Temporal variation on the spherical albedo of the Earth from EPIC images

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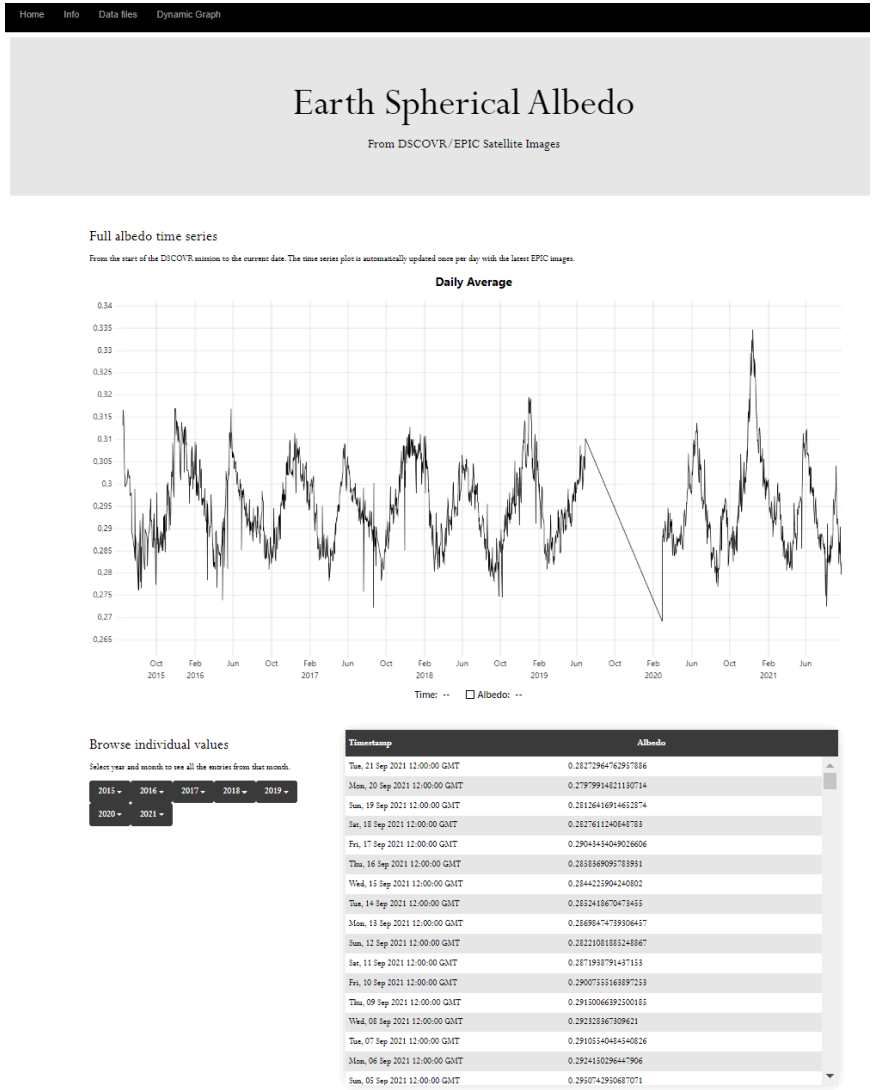
Introduction

- We are producing the shortwave spherical albedo of the Earth from EPIC images
- Daily averages are offered from June 2016 onwards, and the data is updated daily
- The (shortwave) spherical (Bond) albedo of the Earth is the ratio between the reflected radiation from the Earth to the incident radiation on the Earth's disk
- Annual average of spherical albedo is estimated to be 29.5% ± 0.8%

Web interface to the albedo data



See https://albedo.physics.helsinki.fi/

Graphs and tabular data of the daily albedo

Technical details

- Python-scripts running once per day, fetching the latest EPIC images, running the analysis, and updating the website
- For each EPIC image, compute the albedo of every pixel
  - Get land/ocean category from IGBP map
  - Run custom cloud detection for each pixel
    - Cloud detection done using channels 325, 551, and 780 nm in logistic regression model
    - Separate models for land and ocean pixels
  - Use CERES ADM models to convert EPIC radiances into integrated ToA albedos
    - Simplified and interpolated ADM tables for [1] clear land, [2] clear ocean, and [3] cloud-covered surface, observed close to backscattering
  - Average over Earth's disk
  - Correct with current Earth-Sun distance

