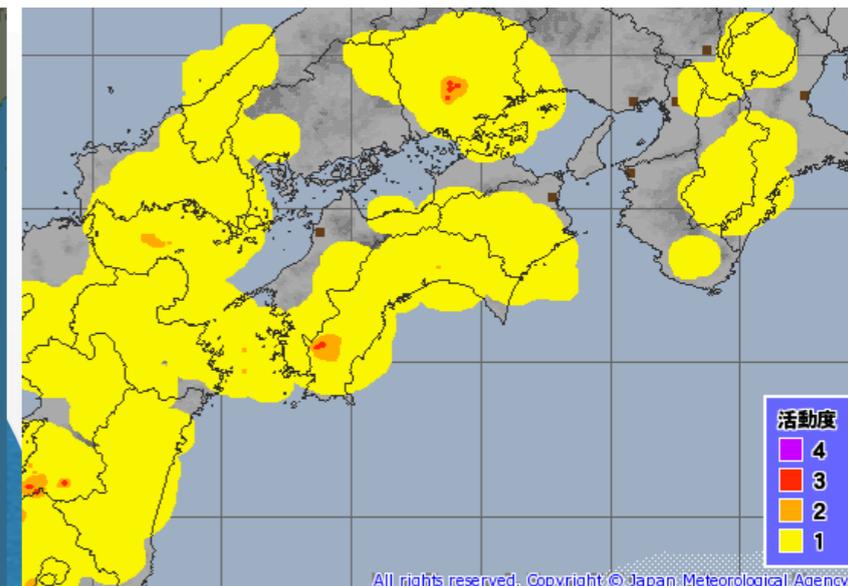
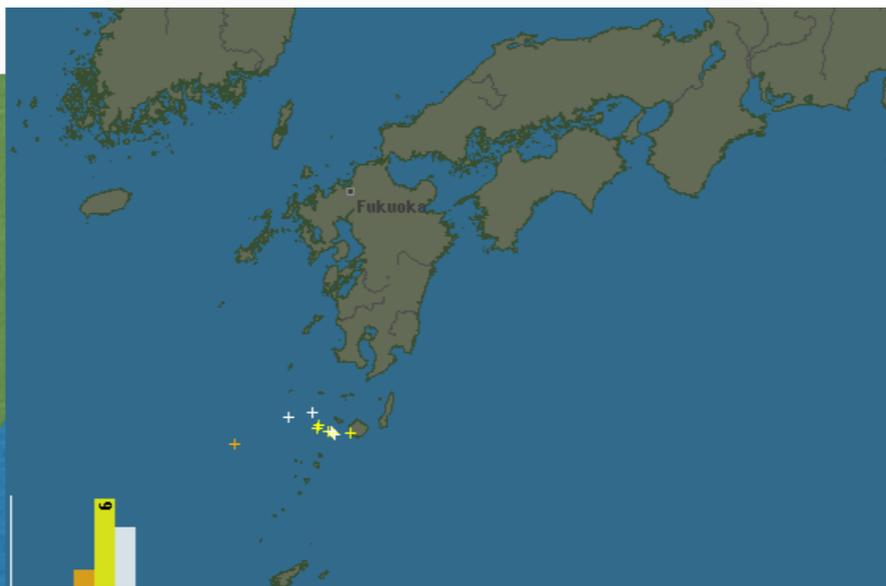
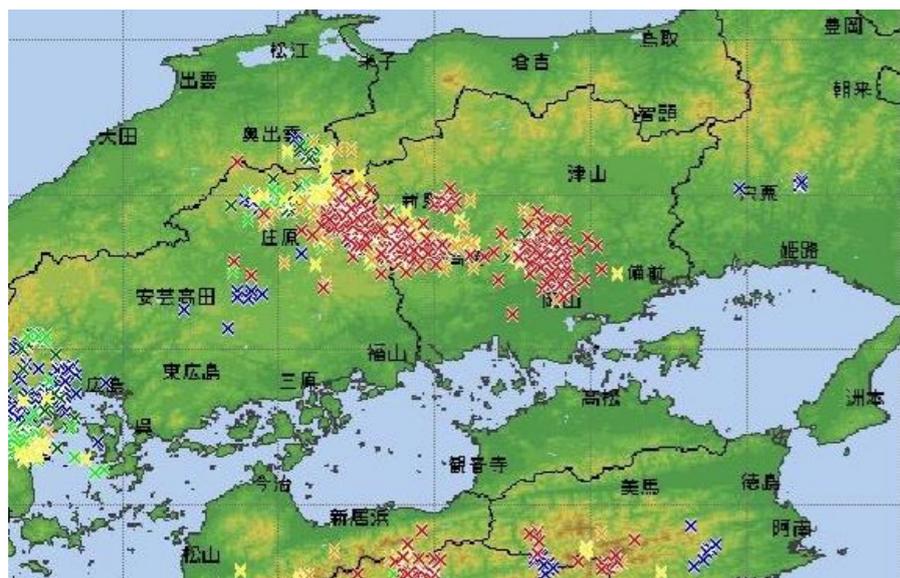
■ Azモーター

