

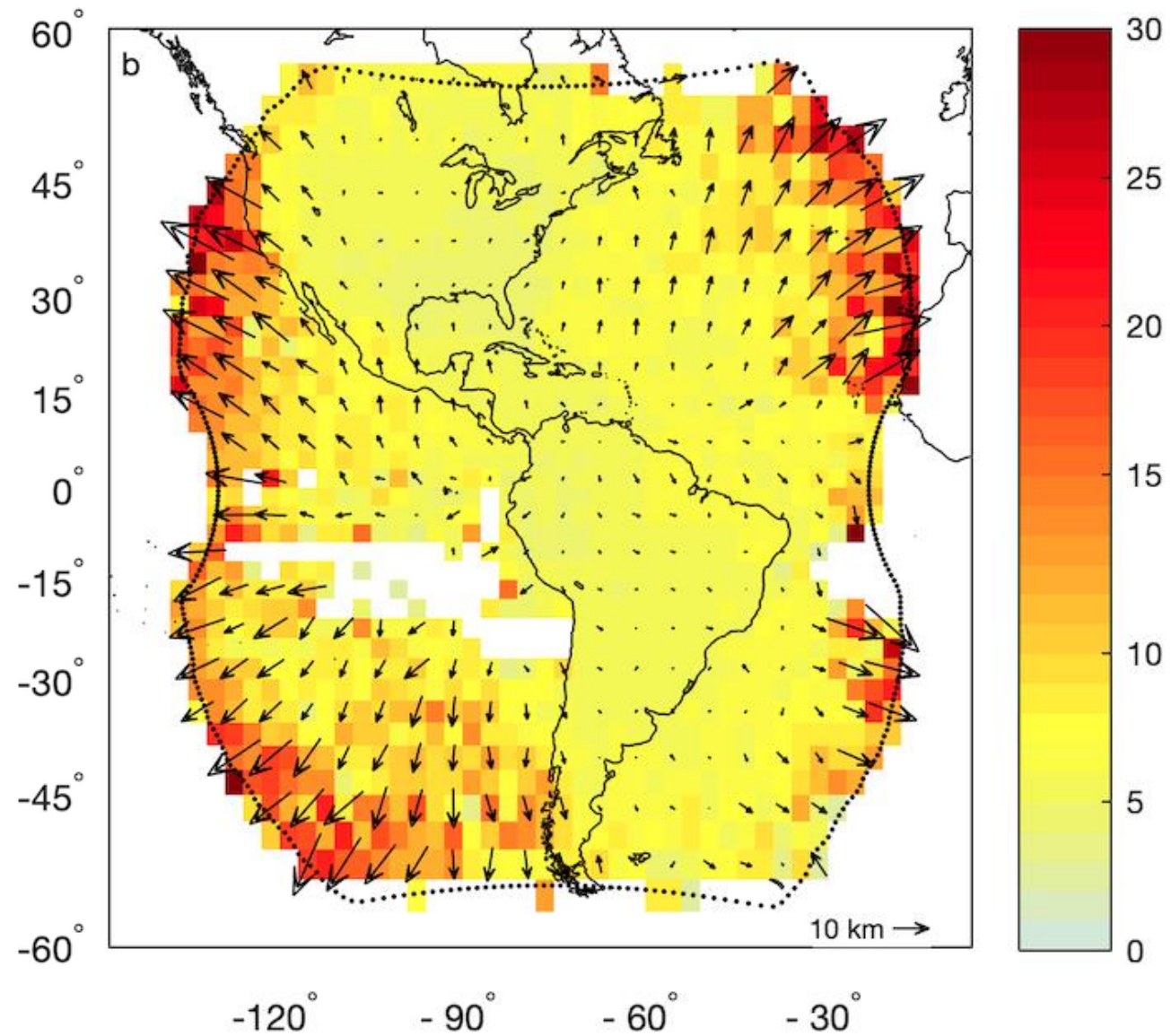
# Performance of the Optimal Estimated Detection Height for G16

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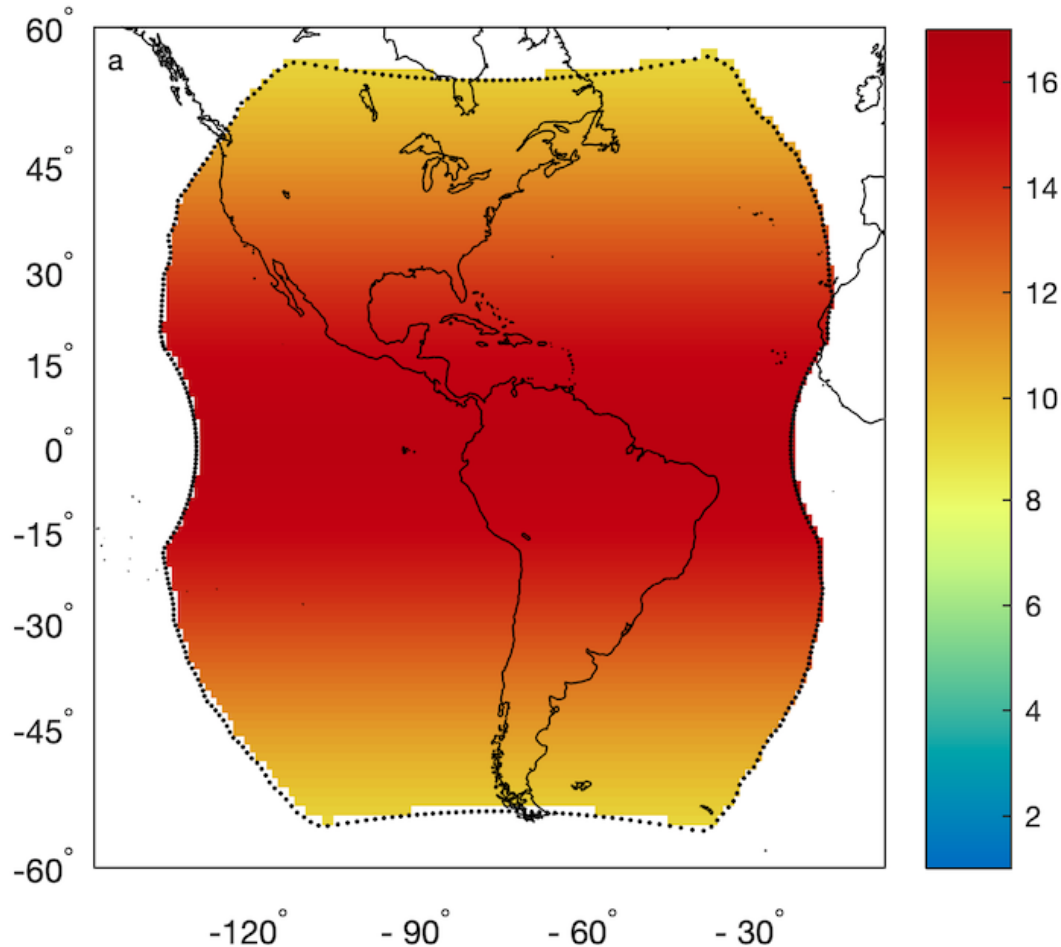
2019 GLM Science Team Meeting