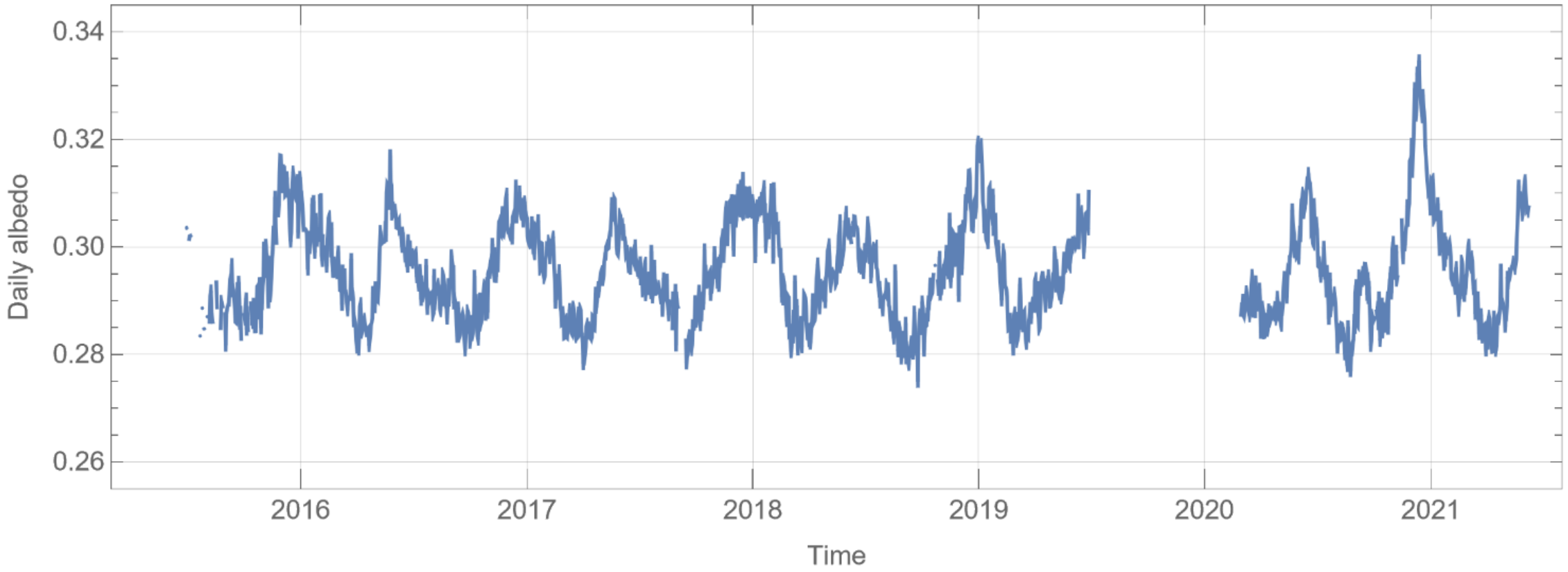
For the daily average albedo

- Average over EPIC albedos over the day
- Filter out if too much missing data for that day — biased to only some parts of the Earth

