

A cloudfree Europe with Sentinel-2

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An (almost) cloudfree ~~Europe~~ Earth with Sentinel-2

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Sentinel-2 basics

- 10 meter resolution
- 13 bands
- Sentinel-2A launched June 2015
- Sentinel-2B launched March 2017
- Full constellation:
 - 10 days revisiting time per satellite on equator
 - At least 5 days revisiting time on full constellation
 - Higher latitudes almost daily
- MGRS tiles (UTM projections)

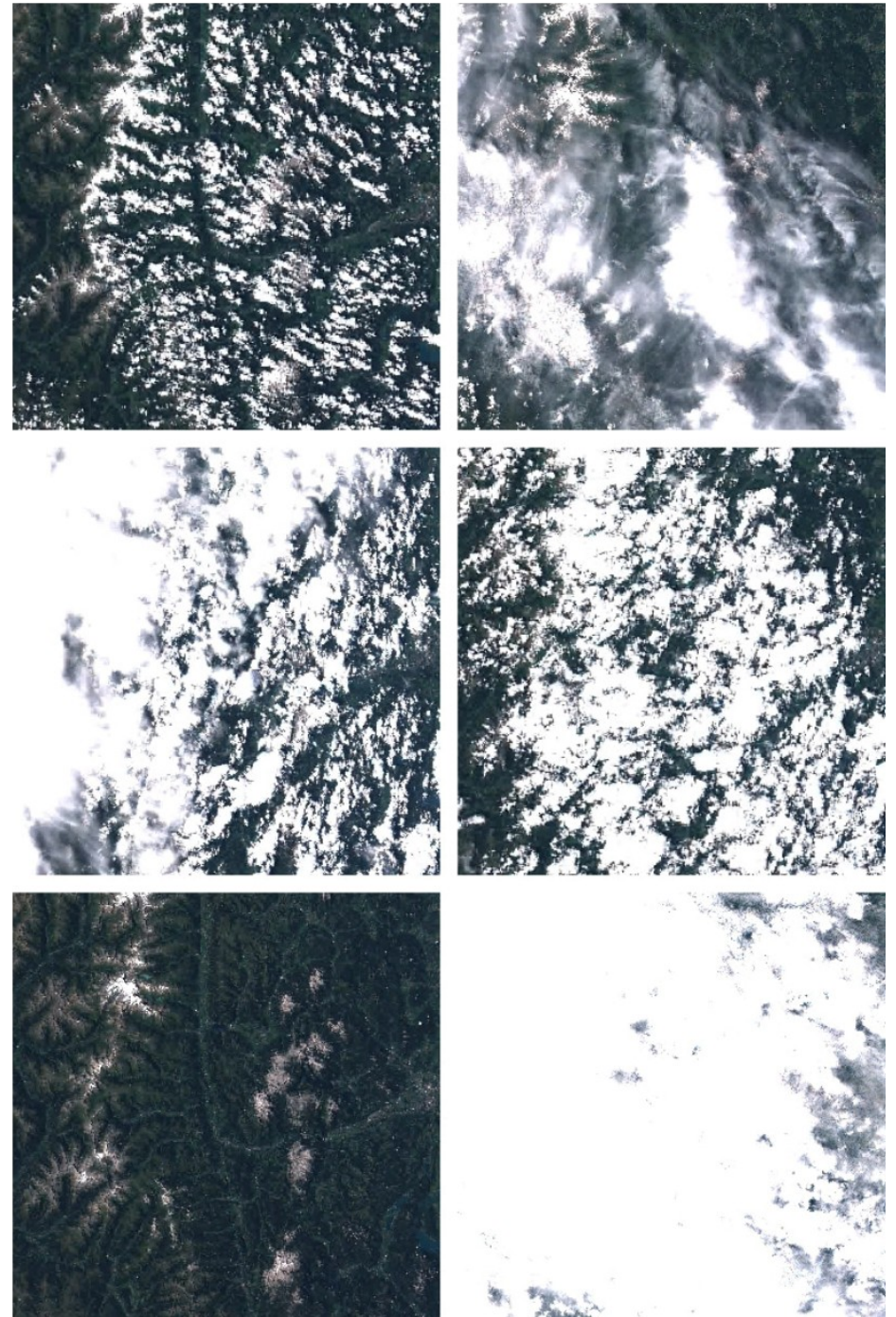
Cloudless mosaic

- Summer / high vegetation
- No clouds & cloud shadows
- seamless



Pixel selection

- Use cloud masks of ESA
- Build pixel stacks
- Sort pixels by brightness
- Third quartile (bright → dark)
- Take average to smooth out
- Alternatives tested: jenks & biggest gap clusters
- +/-
 - reasonably fast
 - prone to cloudmask errors



