OVERVIEW – SUPPLEMENTARY CODE

This folder only contains the code written for this thesis in Python. Results that were obtained by these computations can be found in the image_material folder which also includes an overview file.

Below is a summary of the code in each Python file.

01_data_extraction.py

- Overview of images in the FITS file including quantity, date & time, filter type, exported as a CIV file (see function *fits_overview_table*)
- Image plots of images with a specific filter type (see function fits_image_plot)
- Extraction of FITS image data (see function *fits_image_data*)
- Plot of the histogram and CDF of all combined pixel data of selected sequences
- Plots of raw projected images with a highlighted area indicating the cropping range (see function *fits_image_plot_with_highlight*)
- Cropped images (see function *fits_image_plot_cropped*)
- Conversion of the x and y-axis values given in pixel ranges to coordinates (lat/long) (see function *pixel_range_to_coord*)
- Plot of a topography map with 6 highlighted areas indicating the cropping ranges for each image sequence

02_data_exploration.py

- Overview of image statistics saved as CIV file (see function *image_statistics_overview*)
- Extraction of flattened pixel data (see function *extract_pixel_data*)
- Box Plots of image pixel data (see function *plot_boxplot*)
- Overview of histograms of image pixel data in a sequence (see function *display_image_histograms*)
- Individual histograms of image pixel data (see function *display_image_histogram*)
- Overview of CDF of image pixel data in a sequence (see function *display_image_cdf_overview*)
- Individual CDF of image pixel data (see function *display_image_cdf*)
- Individual histograms plotted along with CDF of image pixel data (see function *display_hist_cdf*)
- Extraction of 2D (unflattened) image data (see function *extract_pixel_data_2d*)
- Plot of image and magnitude spectrum (see function *image_fourier_transform*)
- Plot of original image, high-pass filter mask, high-pass filtered image and square root image (see function *image_high_pass_filter*)
- Plot of high-pass filtered image (see function *image_band_pass_filter*)

- Overview plot of segmented/ clustered images of a sequence (see function *threshold_image*)
- Individual plot of segmented image (see function *threshold_image_individual*)

03_image_processing.py

- Extraction of unflattened pixel data (see function *extract_pixel_data_2d*)
- Plot of original images displayed on a grid (see function *display_images_in_grid*)
- Histogram matching (see function *histogram_matching*)
- Box plot comparison of original and histogram matched images (see function *plot_boxplot_comparison*)
- Saving image results (see function *image_plot_save*)
- Overview of histogram matched images on a grid
- Overview of histograms of histogram matched images (see function *overview_image_histograms*)
- Overview of CDF of histogram matched images (see function *overview_image_cdf*)
- Histogram equalization (see function *histogram_equalization*)
- Histograms of histogram equalized images
- Contrast limited adaptive histogram equalization (see function *adaptive_histogram_equalization*)
- Histograms of CLAHE images
- Sigmoid transformation of images (see function *sigmoid_filter*)
- Histograms of sigmoid transformed images
- Manually created sigmoid transformation (see function *sigmoid_filter_scratch*)
- Overview comparison of histogram equalization, CLAHE and sigmoid transformation (see function *overview_processing*)

04_civ_performance_analysis.py

- CIV result data stored in dictionary (see function *civ_dictionary*)
- Nested CIV result data for each image sequence and processing version (see function *data_sequence*)
- Average correlation co-efficients for CIV1 (see function *scatter_plot_average_correlation*)
- Box plot of correlation co-efficients for CIV1 (see function *box_plot_correlation*)
- Percentage of error flags in CIV1 (see function *scatter_plot_errors_ff*)
- Percentage of warning flags in CIV1 (see function *scatter_plot_errors_f*)
- Average correlation co-efficients for CIV2 (see function *scatter_plot_average_correlation_civ2*)
- Box plot of correlation co-efficients for CIV2 (see function *box_plot_correlation_civ2*)
- Percentage of error flags in CIV2 (see function *scatter_plot_errors_ff_civ2*)

- Percentage of warning flags in CIV2 (see function *scatter_plot_errors_f_civ2*)

05_civ_results.py

- Extraction of unflattened image data (see function *extract_pixel_data_2d*)
- CIV result dictionary of each sequence (see function *civ_dictionary_sequence*)
- Velocity field plot of CIV2 optionally outlining coniditions (see function *plot_civ_02*)
- Error flag removal (see function *remove_errors_ff*)
- Conversion to latitude and longitude (see function *lat_long*)
- Conversion of u and v components to meters/second (see function *velocity_fields*)
- Plot of the converted velocity fields (see function *velocity_plot*)
- Meridional plot displaying the v component as a function of latitude (see function *zonal_mean*)

xx_sigmoid_plot.py

- Additional file containing plots of the sigmoid function displaying the effects of the cut-off and gain factor