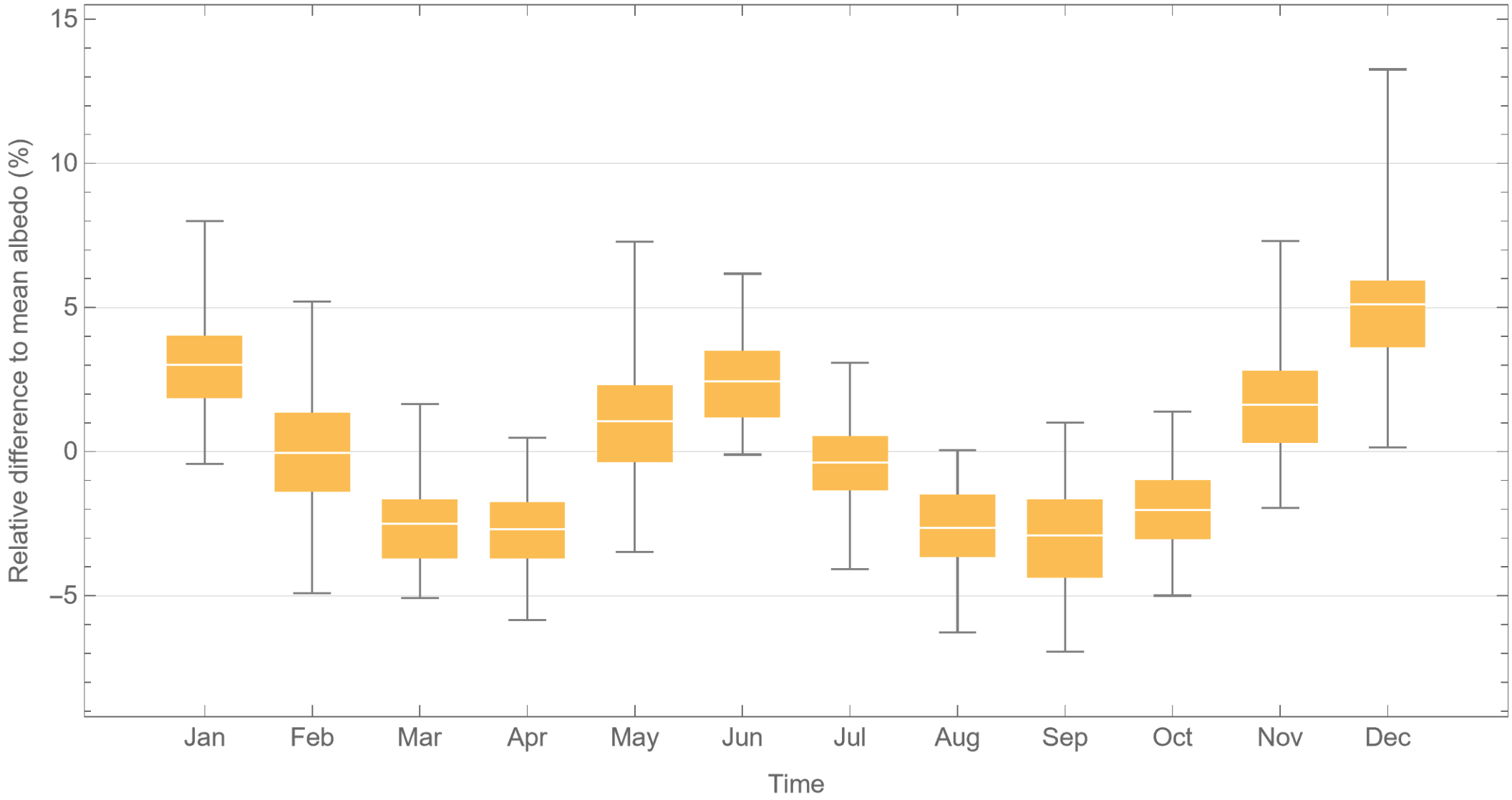
For the annual average albedo

- Average first over day-in-year — avoid bias due to different number of values in different years for some days
- Then, average over day-in-year to the get annual average albedo

