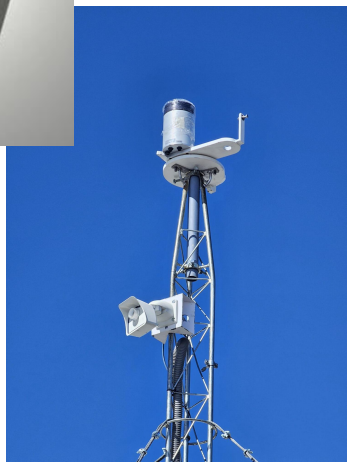
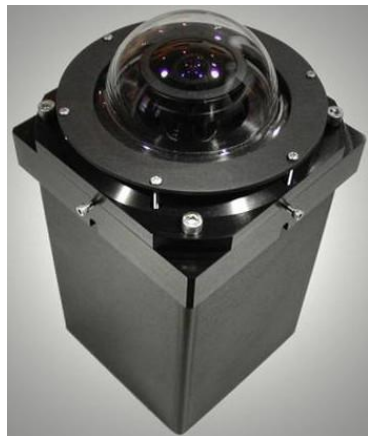


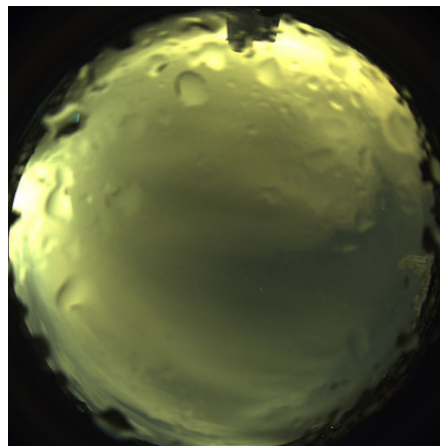
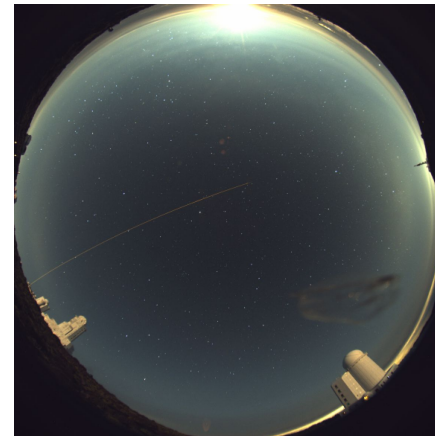
ML for All-Sky Image Classification and Cloud Detection