■ Elモーター

■ フォーカスマーター



雷警報システム



- energia.co.jp

- blitzortung.org

- jam.go.jp

insufficient coverage
for Japan

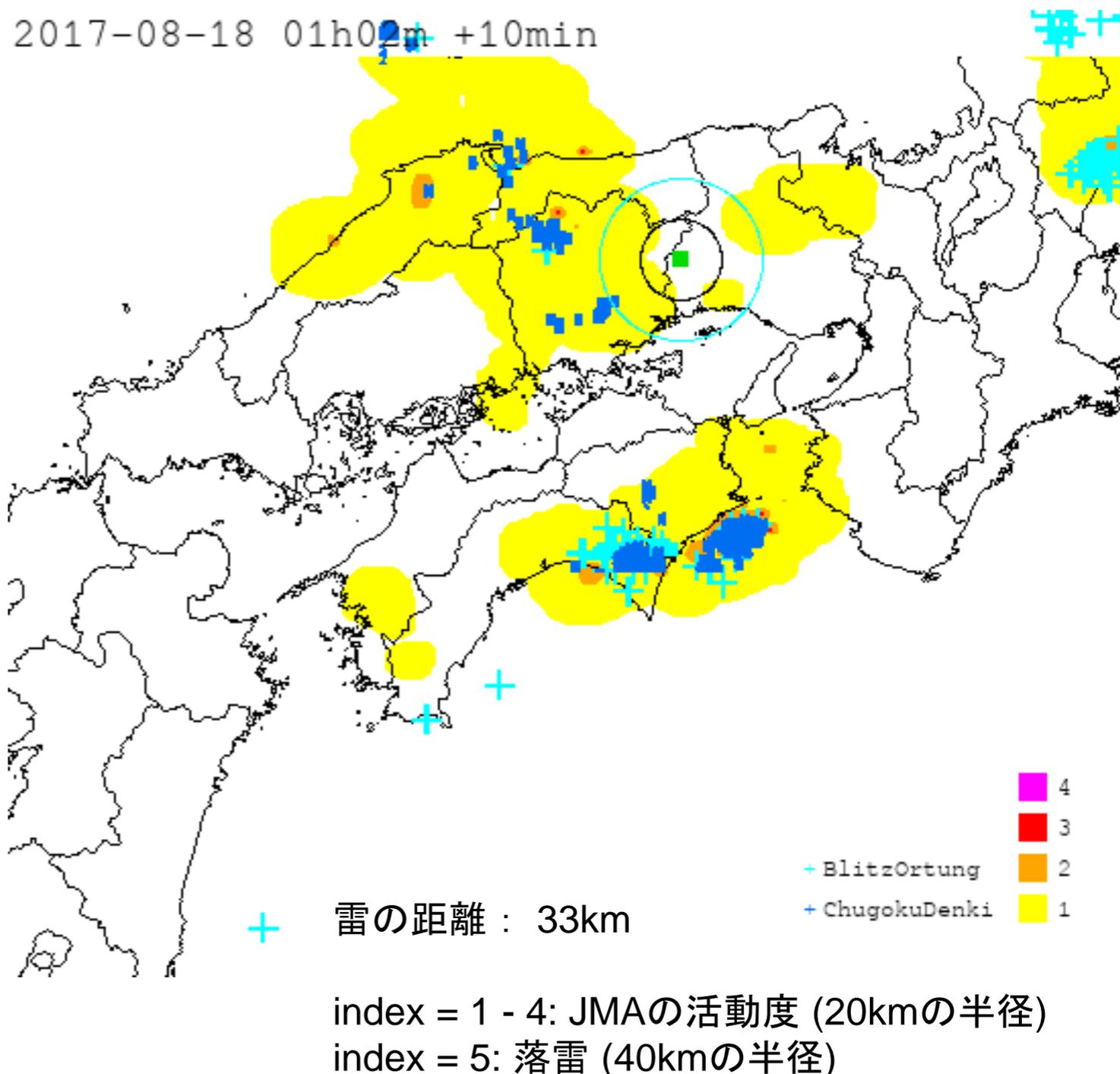
1h forecast

short delay

only map data!!!