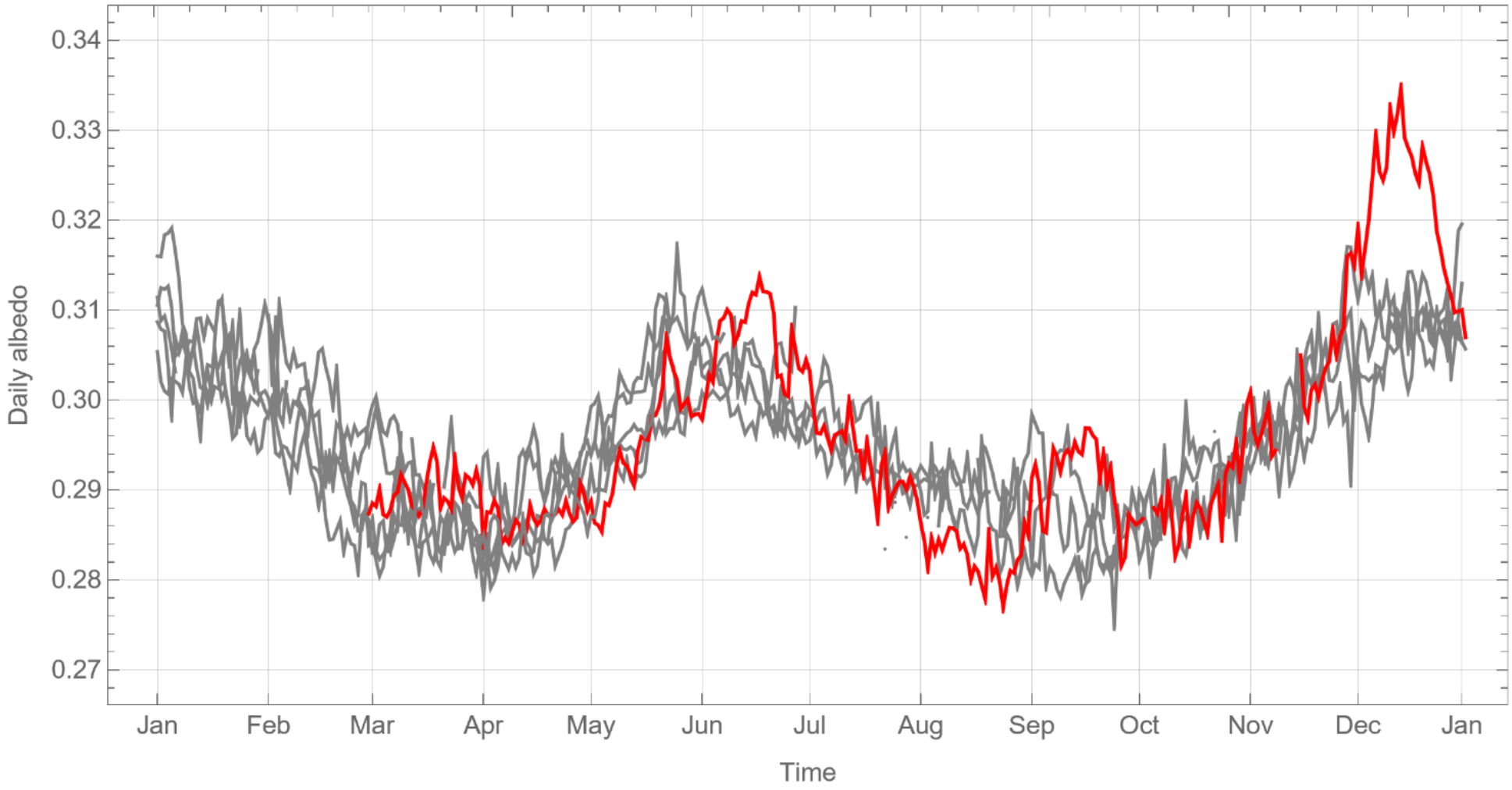
Result – time series of Earth's spherical albedo