Ricardo Zanmar Sanchez
INAF

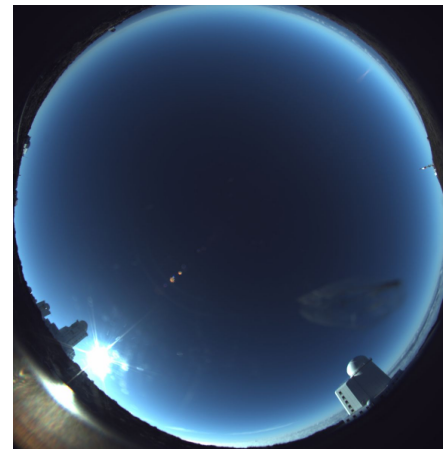
Allsky cameras



ML4astro3/Malta

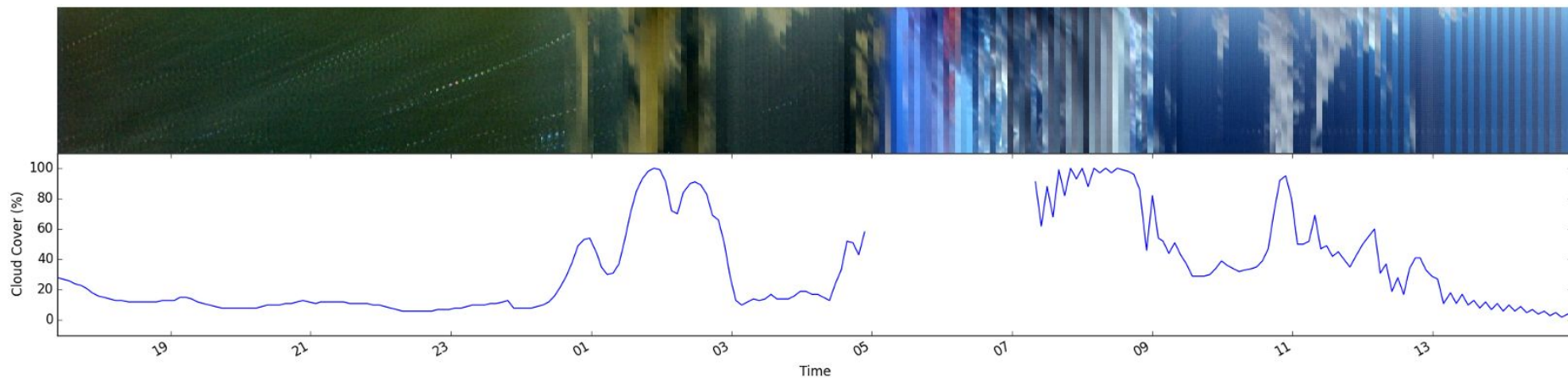