Atmospheric „correction“



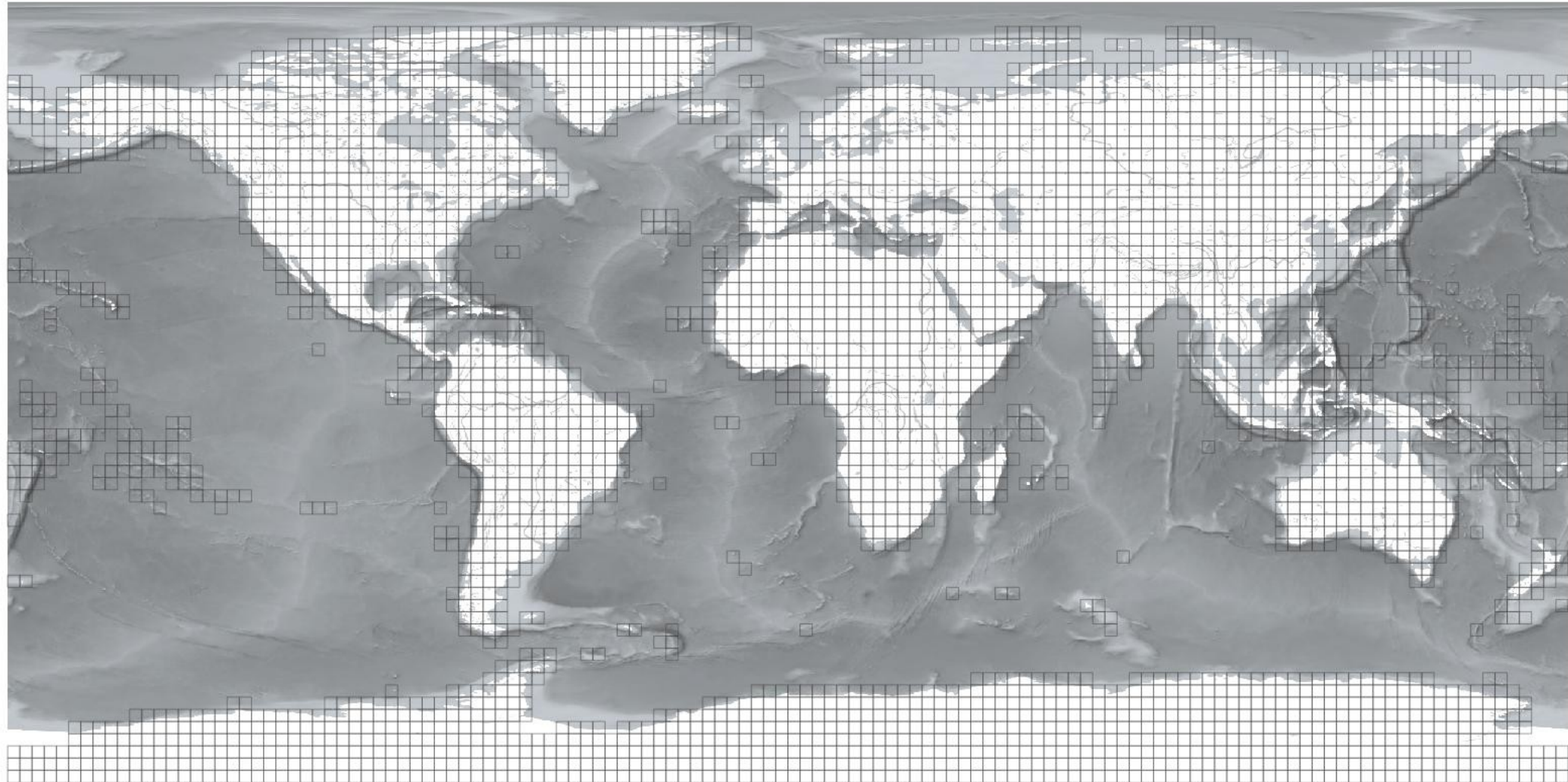
- Only Level-1C data available
- Processing Level-2A too costly
- Quickfix: stretching band values
- <https://www.planet.com/pulse/color-correction/>

