

Pond depth retrieval from CALIOP lidar measurements

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Outline

1. Overview of CALIPSO mission
2. Surface type identification
3. Pond depth retrieval
4. Preliminary Results
5. Future task

1. Overview of CALIPSO mission

Launched: April 28, 2006 with CloudSat Satellite

Instruments:

CALIOP Lidar, Imaging Infrared Radiometer, Wide-Field Camera

CALIOP: provides lidar measurements of aerosols and clouds

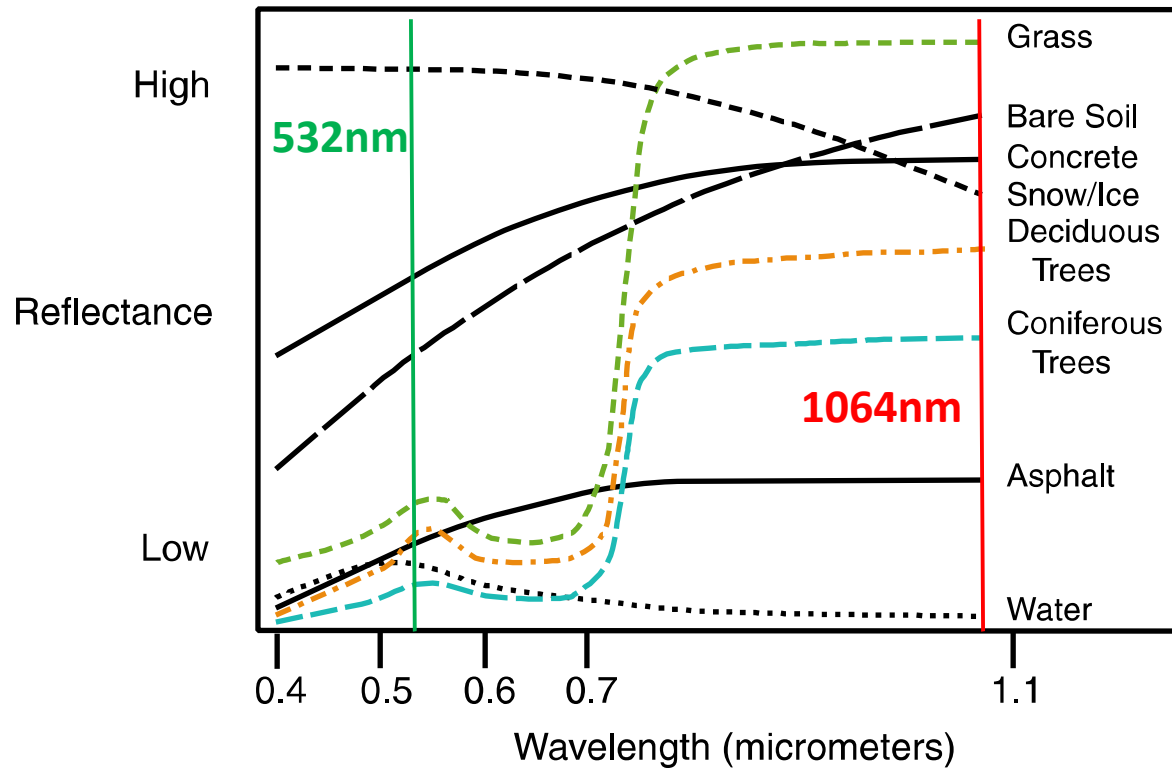
Operational Achievements:

- Long term measurements: CALIOP collected more than 10 years of measurements so far;
- Observations during day/night and for all seasons
- Data publicly available
- CALIOP Adds the Vertical Dimension
- Other applications:
 - Altimetry; (*Hu et. al., 2007; Lu et.al,2014*)
 - Surface type distinguish, Arctic sea ice trend; (*Lu et.al, 2016*)
 - Ocean subsurface; (*Behrenfeld et. al., 2013, 2016; Lu et.al, 2014, 2016*)