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# Motivation: Large location errors near GLM limb



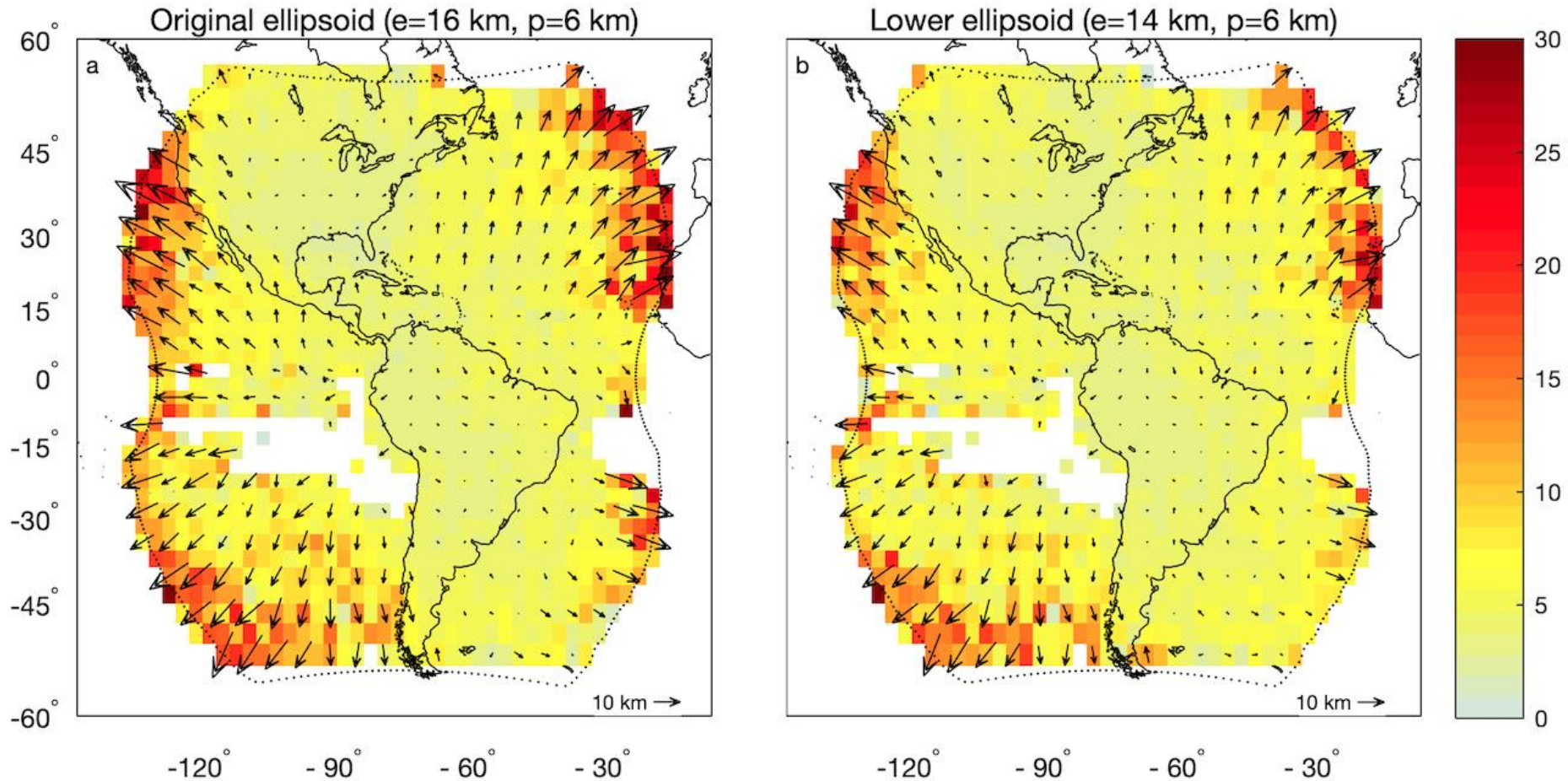
# Lightning ellipsoid



- Assumes GLM detects illumination at cloud top, approximated as:
  - Originally: 16 km (equator) and 6 km (poles)
  - As of fall 2018: 14 km and 6 km
- Lowest ellipsoid height in GLM FOV is ~9 km
- Produces location errors if:
  - Cloud top is below/above the ellipsoid
  - GLM observes side-cloud illumination or below-cloud lightning flashes