Process

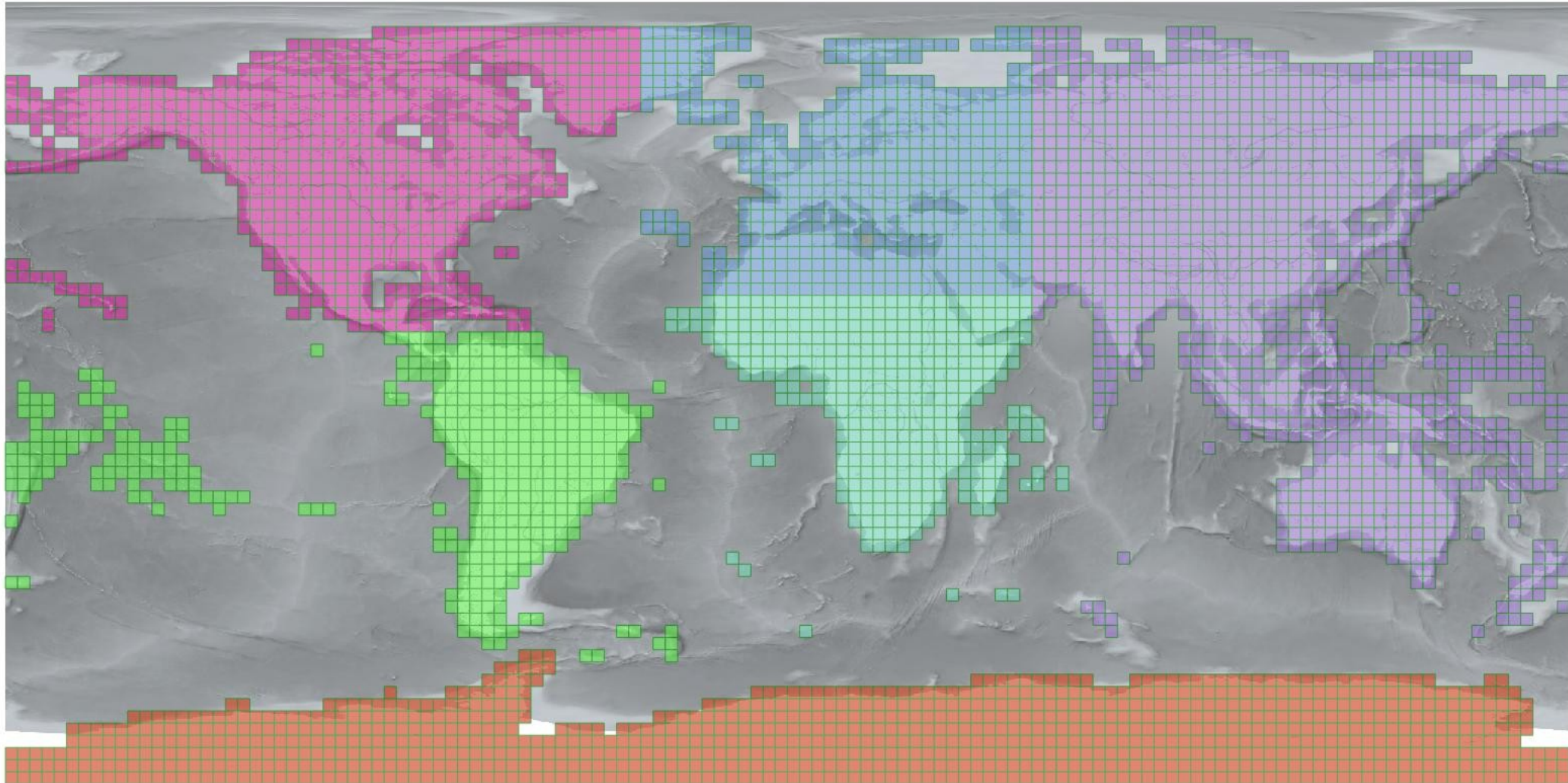


- Fully automated (no manual scene preselection)
- EC2 instances
- S3 bucket to store results
- Celery task queuing