雷警報システム

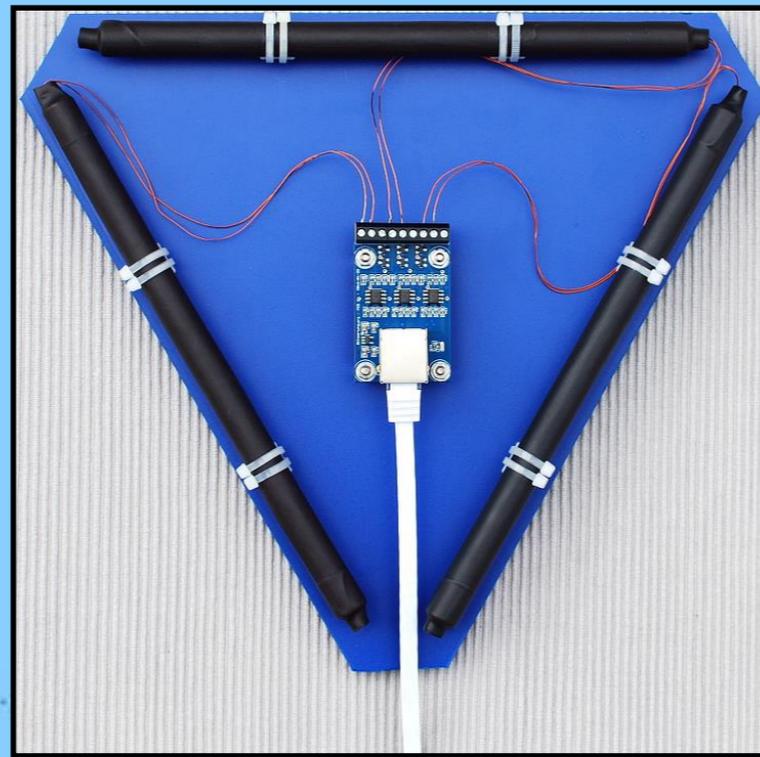
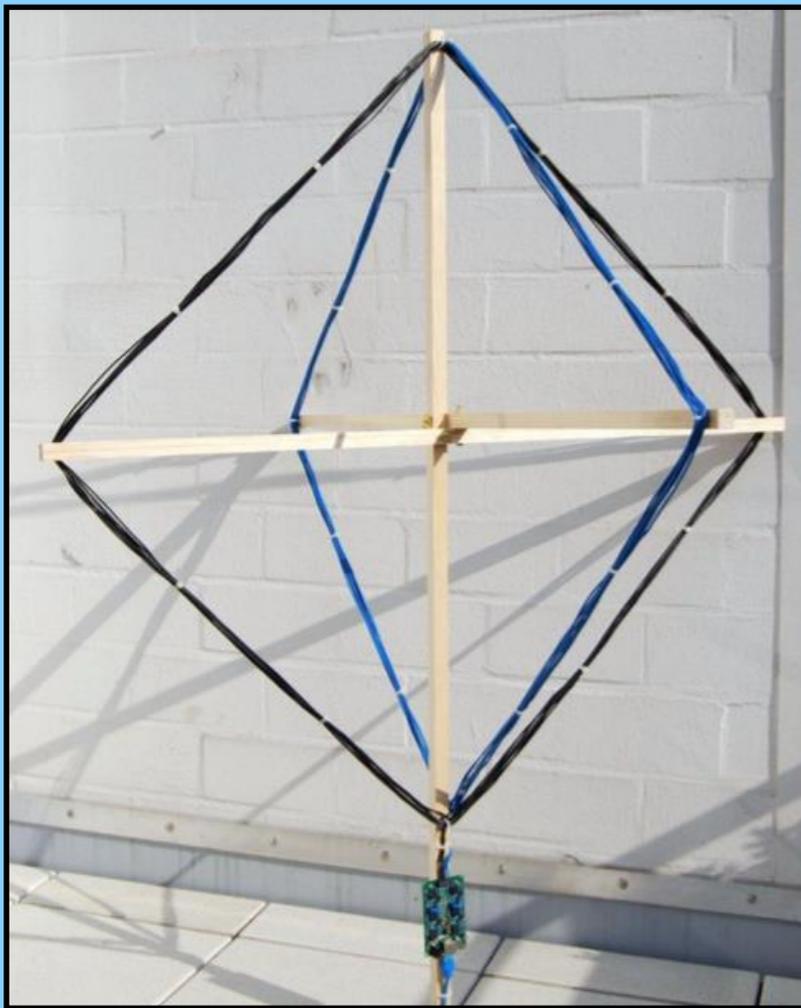
- 地図を分析する
- 雷を見つける
- 雷の距離
- メールを送る



link: <http://www.nhavo.jp/nhavo/live/skymonitor.cgi>

NHAO雷探知機

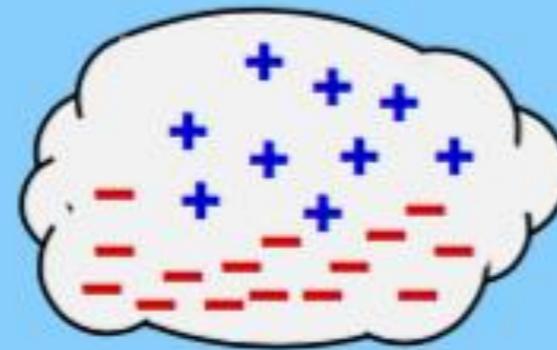
- blitzortungのネットワークに参加
- 来年春まで
- <2万円



GPS Satellites



Blitzortung.org

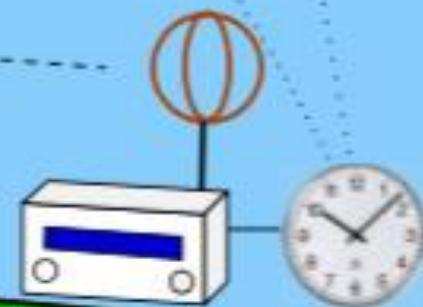
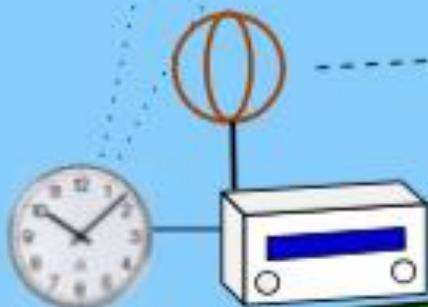