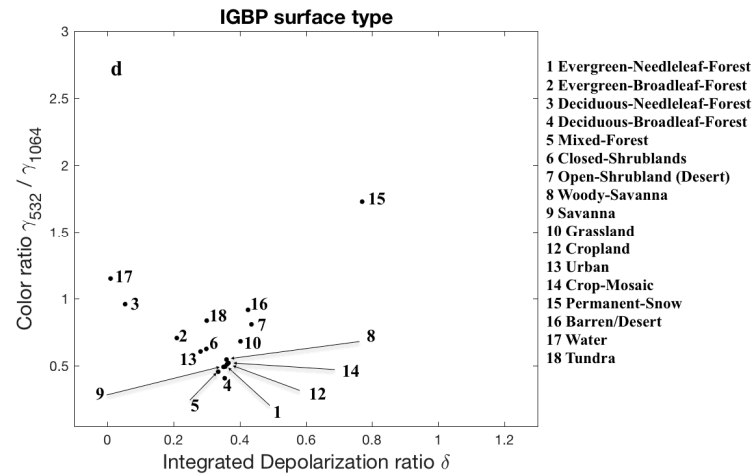
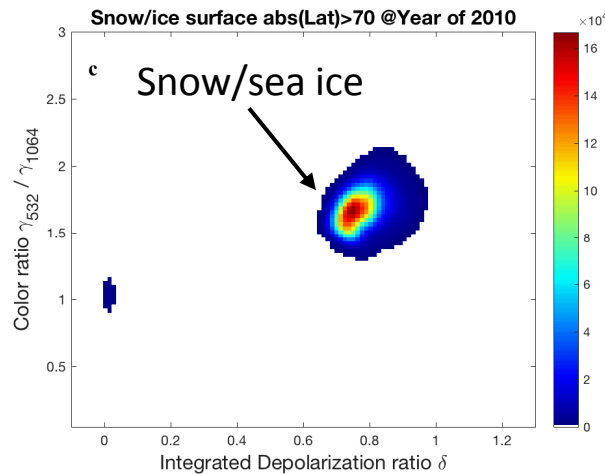
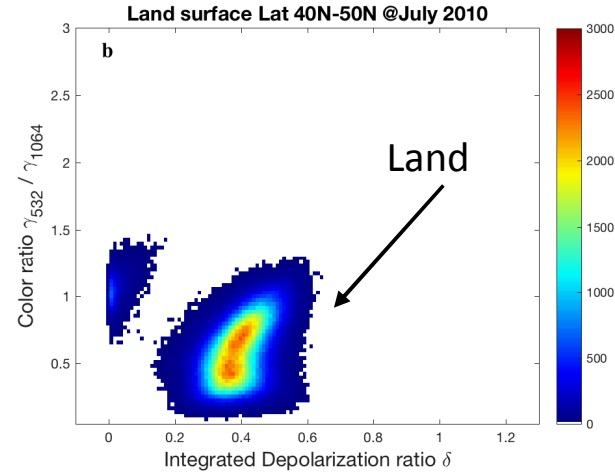
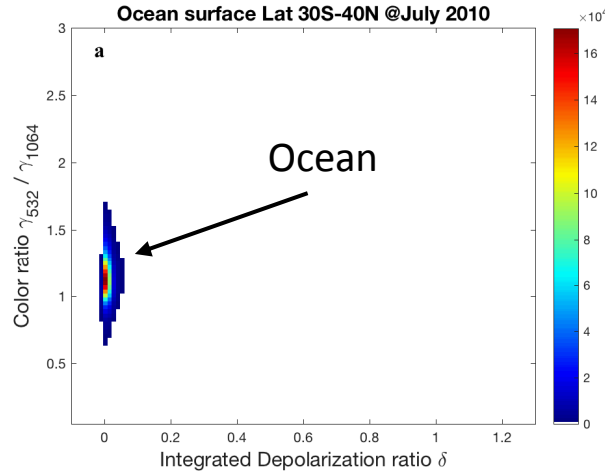