Process zones



Process regions



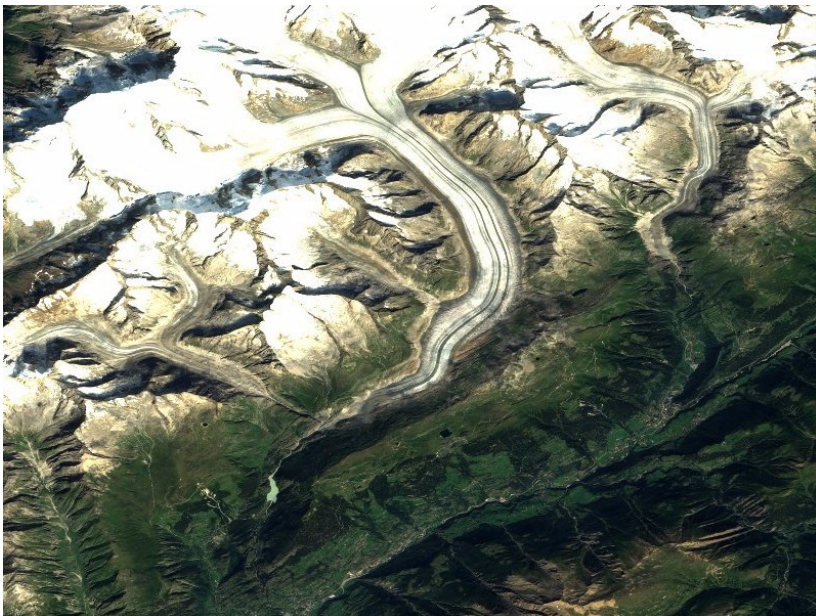
Process worker

- Get zone ID from queue
- Get data for each zone
- Read & reproject data as NumPy arrays (mapchete/Python)
- Extract pixels (orgonite/Cython)
- Upload result to bucket

Europe test run

- Processed in February 2017
- ~2 weeks on ~20 EC2 instances
- data
 - May 2016 until September 2016
 - Only Sentinel-2A
- Release at Sentinel-2B launch event in March
- <https://s2maps.eu/>