60km = 200 μ s

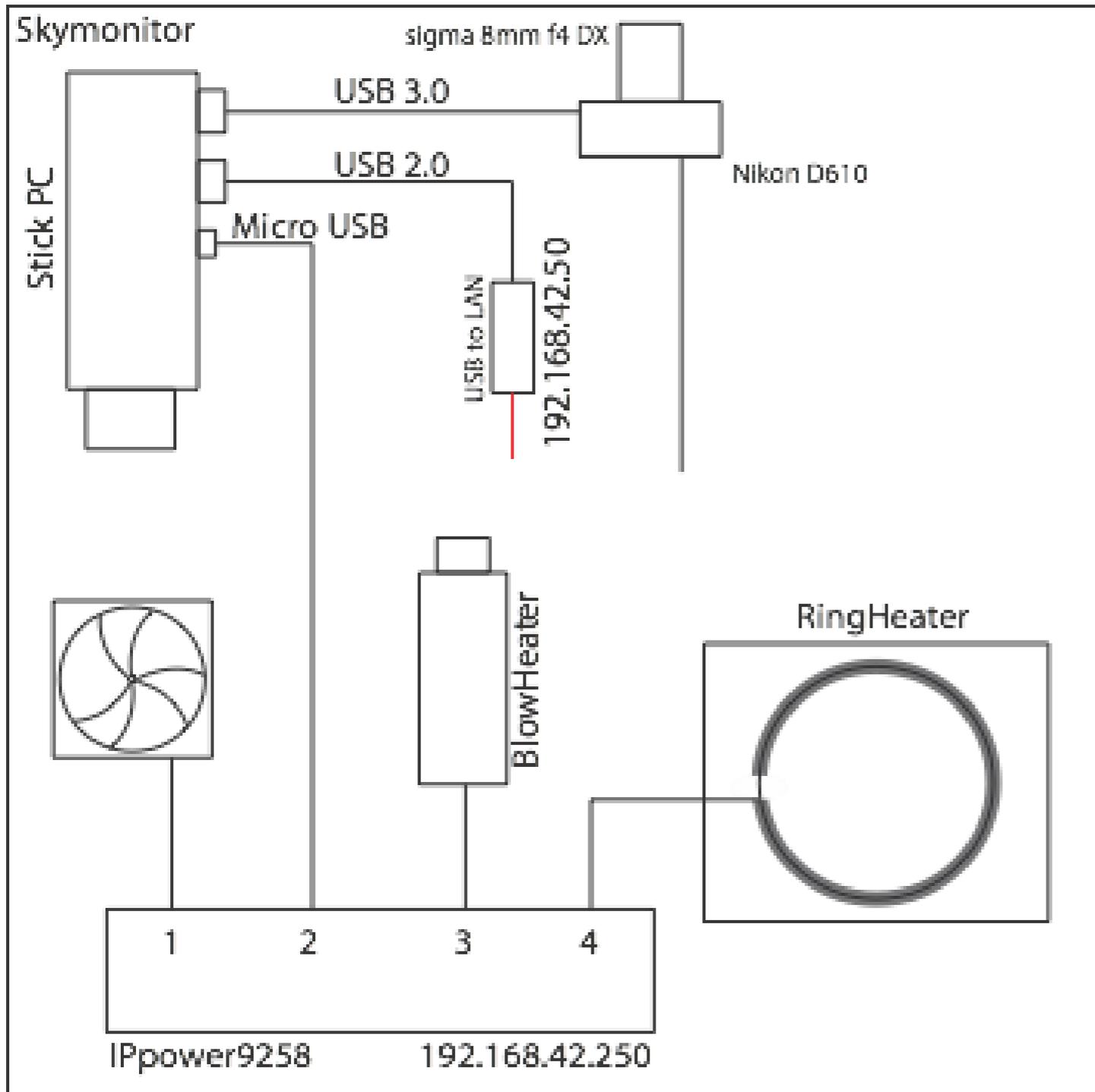
42km = 140 μ s

18:00:02.142783

18:00:02.142723



スカイモニター



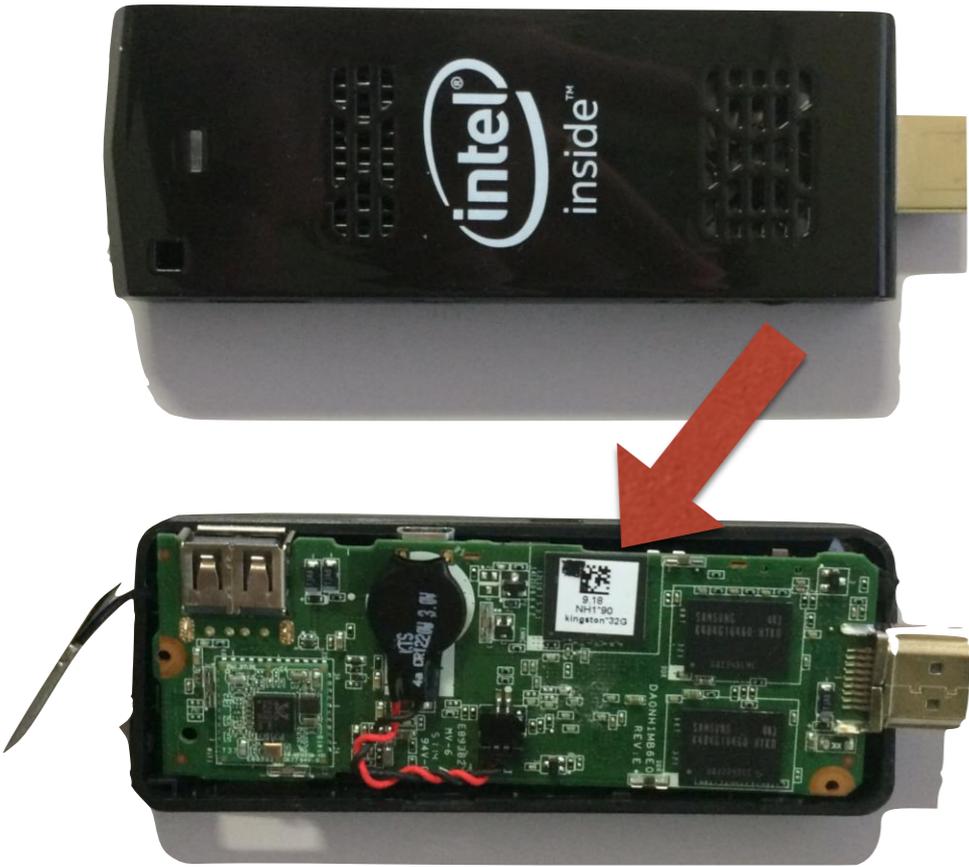
カメラ :