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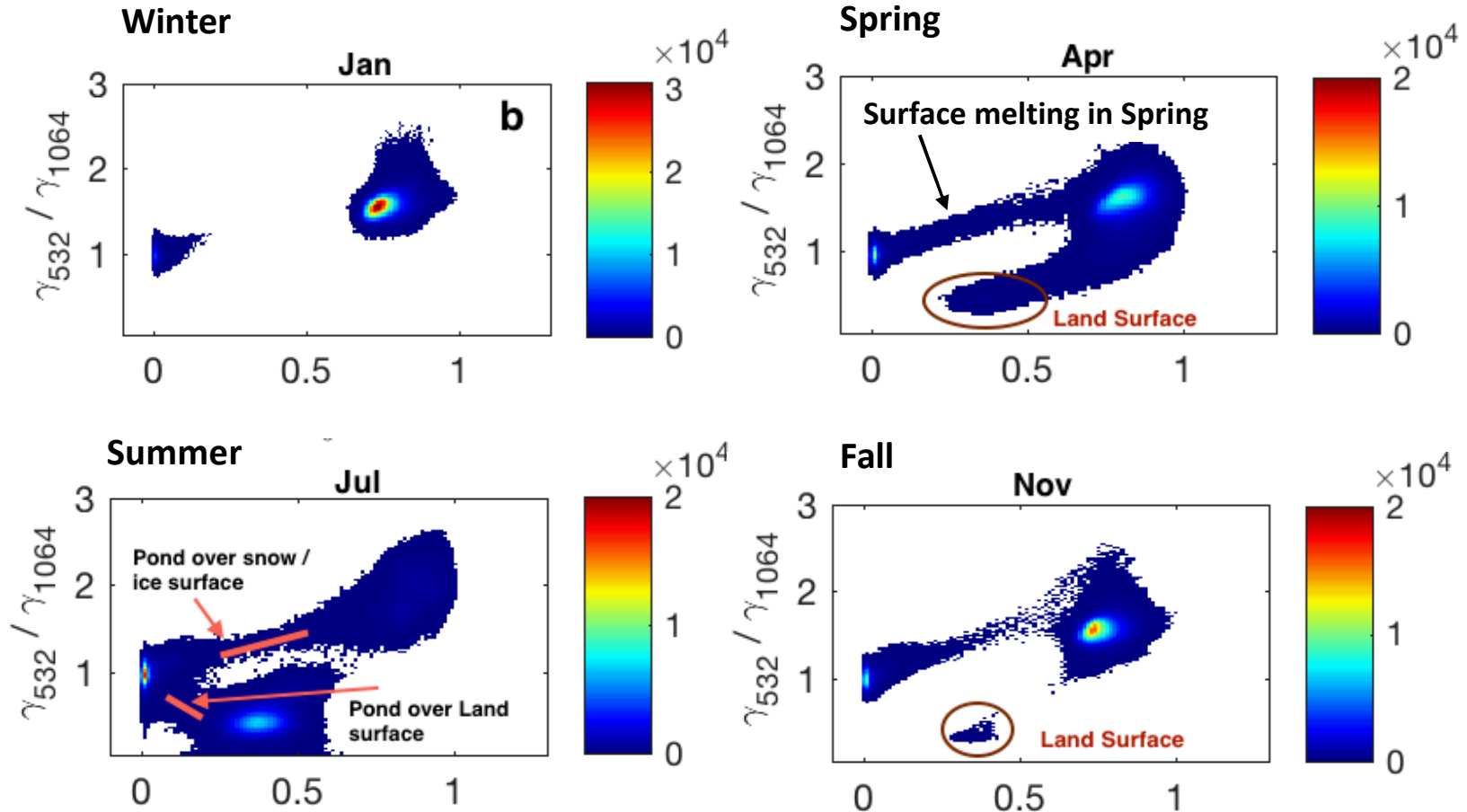
2. Surface type identification