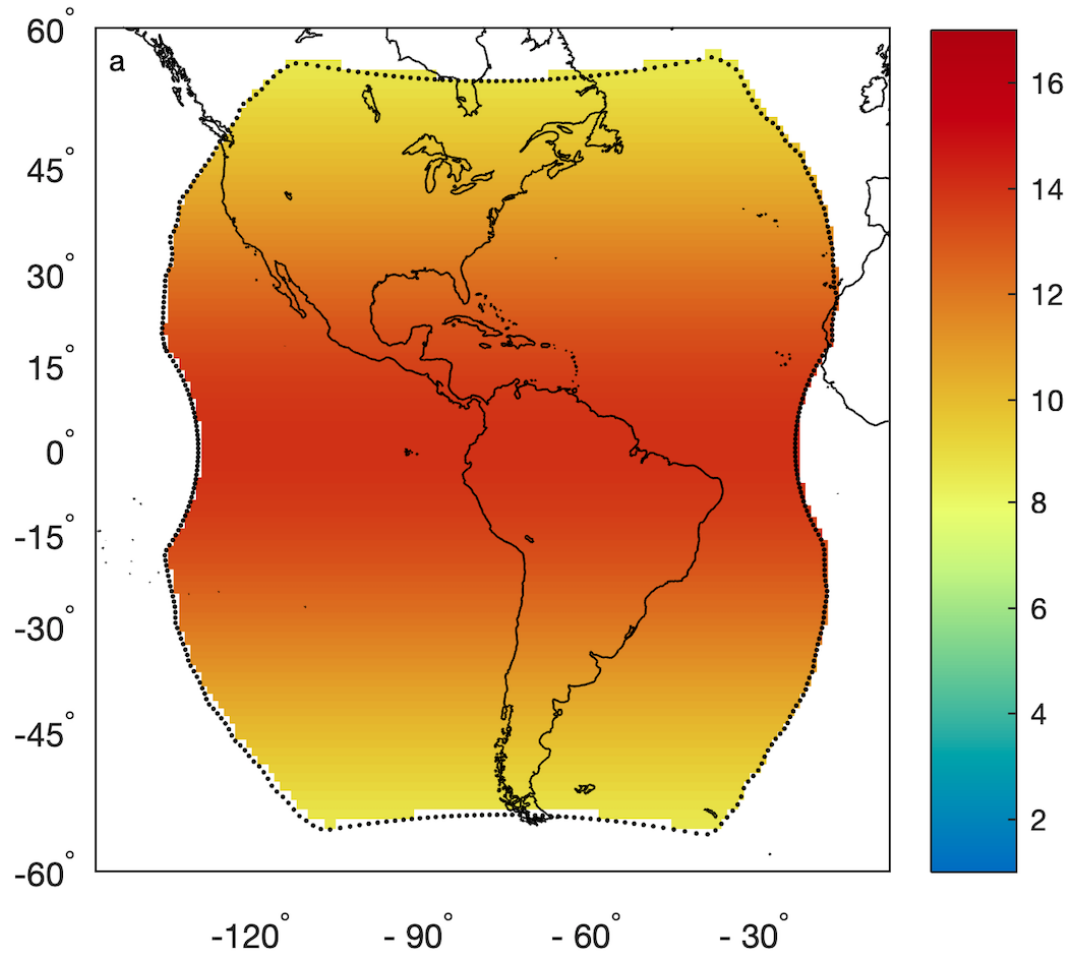
# Performance of optimal ellipsoid

GLM peak distance offset (km) for 2018-01-01 to 2018-12-31, using:



GLM groups are still too close to nadir → ellipsoid is generally too high

# Lightning ellipsoid limitations



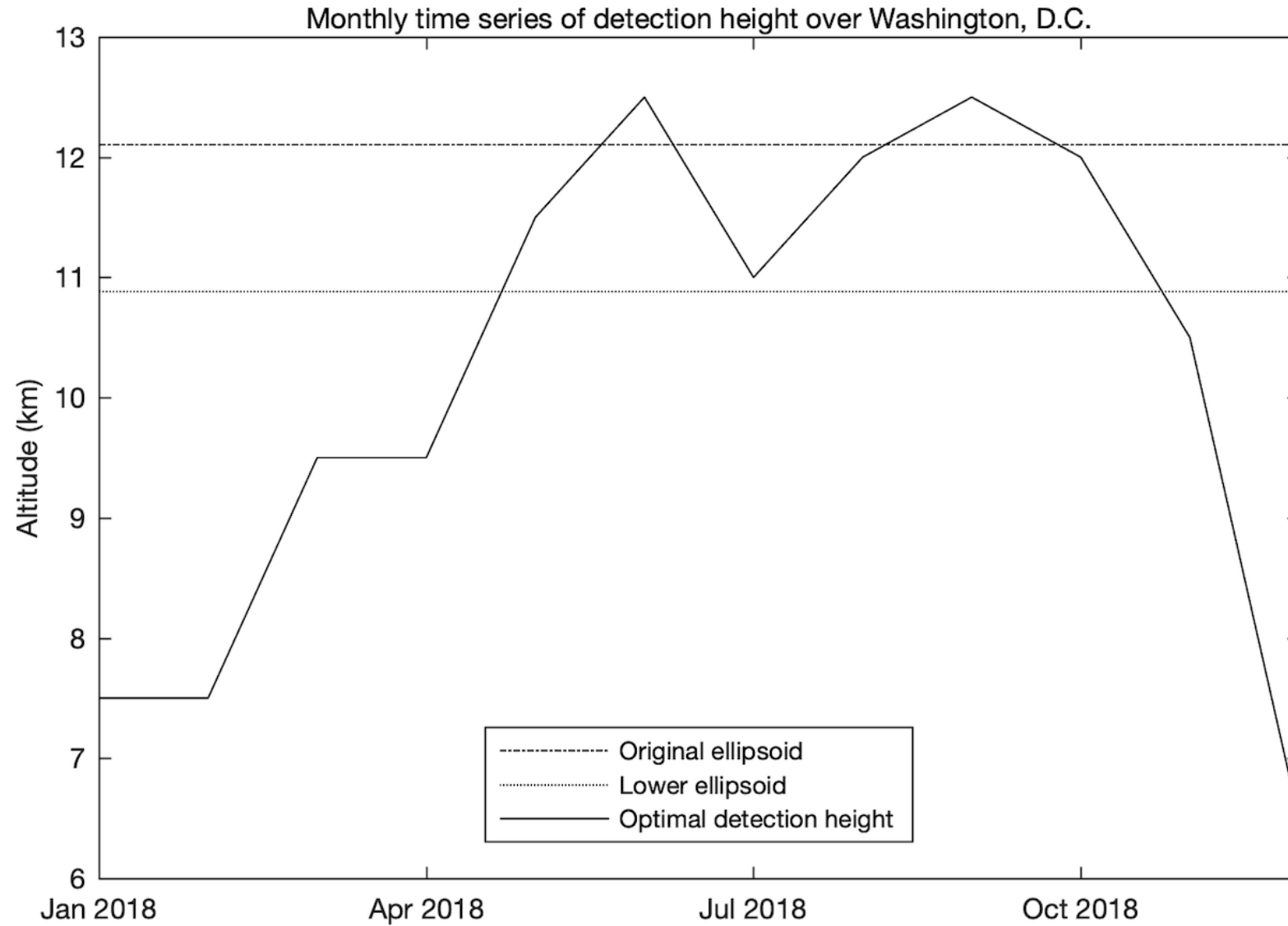
Assumes detection height varies only as function of latitude, not as a function of:

- Longitude
- Season
- Time of day
- Thunderstorm life cycle
- Regional differences including land/ocean
- Flash type

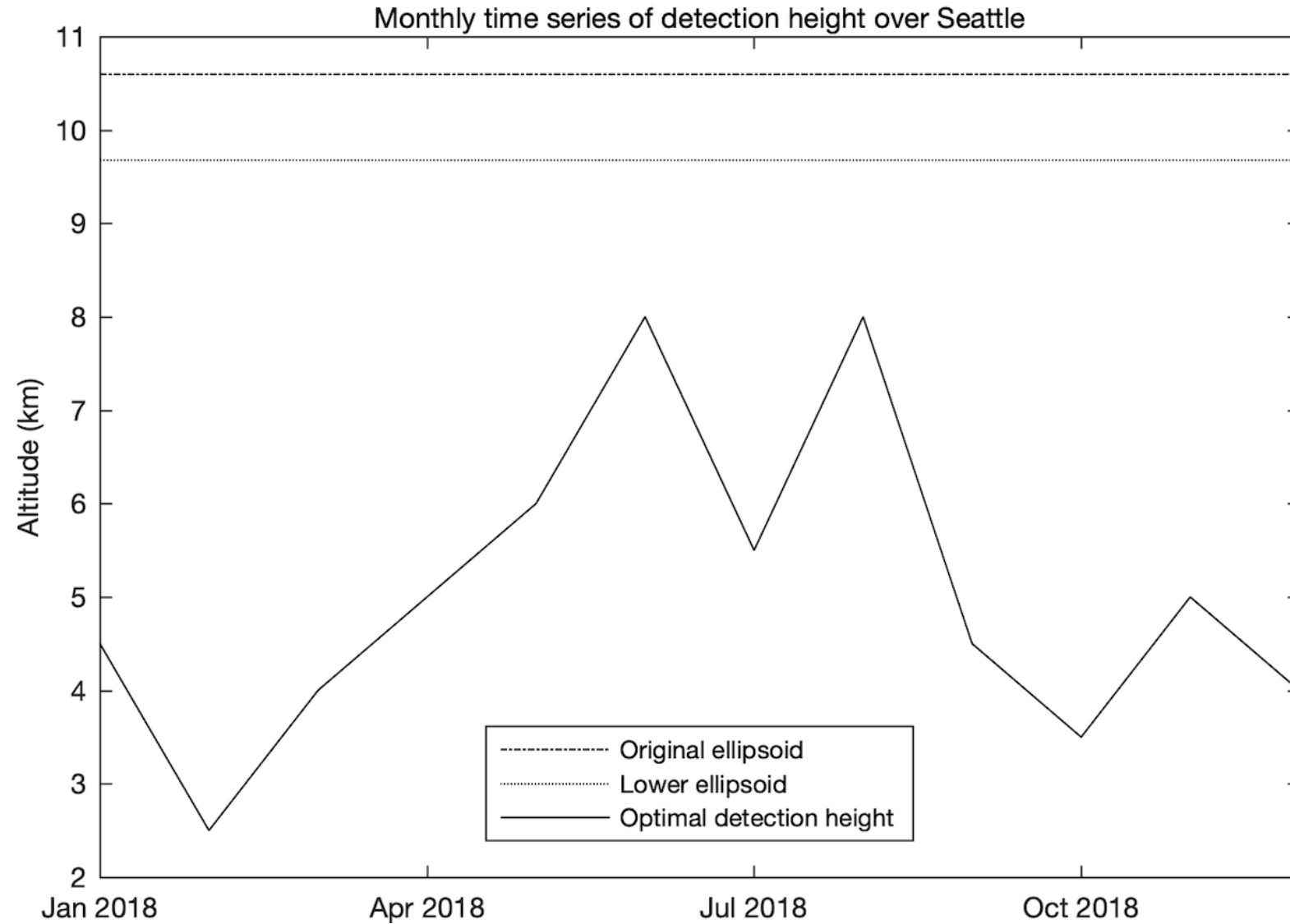
# What is the optimal detection height?