- Nikon D610
- (limited shutter life time)
- sigma 8mm F3.5
- StickPC (Intel Stick, Ubuntu 16.04)

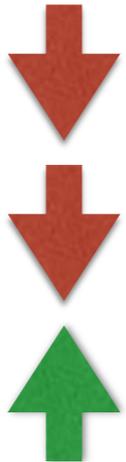
frame rate:

- 1 frame/ minute (Night)
- 0.1 frame/ minute (Day)

Computer



1.5万円 <



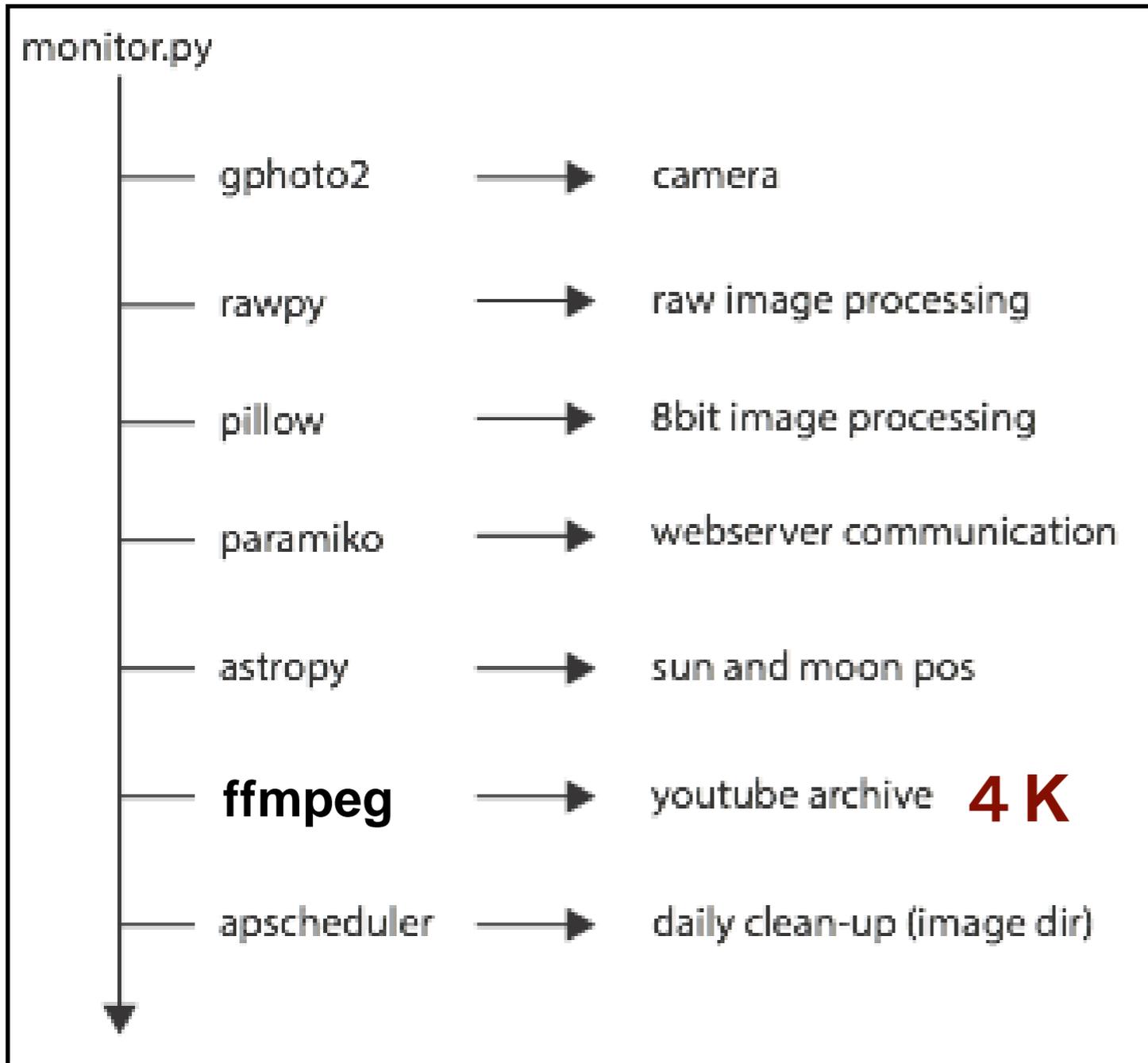
lifetime
reliability
speed



< 1万円



sky-monitoring with less than 200 lines



pros:

- initial write time: <5h
- portable (1 file)
- easy to use

cons:

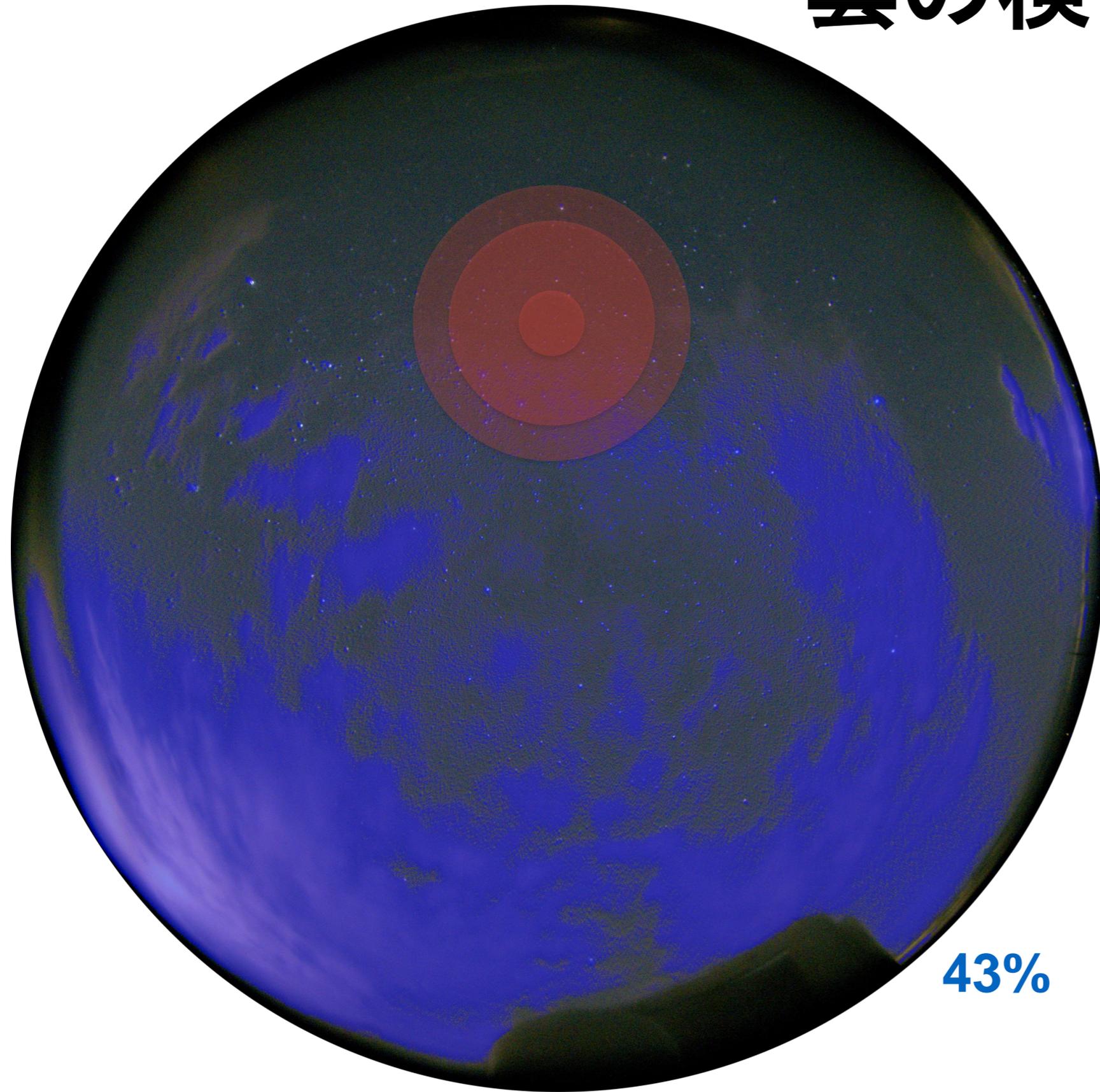
- relatively slow
- low frame rate

—> speed up: use numba or cython compiler

<http://www.nhao.jp/nhao/live/skymonitor.cgi>

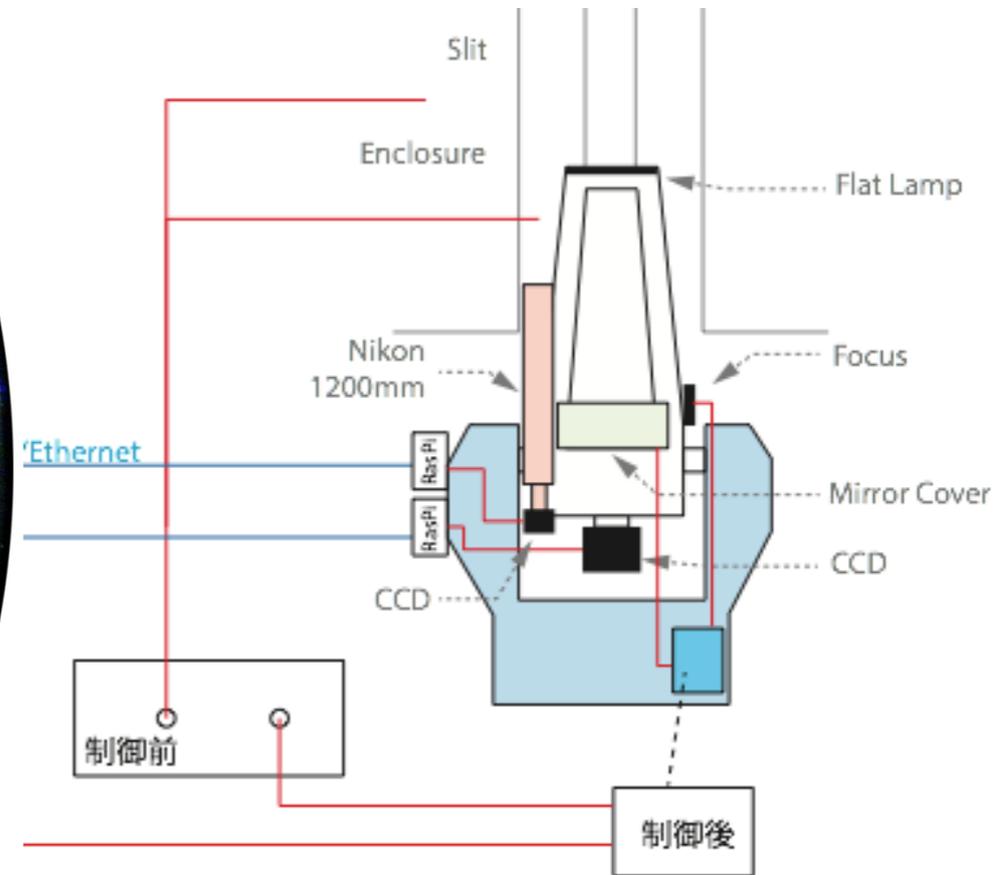
→ [Archive movie of last night](#)