1/Sep/26

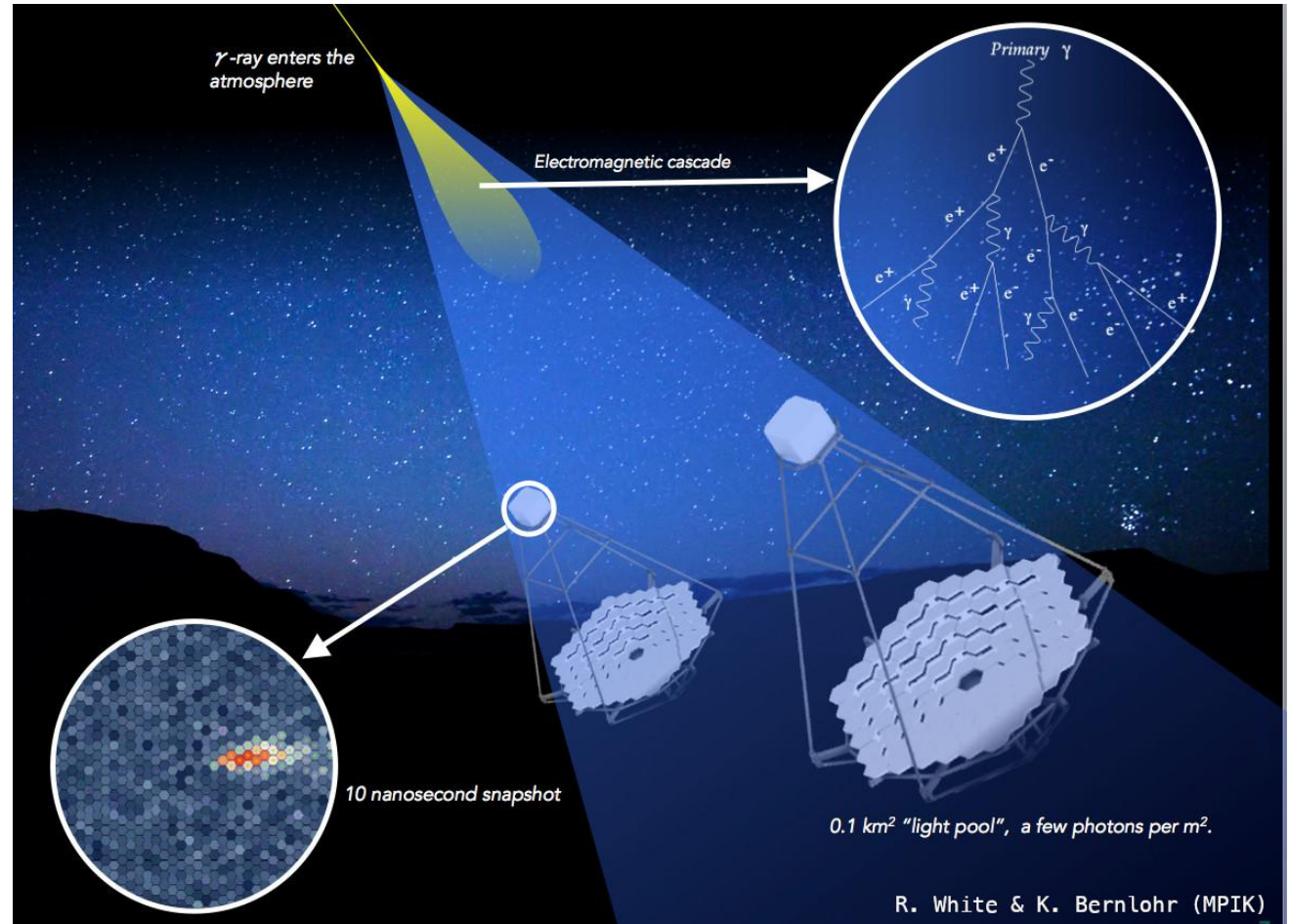


R. Zanmar Sanchez

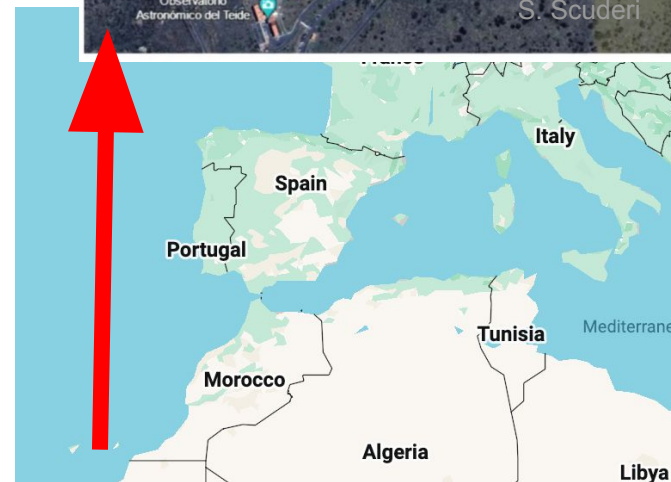
Cloud Cover %