- Renavigate groups from  $(\text{lat}_1, \text{lon}_1)$  for  $(e_1, p_1)$  to  $(\text{lat}_2, \text{lon}_2)$  for  $(h_2, h_2)$ 
  - $h_2 = 1, 1.5, \dots, 17$  km
- Match renavigated GLM data with reference networks (ENGLN and GLD360)
- Identify  $h_2$  that produces smallest mean error for each grid box for each month

# What is the optimal detection height?

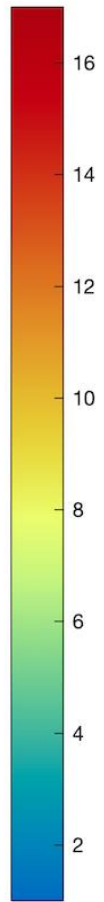
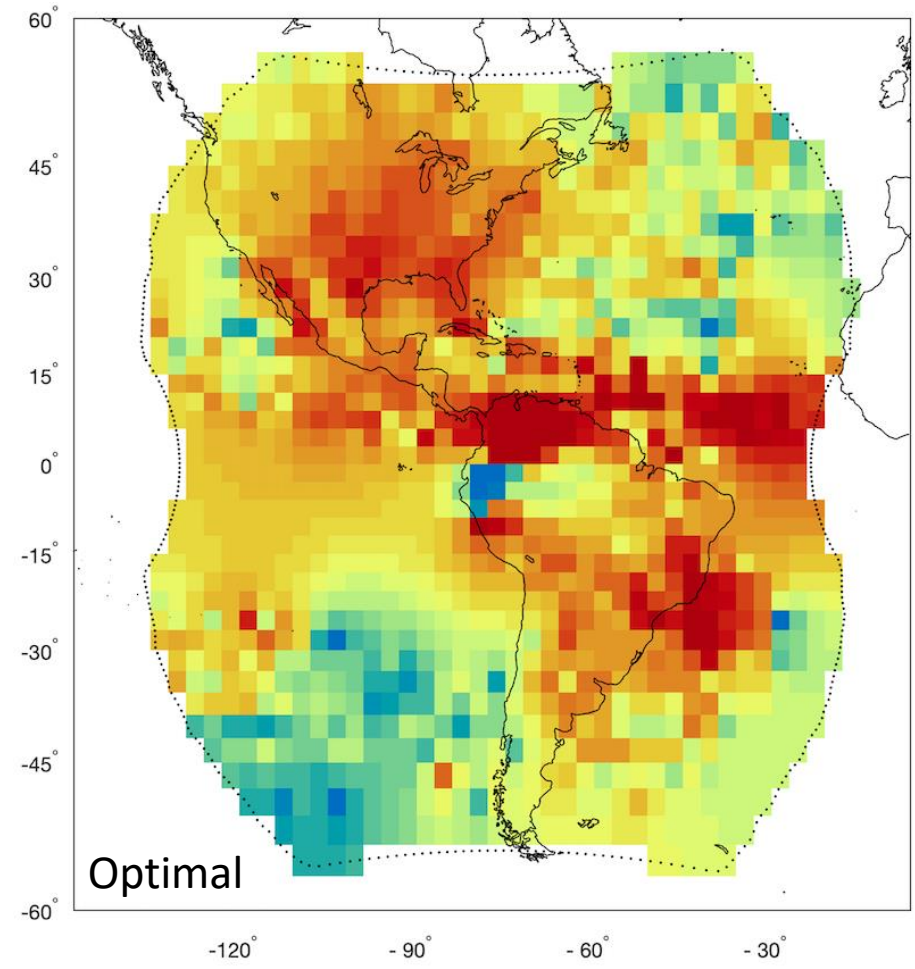
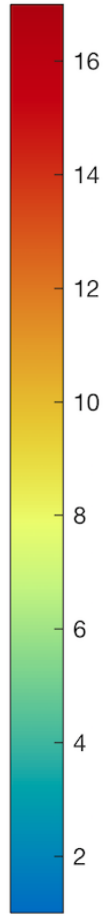
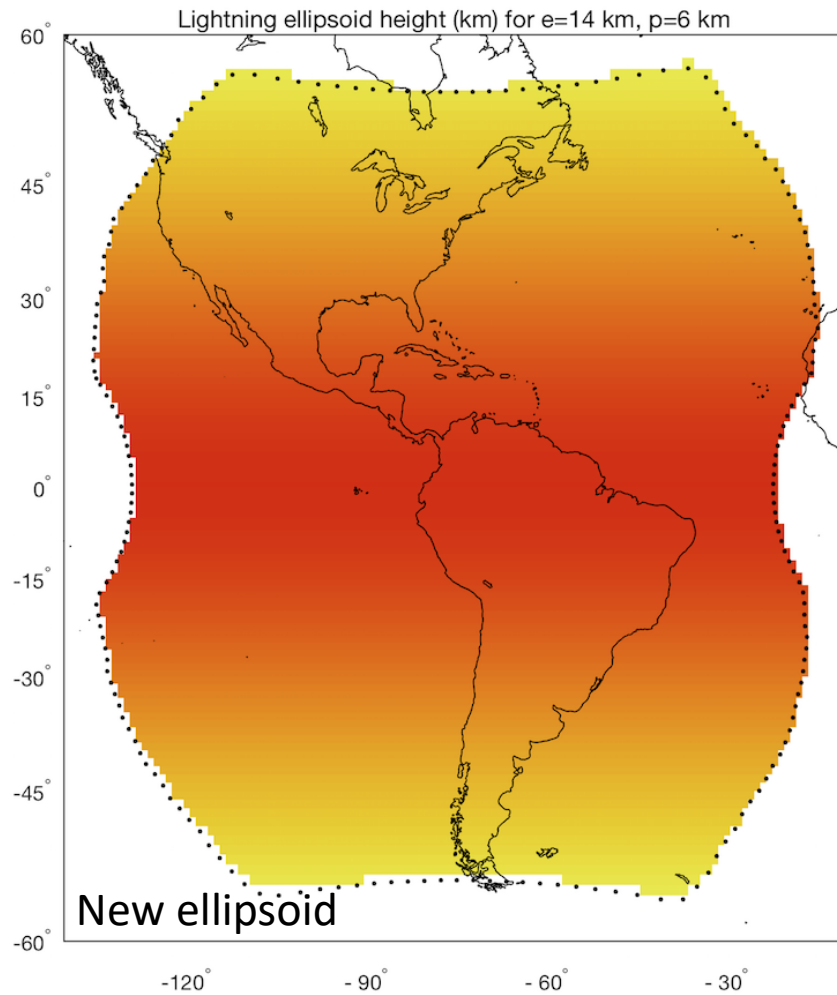