2. Surface type identification



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3. Pond depth retrieval

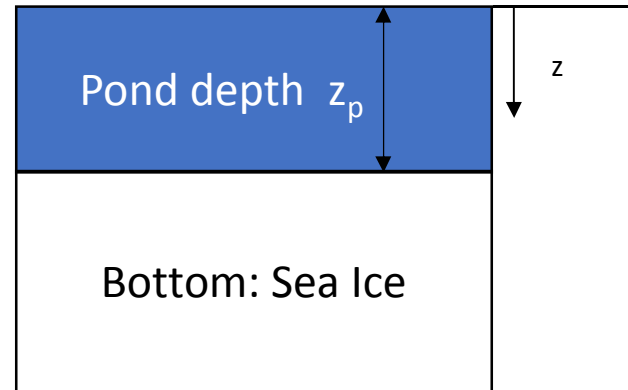
$$\gamma_{ice} = CT^2 \rho / \pi$$

Atmosphere



$$\gamma_{pond} = CT^2 \frac{t^2}{m^2} \frac{\rho}{\pi} \exp\left(-\frac{2\alpha z_p}{\cos\theta}\right)$$

Atmosphere



Pond depth

$$z_p = -\frac{\cos\theta}{2\alpha} \ln\left(\frac{m^2 \gamma_{pond}}{t^2 \gamma_{ice}}\right)$$

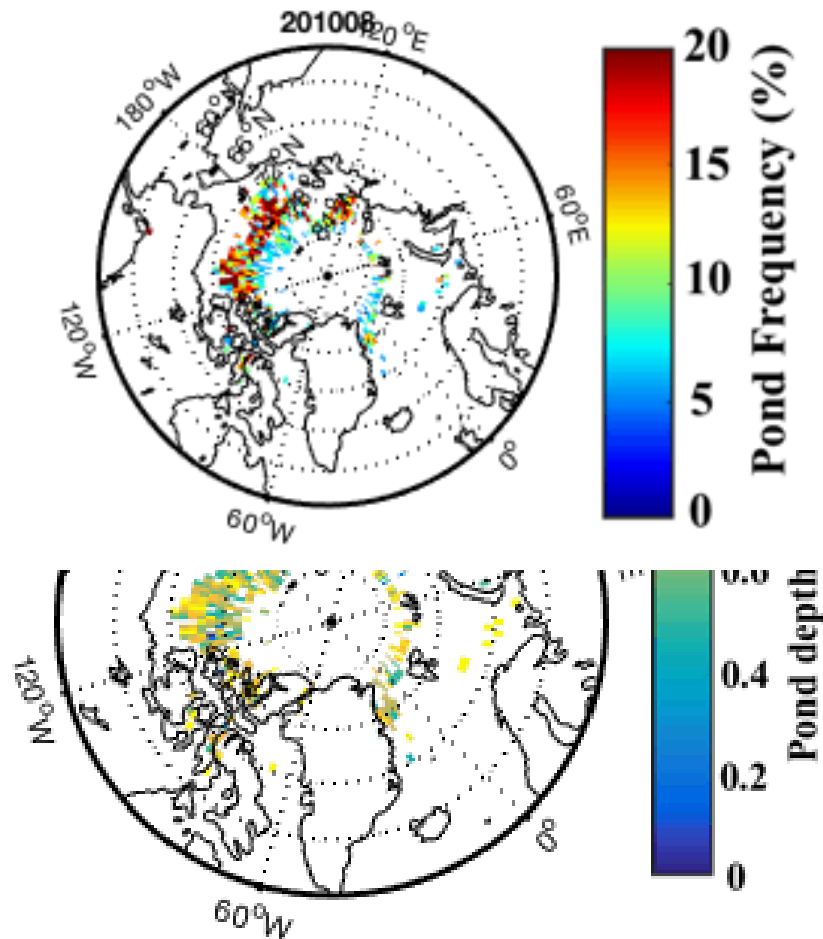
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Observed Pond frequency

Corresponding Pond depth



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- Validate the pond depth
- Pond fraction vs. Cloud Cover fraction
- Pond fraction vs. Sea ice area/extent decline

Any Question?