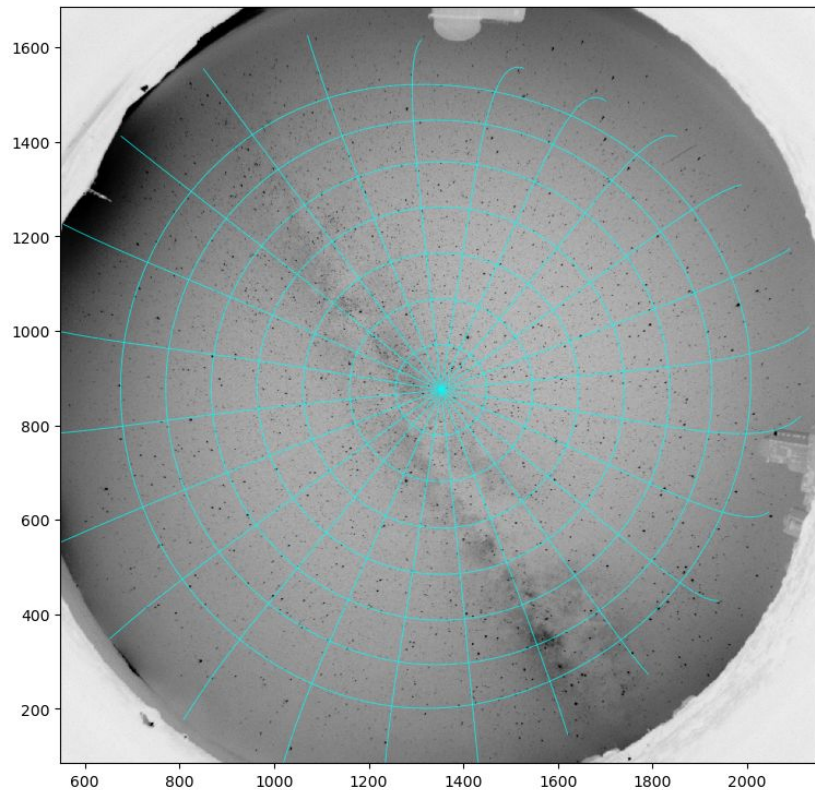
Ground-based Gamma-ray Astronomy



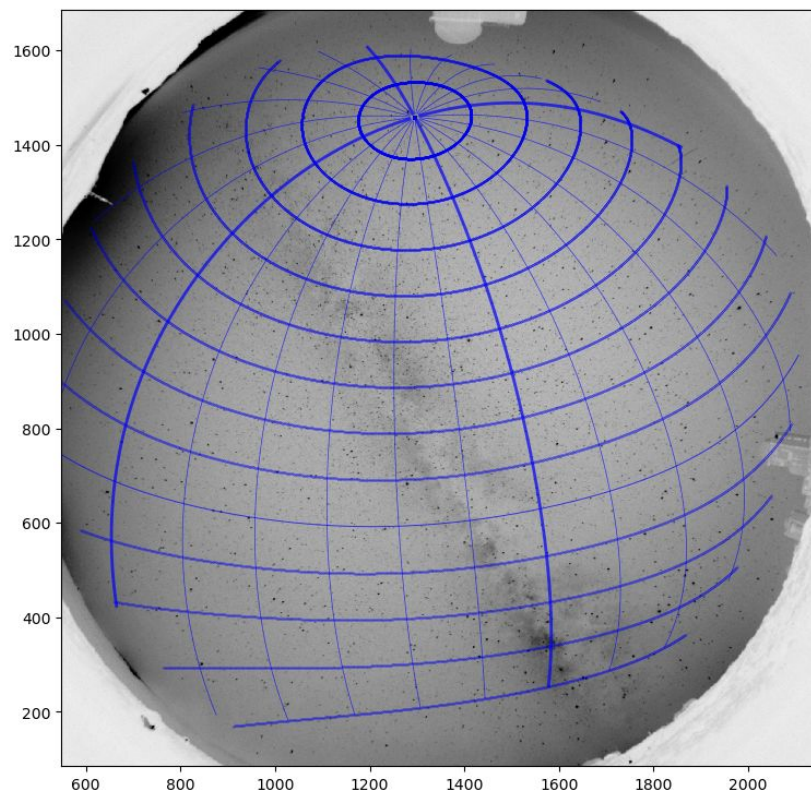
ASTRI MA



WCS using stars