# What is the optimal detection height?



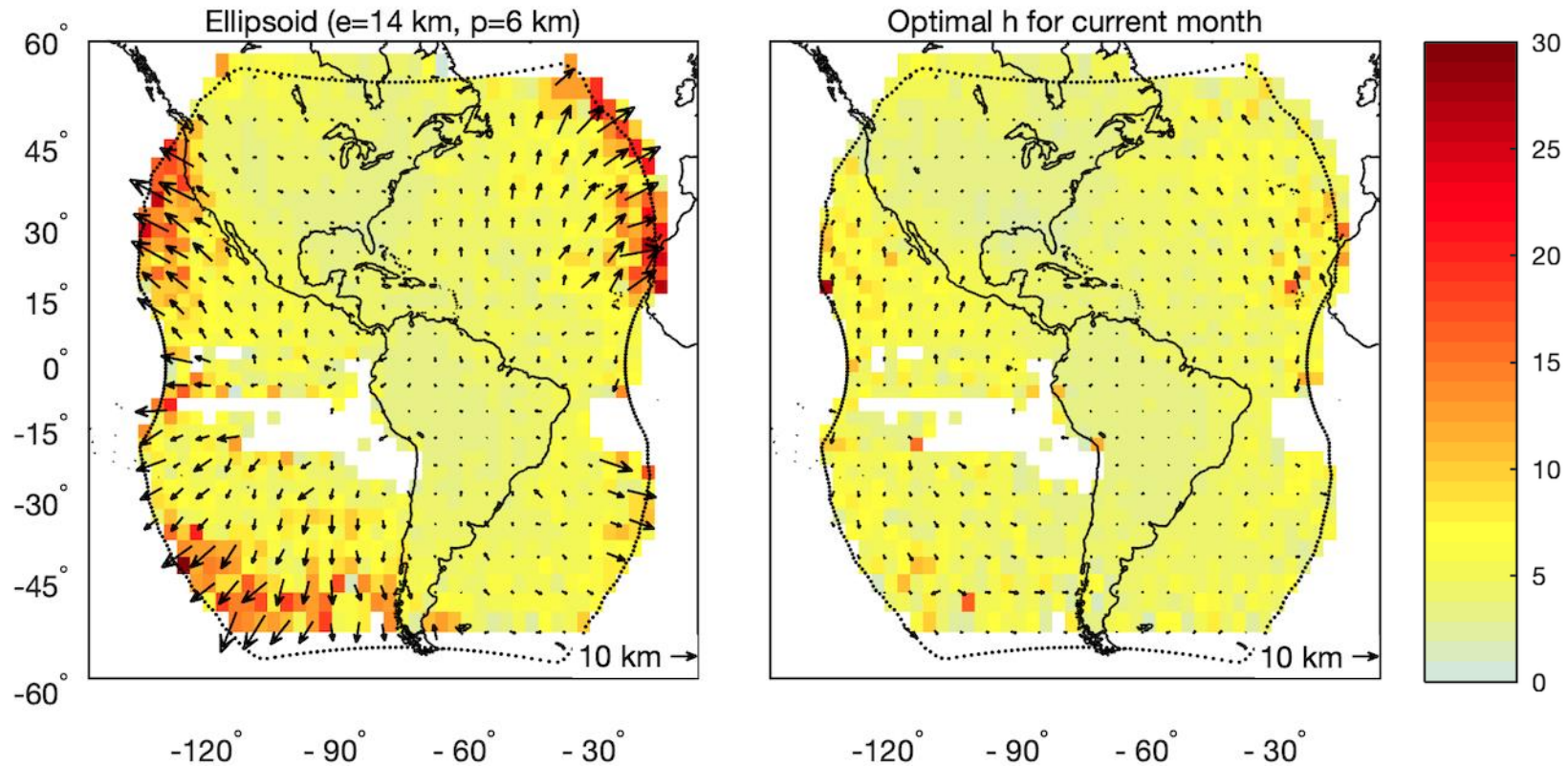


# Optimal detection height – August 2018



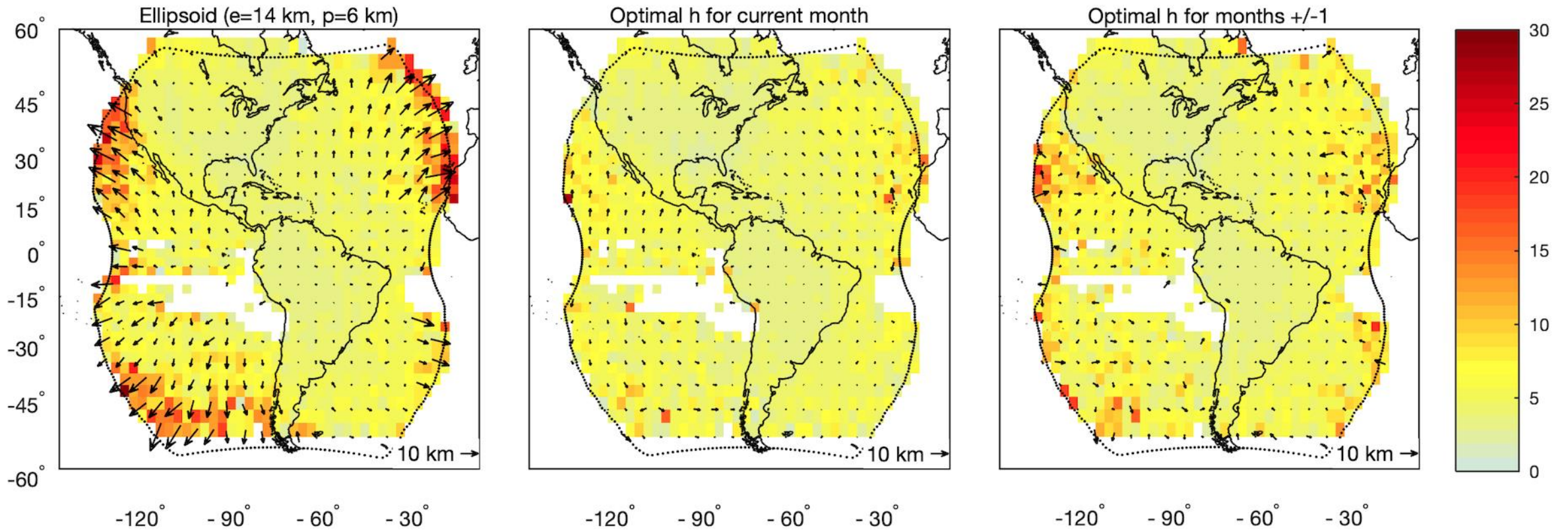
# Performance of optimal detection height