Average variation over a year



Year 2020, especially January 2020

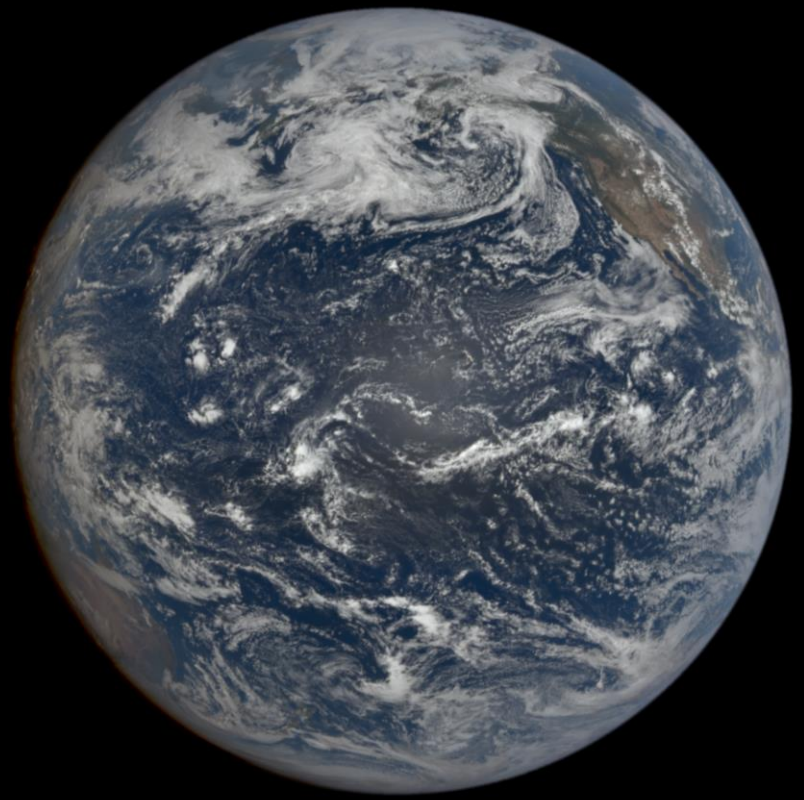


Red line – year 2020
Gray lines – other years

What is causing high or low albedo values

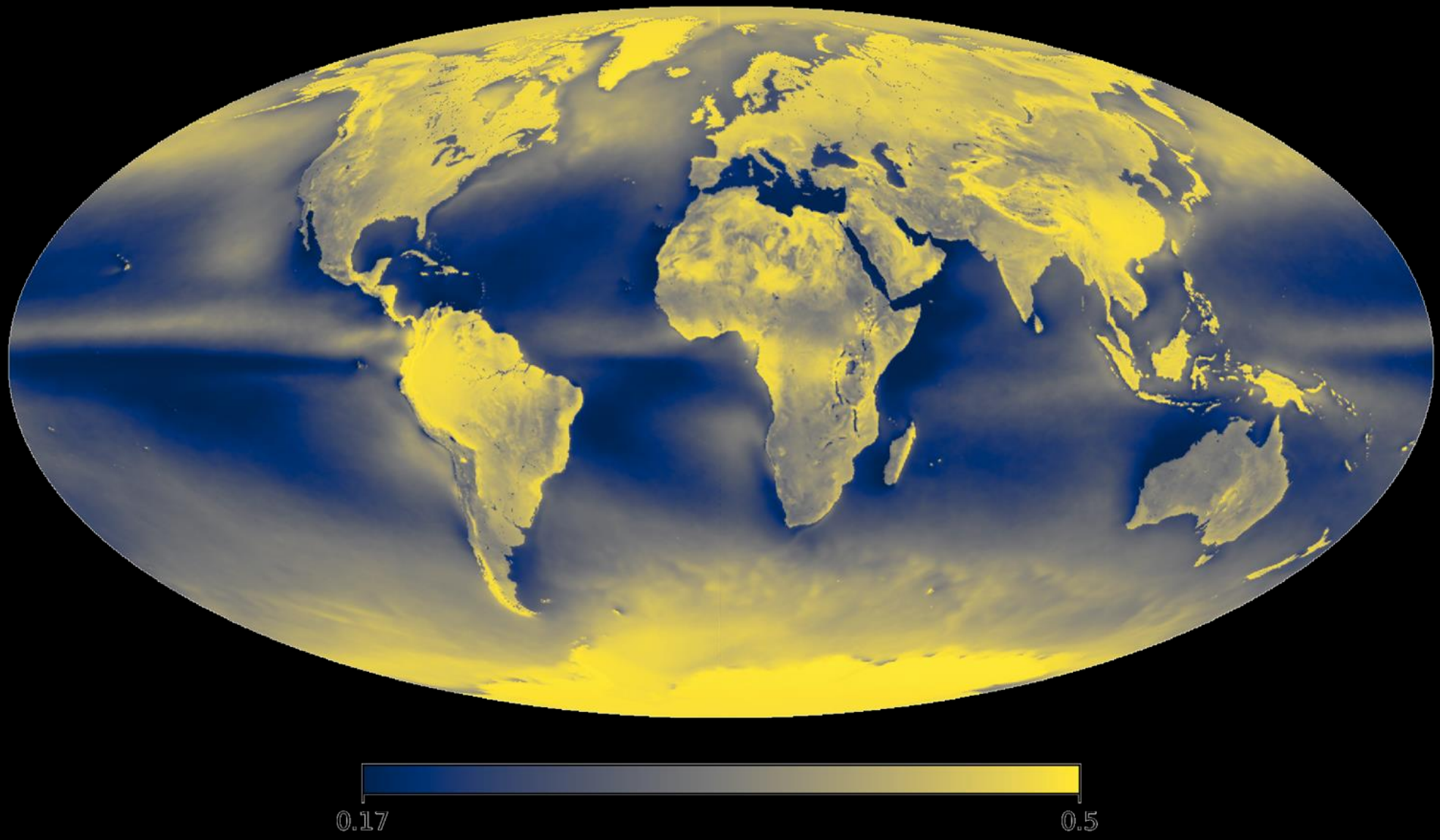
Highest albedo, 0.350 (2020-12-13 at 04:40 UCT)