ML4astro3/Malta



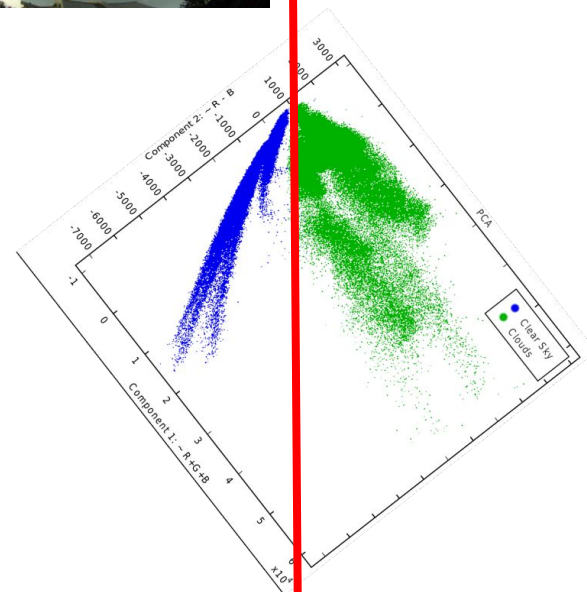
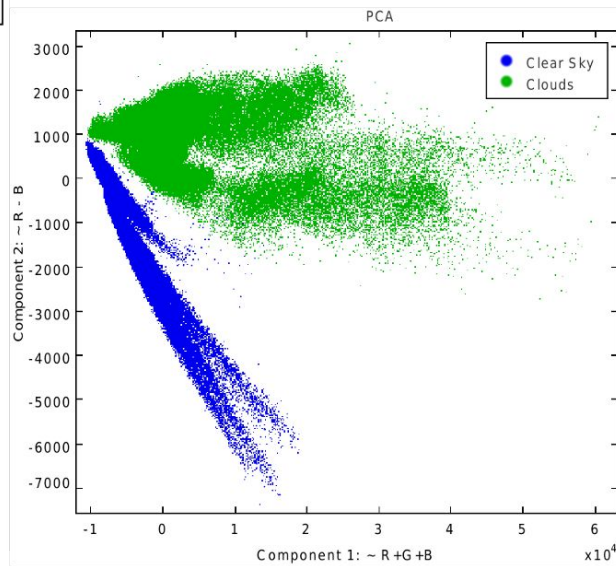
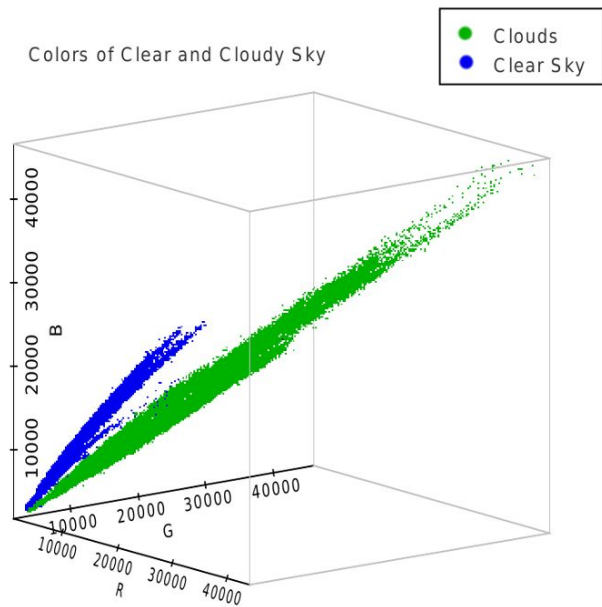
1/Sep/26