GLM peak distance offset (km) for 2018-01-01 to 2018-12-31

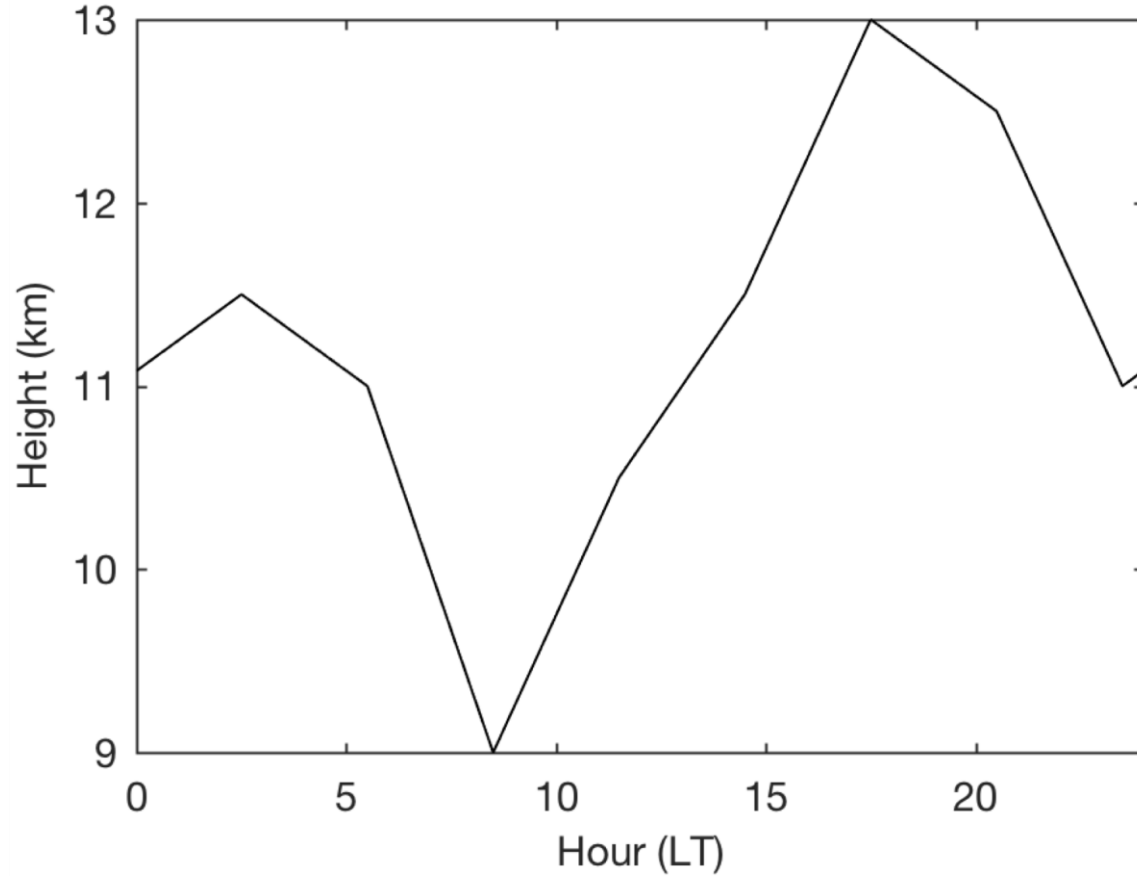


# Performance of optimal detection height

GLM peak distance offset (km) for 2018-01-01 to 2018-12-31, using:



# Other factors affecting detection height: Diurnal cycle



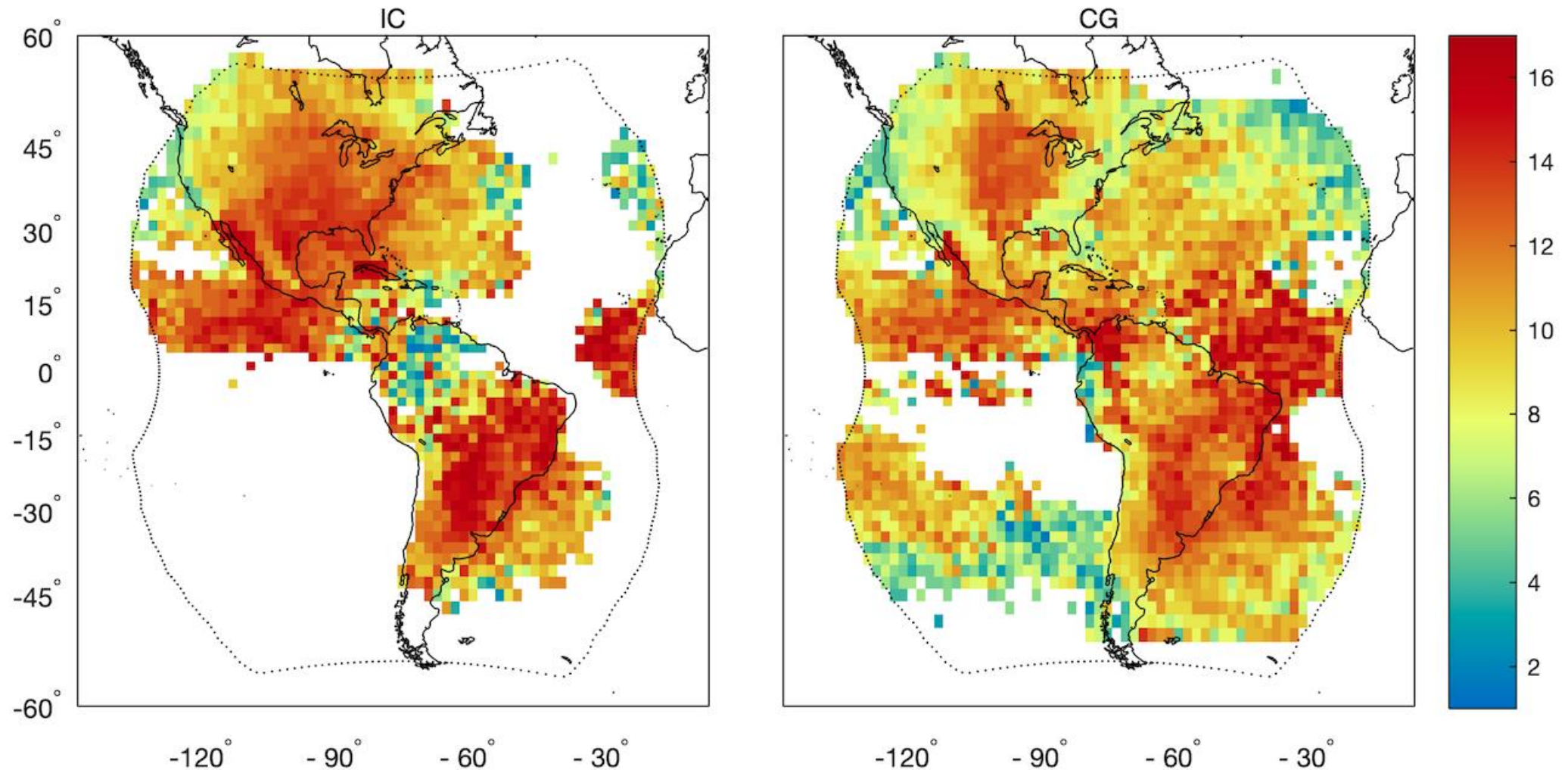
- 3-hourly optimal detection height for Washington, D.C. during August 2018
- Optimal detection height varies by ~4 km diurnally

# Other factors affecting detection height: Flash type

Assign GLM group type based on the “best match” ground network stroke type

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Assign GLM group type based on the “best match” ground network stroke type

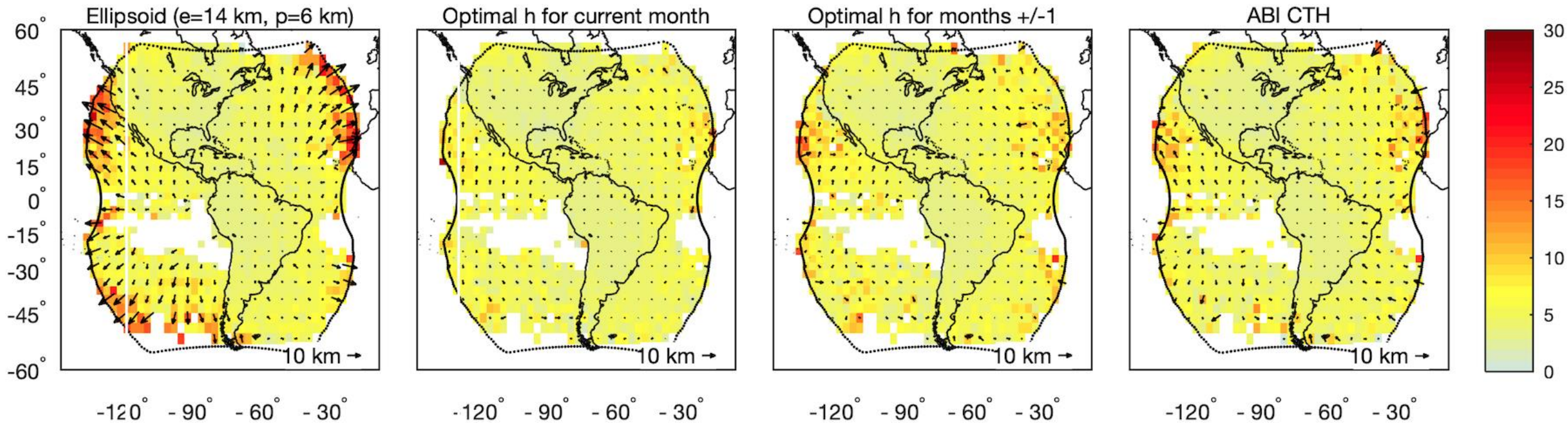


# What about using ABI cloud-top height?

- Renavigate GLM groups to the ABI fixed grid
- Extract ABI CTH associated with GLM group centroids
  - Use most recently completed full-disk CTH image
- Renavigate GLM groups using ABI CTH, then match with reference networks

# What about using ABI cloud-top height?

GLM peak distance offset (km) for 2018-01-01 to 2018-12-31, using:





# Conclusions

- Lightning ellipsoid used operationally displaces observations toward nadir; largest location errors near the limb
- Lower ellipsoid (e=14 km, p=6 km) was implemented in fall 2018
- Monthly optimal detection height maps are available that significantly improve location accuracy near the limb
- Further refinements possible for diurnal cycle and/or flash type