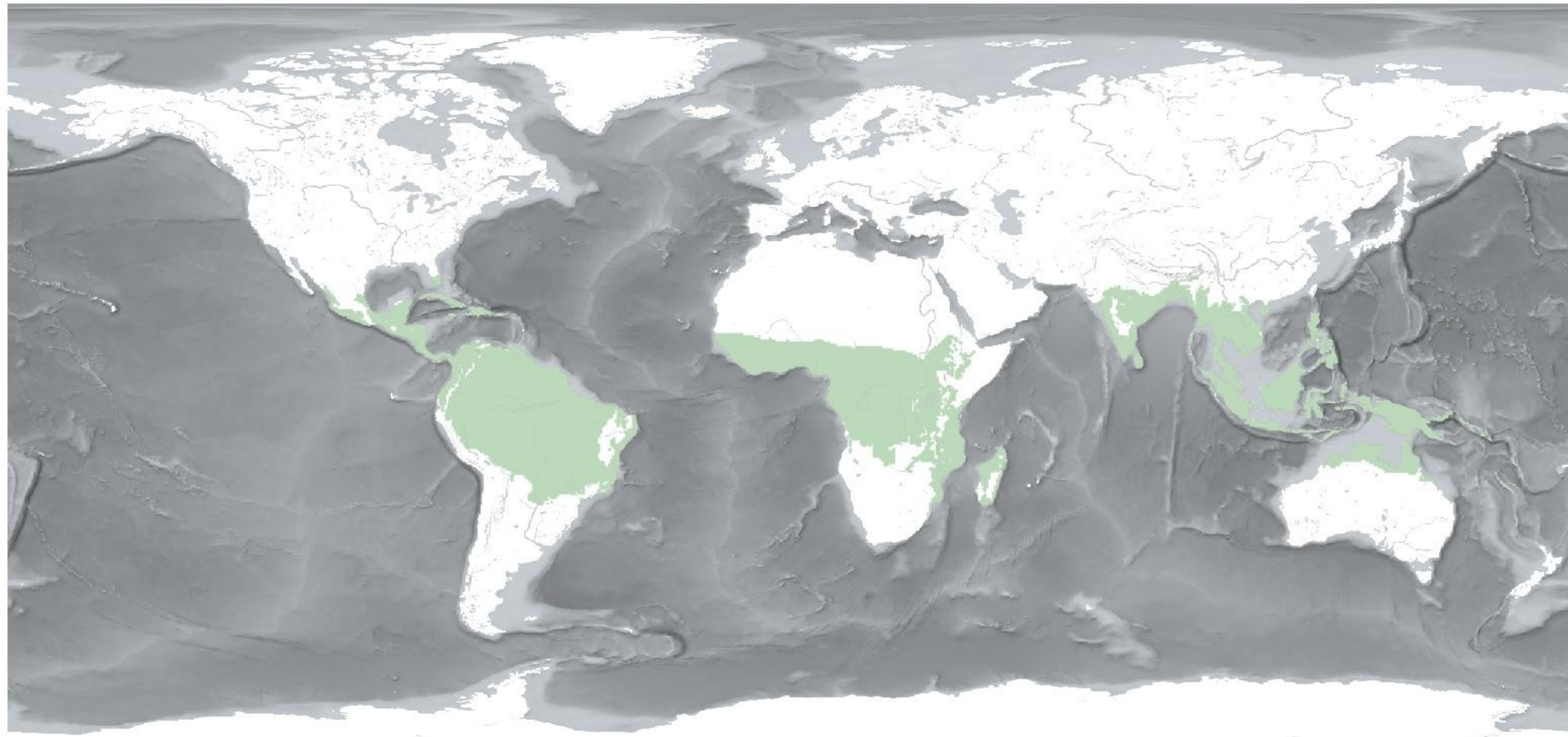




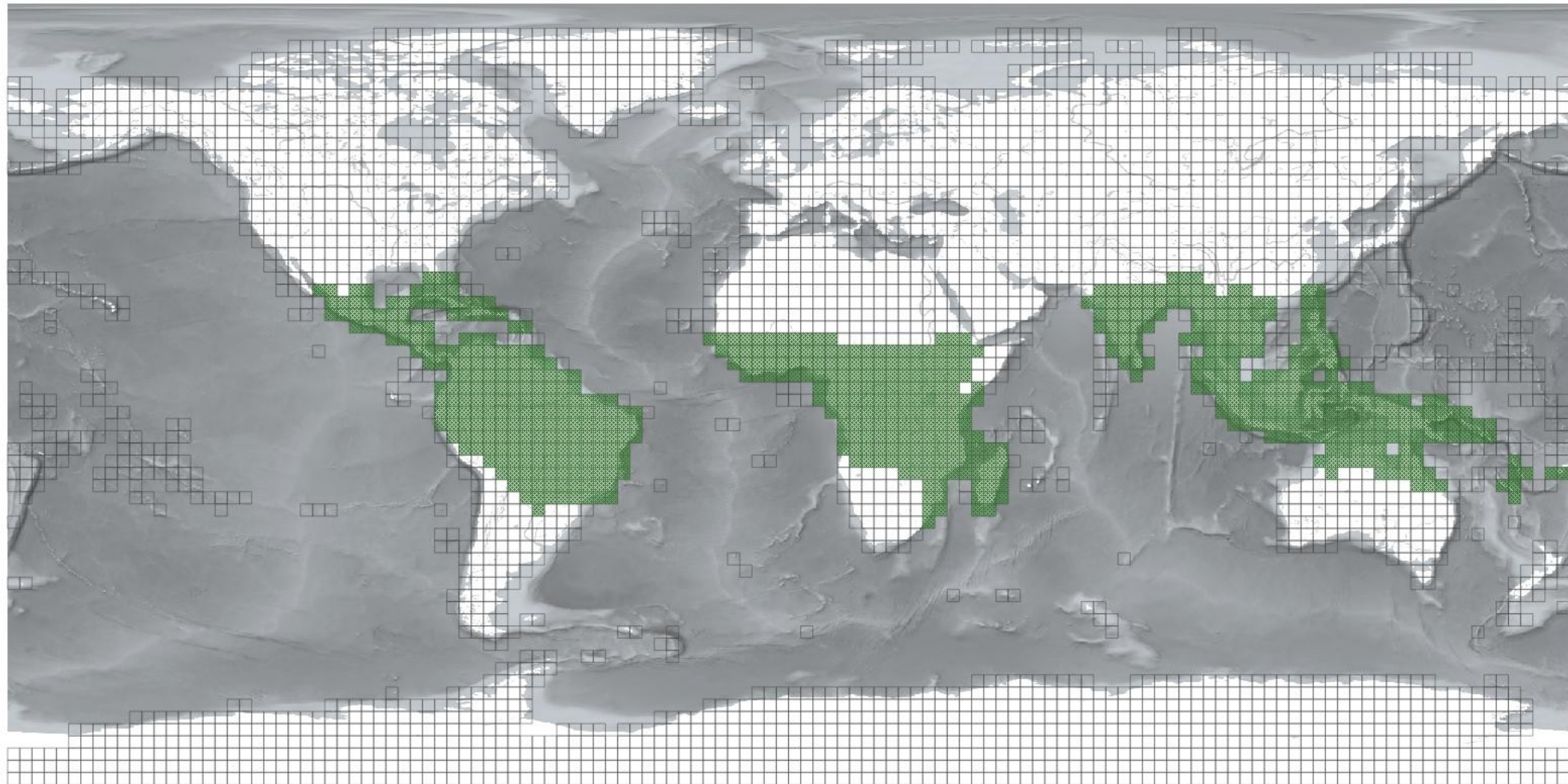


Next: the world

Tropical regions



Tropical regions

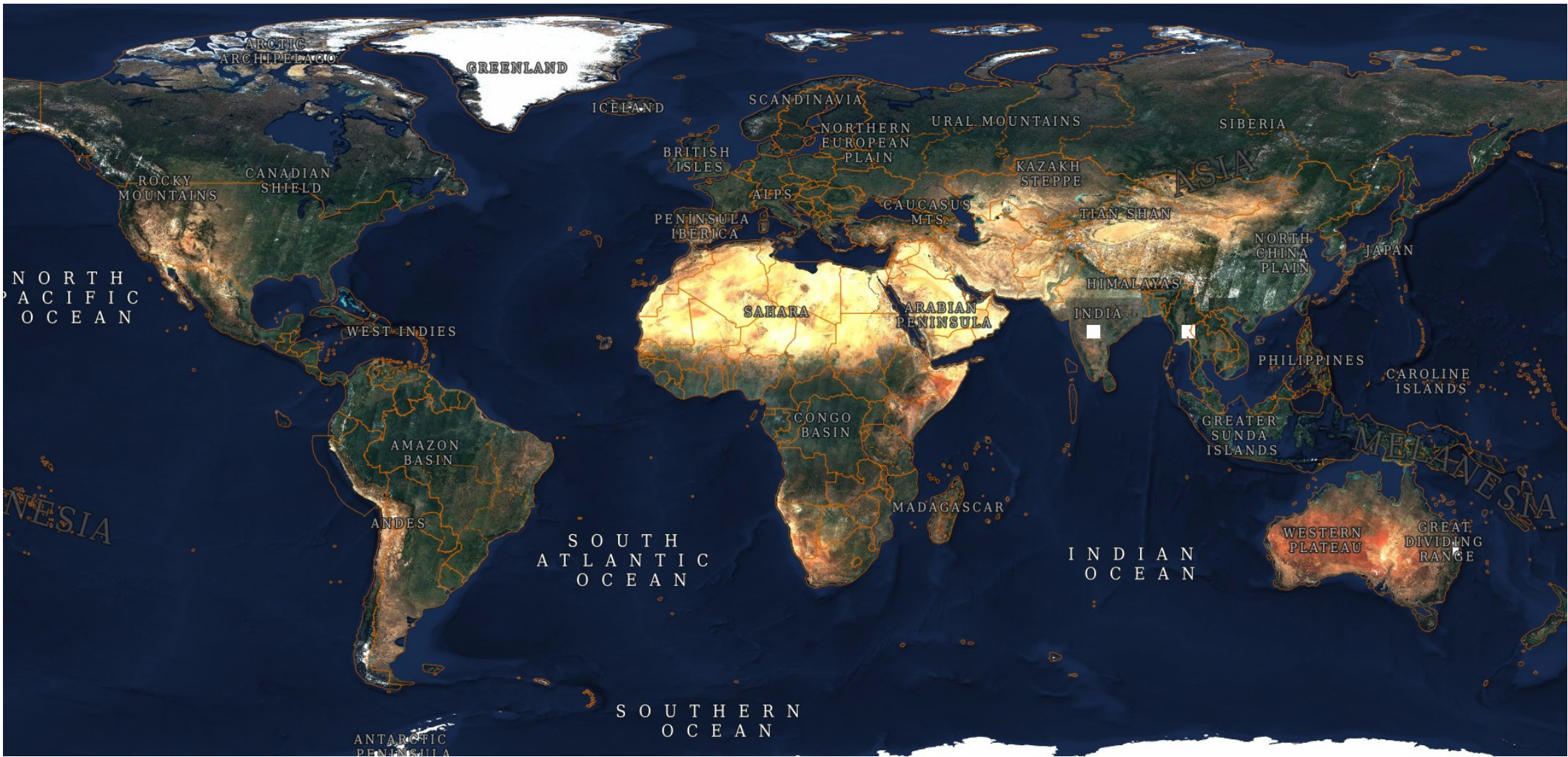