雲の検出



43%

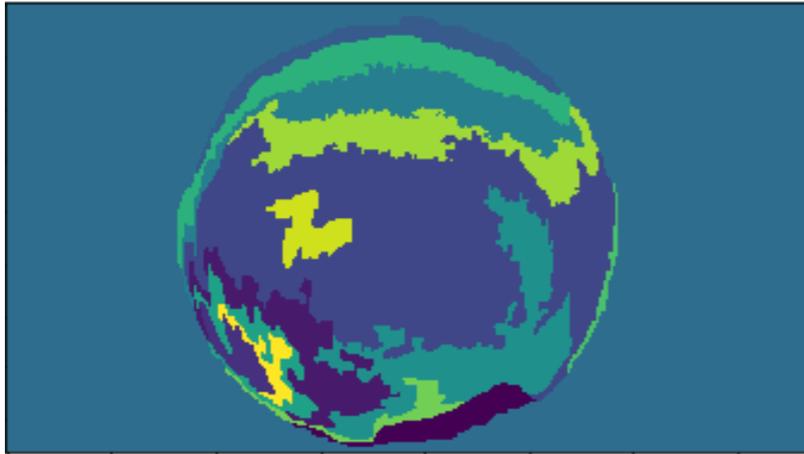
**compute best
visibility direction**



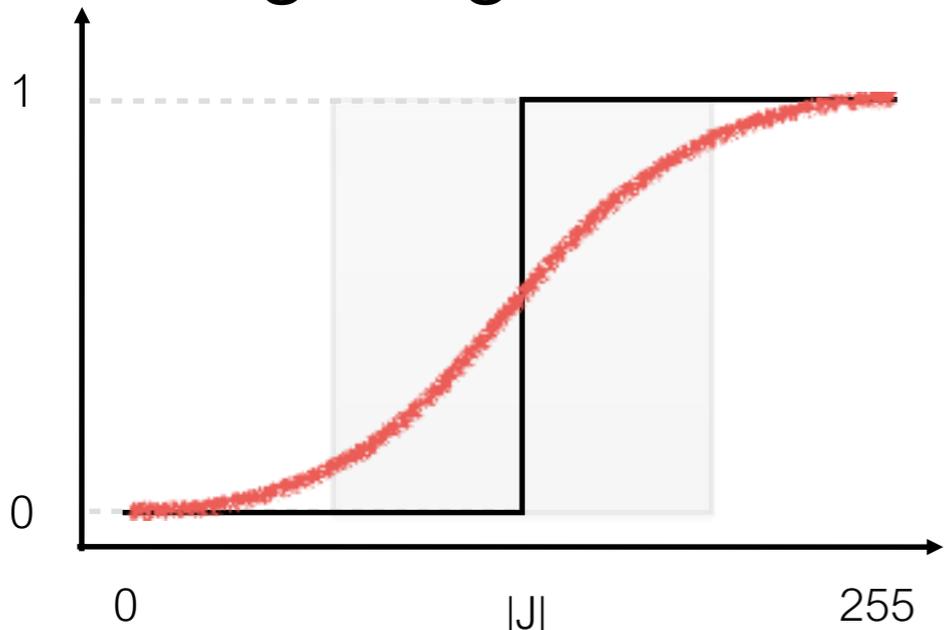
**compute current
cloud coverage**

雲の検出

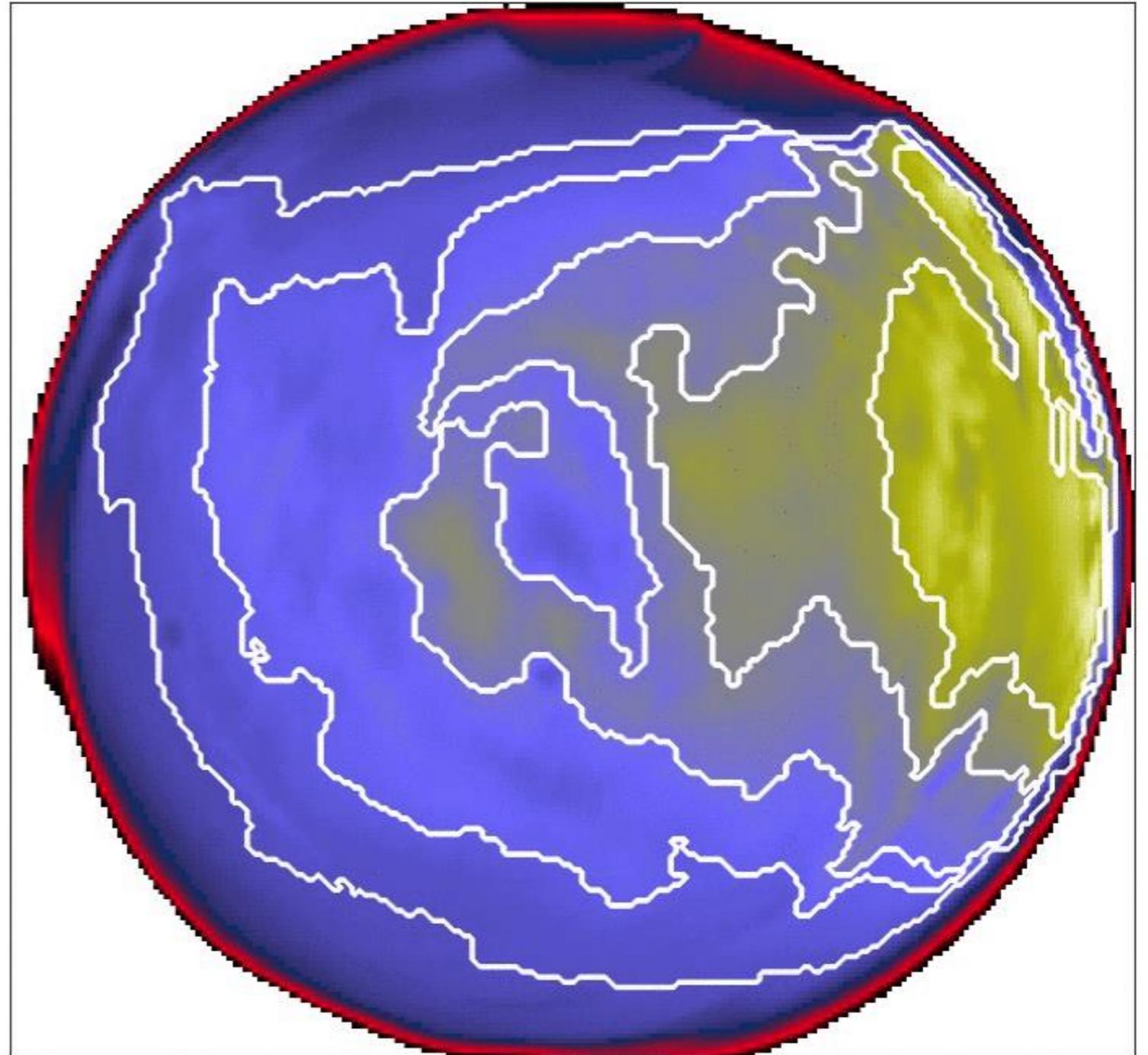
- color reduction
- down sampling
- spectral clustering



- sort cluster by mean
- weighting



- ◆ scikit-learn
- ◆ tensorflow
- ◆ pytorch



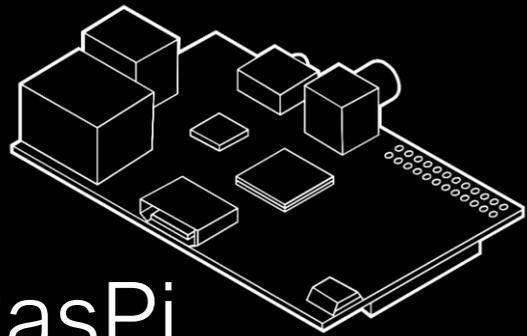
