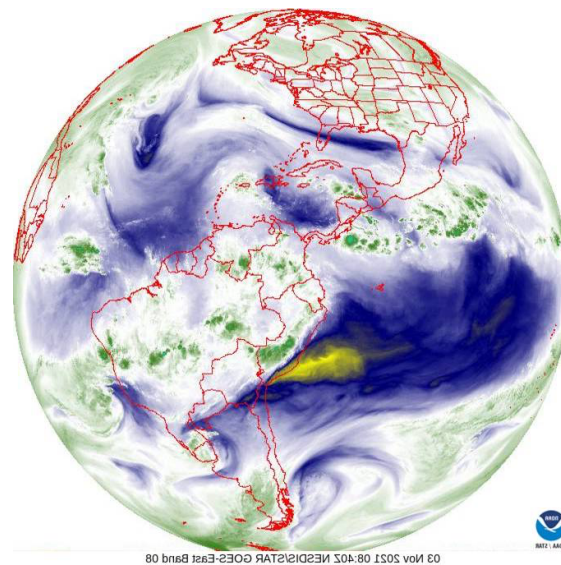


# BACHELOR THESIS ASSIGNMENT

## WORLD-WIDE CLOUD DATA COMPILED FROM SATELLITE IMAGERY

Multiple governmental entities throughout the world, like the National Oceanic and Atmospheric Administration, provide publicly available images captured by weather satellites at regular intervals. Sourcing these images, processing them, and storing them in an accessible format allows querying for cloud coverage for specific locations on Earth.

The goal of this assignment is to be able to render a visualization of world-wide cloud coverage by combining and normalizing partial satellite imagery provided by different sources.



|                  |   |   |
|------------------|---|---|
| Participant      | Joachim Andreassen  |   |
| Company          | Time and Date AS  | Kanalsletta 4, 4033 Stavanger                         |
| Company Contacts |   |   |
|                  | Stephen Michael Jothen<br>sjothen@timeanddate.com   | Master of Computer Science<br>University of Stavanger |
|                  | Steffen Thorsen<br>thorsen@timeanddate.com  | Sivilingeniør<br>NTNU                                 |
| Resources        | Publicly sources data and open-source tooling.<br><br>Company will have technical experts available for assistance. |   |
| Equipment        | Laptop and computer accessories provided by Company.  |   |

## DESCRIPTION

The student will have to source satellite imagery from different governmental agencies and intergovernmental organizations around the world. These entities typically only provide satellite imagery for a part of the Earth

Examples of such entities are

- National Oceanic and Atmospheric Administration, National Hurricane Center
  - Provides satellite imagery of North and South America
- European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)
  - Provides satellite imagery of the Europe and Africa
- Japan Meteorological Agency
  - Provides satellite imagery of East Asia
- Meteorological Service Singapore
  - Provided satellite imagery of South-east Asia

The different entities all provide imagery, but they can be provided in different formats and with different scale, resolution, contrast, and brightness. The time intervals they can be retrieve at may also vary. In other words, some sources may provide data every 5 minutes while others may provide them at every 15 minutes. In addition, the documentation for these sources may be different as well so time must be accounted for analyzing the formats to get a proper understanding of how they are structured.

Once the imagery has been sourced there will need to be a pre-processing step to normalize and align the different images into one unified format. This means adjusting the image parameters for each source to all have the same properties in terms of scale, resolution, contrast, and brightness. To verify the result, it is advised to have an intermediate step to output a visualized result of the normalization performed on each image to visually confirm that they match.

The sourced images will likely come in the format of a disc representing a part of the Earth the entity is responsible to cover. There will also be poor to no coverage around the poles. After each image has been aligned and normalized to have the same visual properties, the different images need to be combined into a single image by overlapping the different discs. The result should be stored in a GeoTIFF image format; a format which allows you to specify georeferencing metadata along with the visual properties of a TIFF image format. This georeferencing metadata should contain the latitude/longitude for each pixel.

Lastly, to achieve the goal of this assignment the student should be able to write a processor which accepts the GeoTIFF image and presents a PNG or JPG image to the end user.

## ACTIVITIES AND SCHEDULE

Following is the different activities we have summarized from the overall assignment description and it's approximate time to completion. The student will have a designated 30 minutes - 1 hour weekly meeting with company contact for guidance during the time of working on assignment.

| Activity 1                              | Activity 2                               | Activity 3  | Activity 4                              |
|---|--|---|---|
| <b>Sourcing publicly available data</b> | <b>Normalization of the sources data</b> | <b>Combining source data to single GeoTIFF file</b> | <b>Storage format and visualization</b> |
| Est. 2 weeks                            | Est. 6 weeks                             | Est. 8 weeks  | Est. 1 week                             |