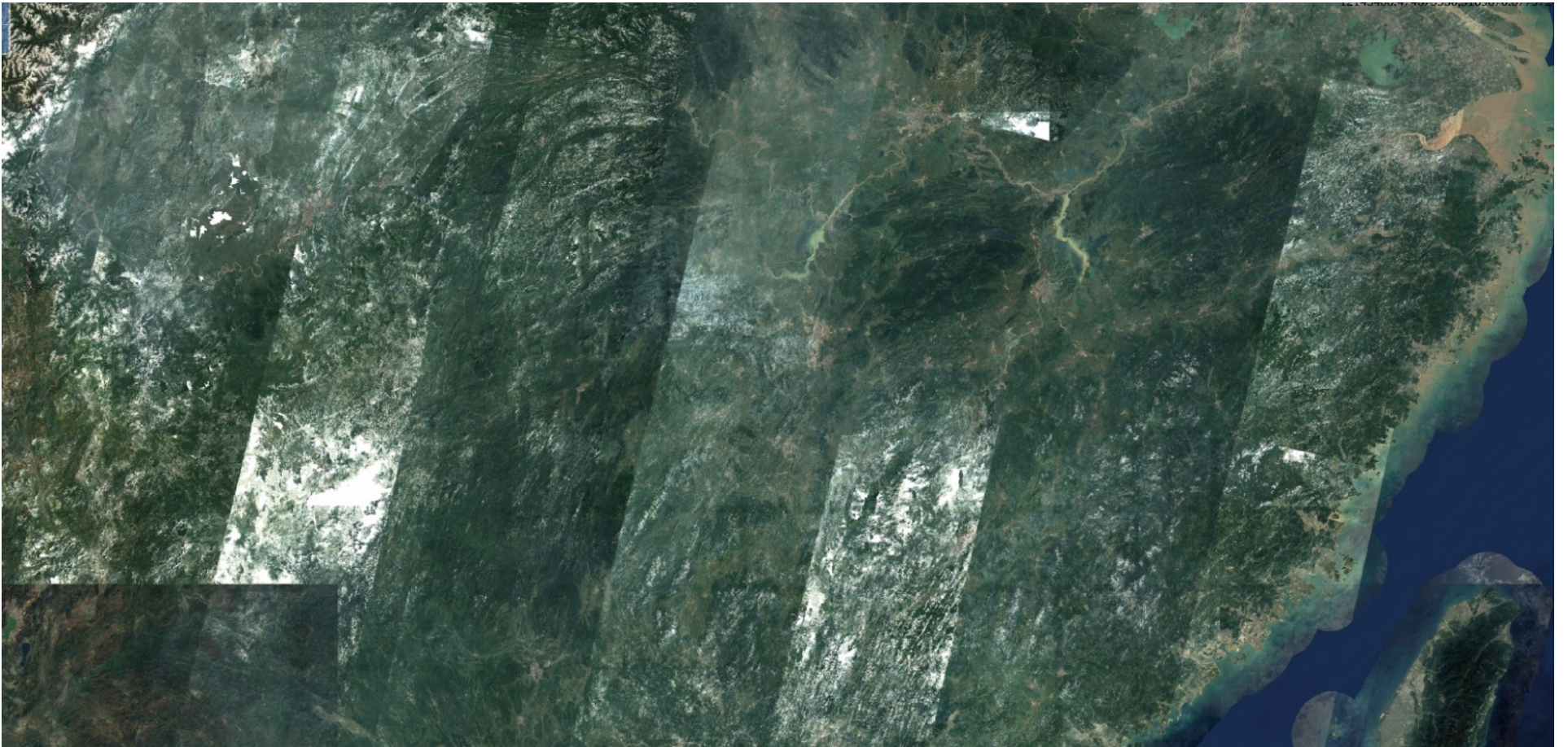
Process

- Time spans:
 - Northern hemisphere:
 - May 2016 until September 2016
 - Southern hemisphere:
 - November 2016 until March 2017
 - Tropical regions:
 - May 2016 until April 2017
- Software Updates:
 - Read all of the data at once for processing (mapchete)
 - Updated Cython code (orgonite): 2-3x speed