Lowest albedo, 0.253 (2020-08-04 at 22:25 UCT)

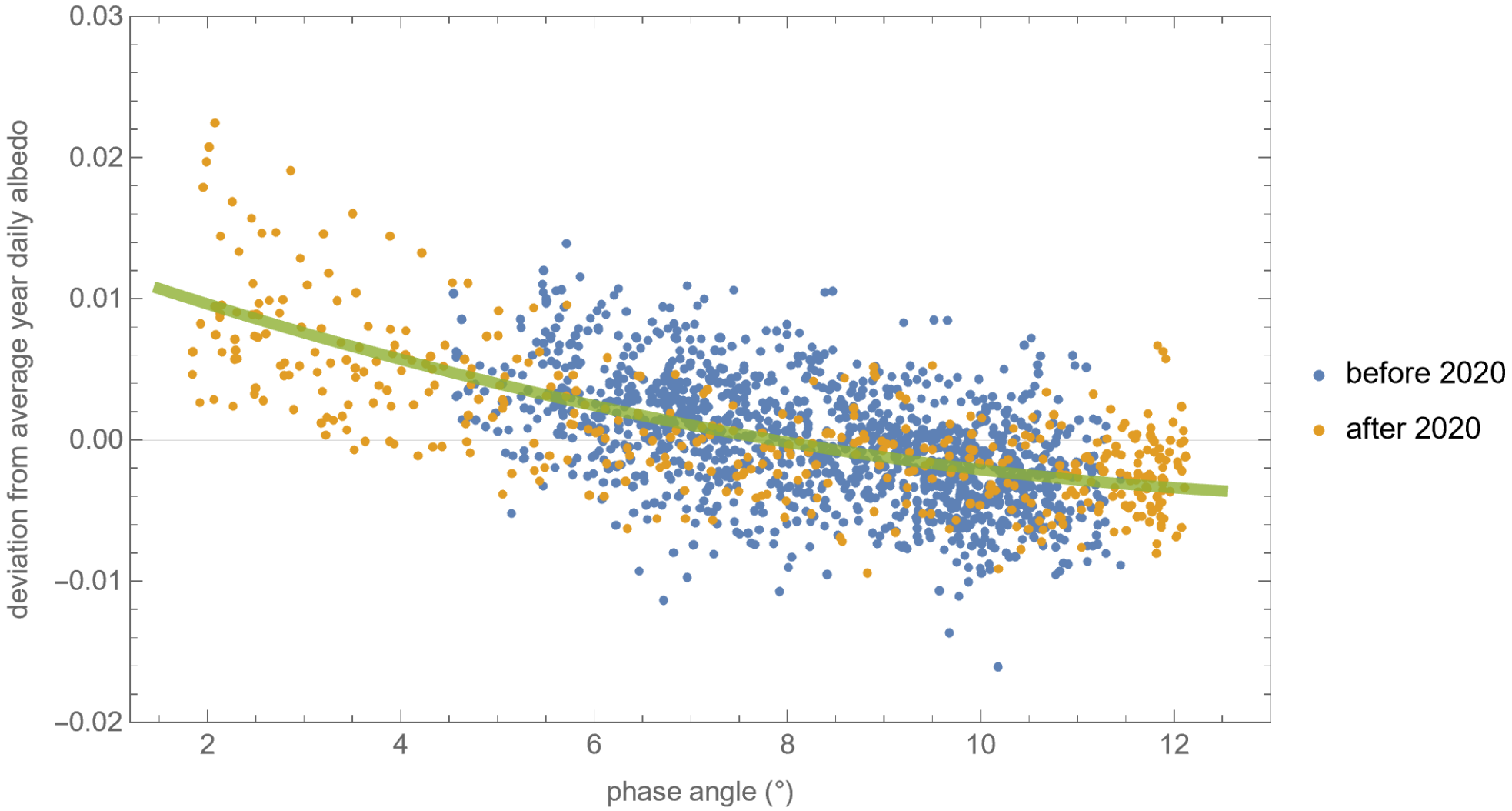


Short answer — clouds

Map of Earth’s average albedo over 2015–2021



Sun-EPIC phase angle can have influence on the derived albedo values



Thanks for you attention