雲 :



飛行機検出

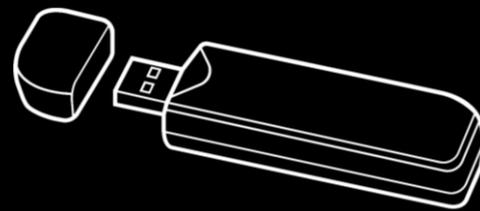
流れ星検出

ModeS: 800742 Callsign: [AIC307](#)
Lat: 34.9515
Long: 134.4881
Alt: 38000ft
SQW: 3115



RasPi

+



DVBT
R820T2

機械学習

supervised learning

- tensorflow
- pytorch

flightradar24

link: www.nhao.jp/~sbaar/skymonitor.html

座標變換

Deneb

Vega

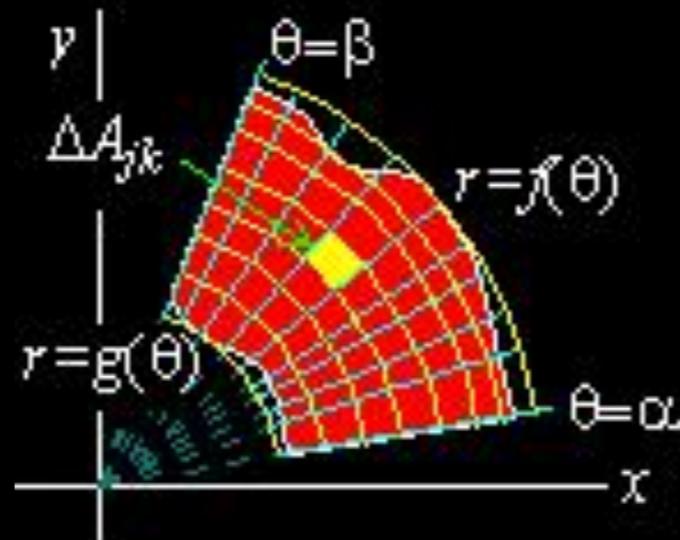
m31

Arcturus

東

南

西



openCV

astropy