R. Zanmar Sanchez

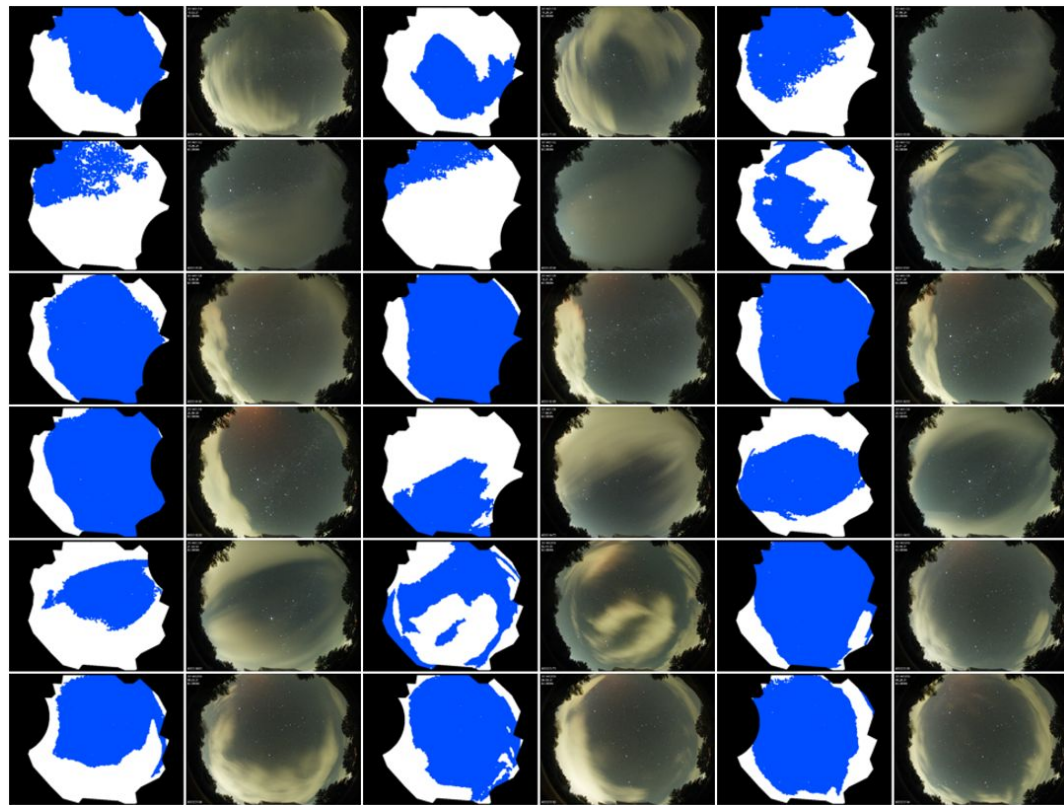
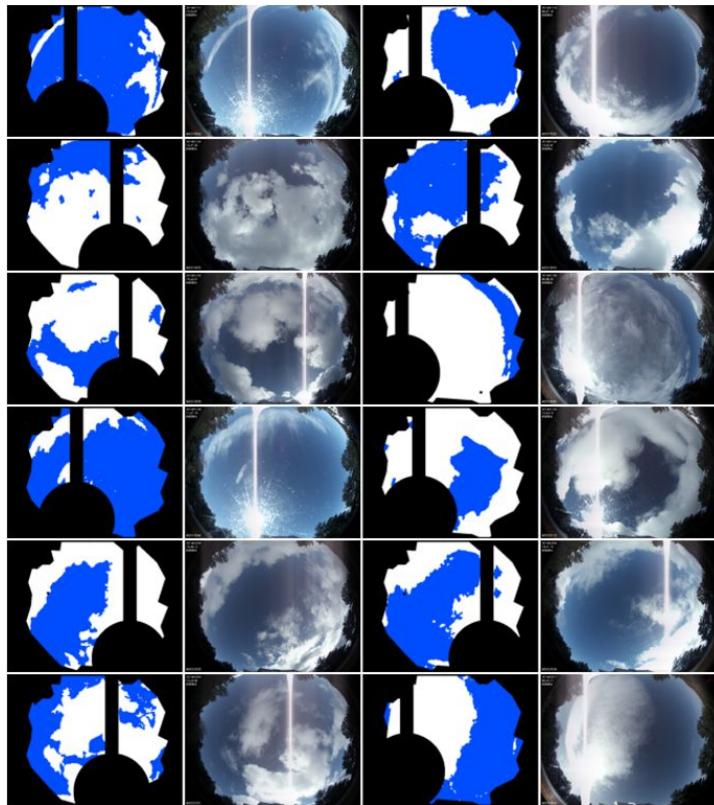
PCA and thresholding