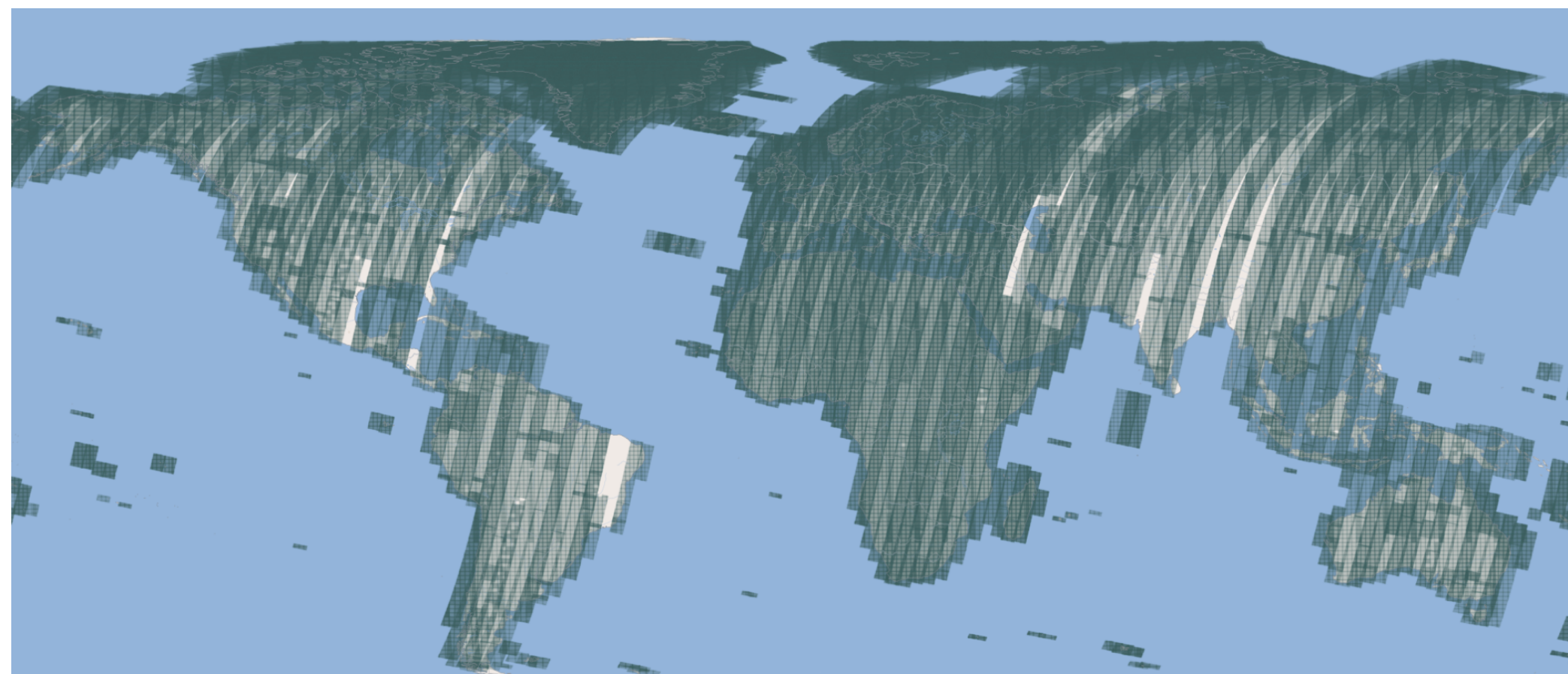
Results

- Ran for ~4 weeks
- ~20 EC2 instances
- Generated GeoTIFFS available at AWS
 - Bucket ID: **eox-s2maps**
 - Region: **eu-central-1**





Current Sentinel-2 coverage



<https://code-de.org>, June 2017



Outlook

- Release global map (soon!)
- Use Level-2A data
- Improve pixel selection
- Build custom mosaics
 - user defined time range
 - user defined spectral bands

Thanks!

- <https://s2maps.eu>
- <https://maps.eox.at>
- <http://github.com/ungarj/mapchete>

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