Colors of Clear and Cloudy Sky



PCA and thresholding



Cloud detection with k-Means Clustering

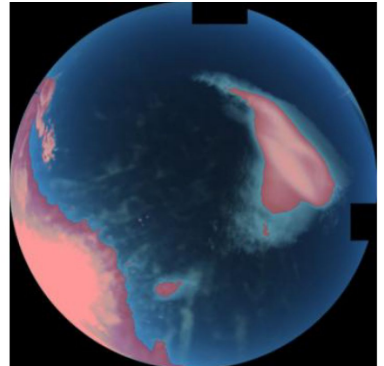
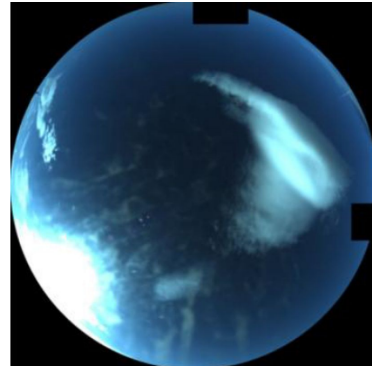
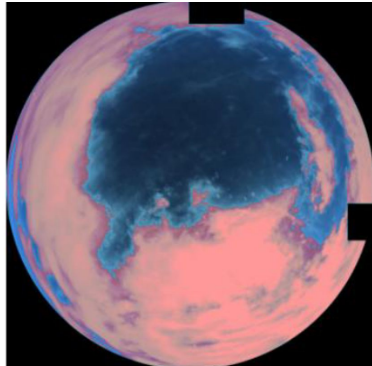
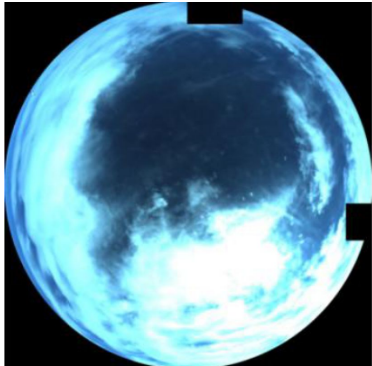
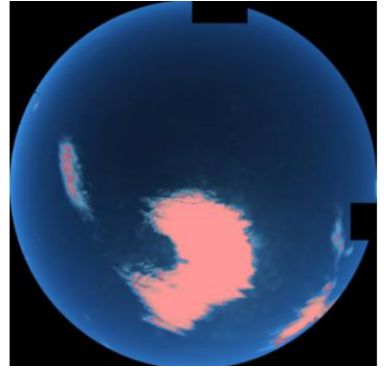
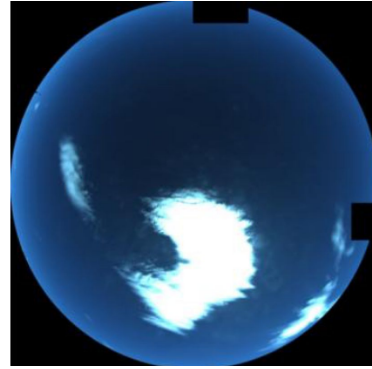
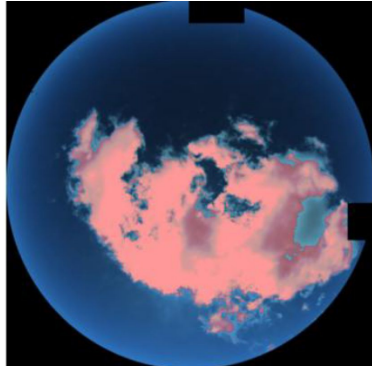
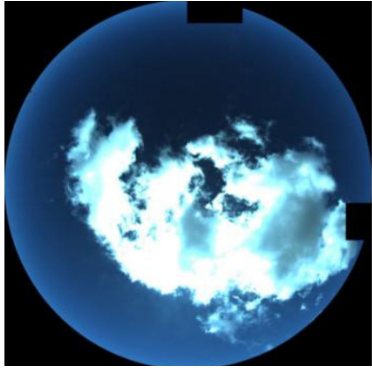
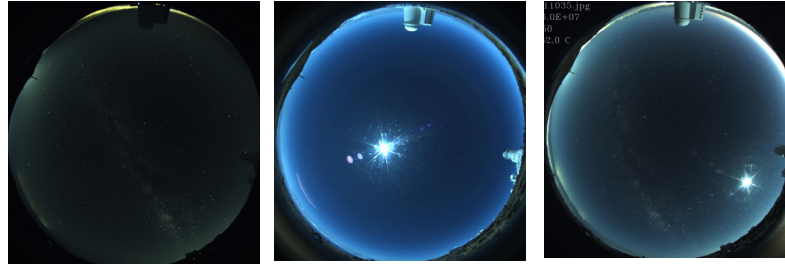


Image Classification

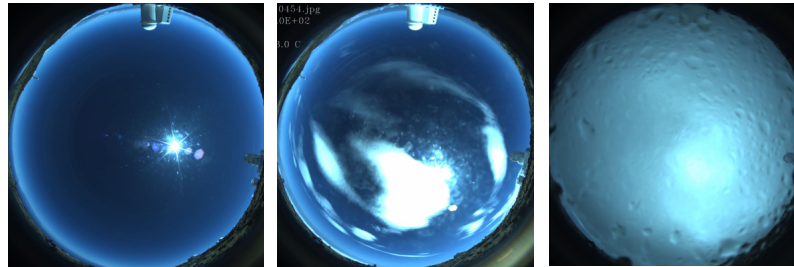
- Use sun/moon altitude to pre-classify images

- Day
- Night moonless
- Night moon



- For each class: **Supervised Learning** via Transfer Learning (CNN)

- Clear sky
- Partially cloudy
- Other



Supervised Learning

- **Label** images to get about ~600 images per class
- Separate into **train** (80%), **test** (10%), **validate** (10%)
- ROI masking and resizing
- Data **augmentation** (random rotation and horizontal flip)
- Transfer Learning: Pre-trained **ResNet-18** model.
- Replace output layer (3 classes)

Results: Confusion Matrix



Daytime Model N = 190 Samples

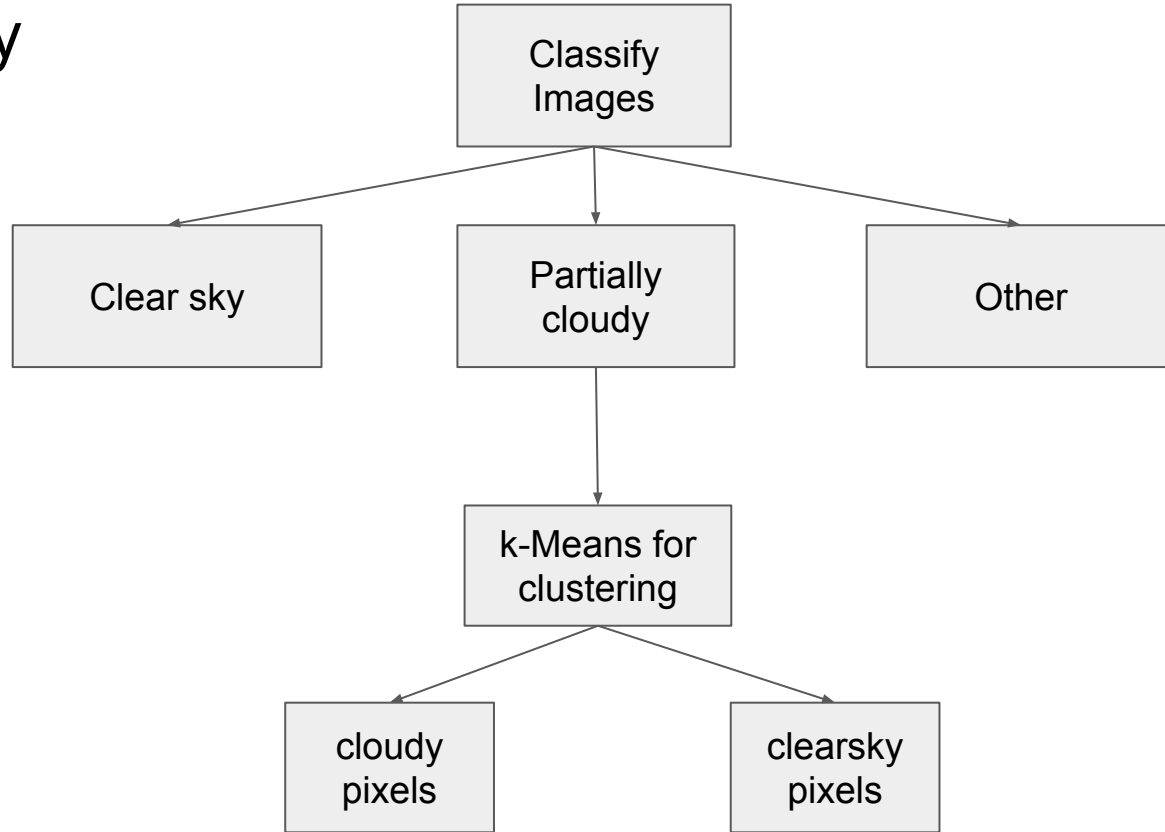
	PREDICTED CLASS		
	Clear	Other	Partial
ACTUAL CLASS	Clear	67	0
	Other	0	57
	Partial	2	64



Nighttime Model N = 230 Samples

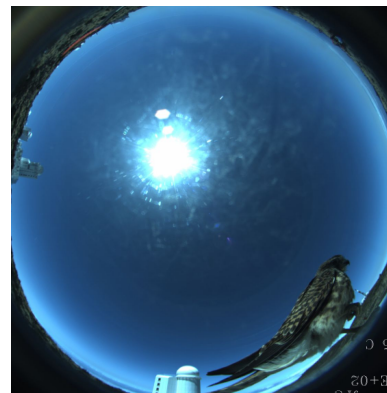
	PREDICTED CLASS		
	Clear	Other	Partial
ACTUAL CLASS	Clear	82	0
	Other	0	68
	Partial	0	79

Summary





Thanks!





Storm Emilia!