**Syllabus**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Discipline’s code | Discipline’s title |  | | | Number of ECTS | SWST  Self-work of student with teacher in hours |
| Lect. | Pract. | Demo |
|  | Applications for Environmental protection, GIS software – ILWIS-386 | 3 | 7 | 1 | 5  Total hours:  150 | 100 |

|  |  |
| --- | --- |
| Academic presentation of the course | **Aim of course:** Participants are able to apply ILWIS386 for water and environmental analysis and protection  **As a result of studying the discipline, students should be able to:**   1. Able to apply ILWIS to import and pre-process some satellite derived products, using a set of guided exercises 2. Apply ILWIS to process elevation data, using a set of guided exercises 3. Conduct time series visualization and calculations, using a set of guided exercises 4. Conduct data sampling to retrieve statistical information, using a set of guided exercises 5. Use command line utilities in conjunction with ILWIS386 for efficient data processing 6. Independently apply ILWIS 386 functionality using a dataset prepared for Central Asia |
| Prerequisites | Tertiary education in science, mathematics, technology and engineering  Basic skill in statistical analysis |
| Post requisites |  |
| Information resources | **Literature:**  B. H.P. Maathuis, L. Wang (2008): Digital Elevation Model Based Hydro‐processing. <https://www.tandfonline.com/doi/abs/10.1080/10106040608542370>  Maathuis, Kwast and Mannaerts (2020): Introduction to GDAL/OGR and MS‐DOS command line programming – V3.  **Internet-resources:**  ILWIS 386 software:  <https://filetransfer.itc.nl/pub/52n/ILWIS386/Software/>  ILWIS 386 Installation Instructions:  <https://filetransfer.itc.nl/pub/52n/ILWIS386/Tutorial/ILWIS_installation_instructions.pdf>  ILWIS 386 Exercises:  <https://filetransfer.itc.nl/pub/52n/ILWIS386/Tutorial/ILWIS_3.8.6_Exercises.pdf>  ILWIS 386 Tutorial:  <https://filetransfer.itc.nl/pub/52n/ILWIS386/Tutorial/ILWIS_3.8.6_Tutorial.pdf>  ILWIS Map Visualization reference document:  <https://filetransfer.itc.nl/pub/52n/ILWIS386/Tutorial/ILWIS_3.8_Map_Visualization.pdf>  ILWIS 386 exercise and tutorial data:  <https://filetransfer.itc.nl/pub/52n/ILWIS386/Data/>  Data set prepared for Central Asia:  <https://filetransfer.itc.nl/pub/52n/Central_Asia_data/>  Provided via Digital Learning Environment:  Introduction to GDAL with introduction DOS and sample data /scripts |

Calendar (schedule) the implementation of the course content**:**

|  |  |  |  |
| --- | --- | --- | --- |
| Week / date | Topic title (lectures, practical classes, Independent work of students, IWS) | Number of hours | Maximum score |
| 1 | Lecture 1. Introduction to ILWIS 386 | 2 |  |
| Practical class 1. Import NDVI a satellite precipitation estimate, data scaling and visualization | 8 |  |
| 1 | Lecture 2. Digital Elevation Data processing | 2 |  |
| Practical class 2. DEM processing to derive Compound Indexes | 8 |  |
| 2 | Lecture 3. Time Series: data visualization and calculations on time series data | 2 |  |
| Practical class 3. Calculation on ndvi, temperature and rainfall data to derive climatologies and application for climate assessment / Mosquito habitat suitability mapping | 8 |  |
| 3 | Lecture 4. ILWIS in combination with command line utilities like MS-DOS / GDAL and toolbox plug-ins | 2 |  |
| Practical class 4: Use of MS-DOS & introduction GDAL | 8 |  |
| 3 | DEMO: Multi temporal data import and processing using batch looping routines in conjunction with ILWIS | 2 |  |
| Practical class 4: Using For-Do loops to automate multiple file retrieval and processing and retrieval - (pre‐)processing of time series using a dual batch file technique | 8 |  |
| 4 | Self-work of student with teacher support:  Analyse data of Central Asia according to exercises template prepared (see annex-1) | 100 |  |
|  | Total hours | 150 |  |

**Annex-1: ILWIS 386 Exercises using data from Central Asia**

Window extent is covering Azerbaijan (AZE), Kazakhstan (KAZ) and Turkmenistan (TKM)

Description of the data sources.

**Raster data:**

|  |  |  |  |
| --- | --- | --- | --- |
| name | source | description | Unit |
| dem | GEE – CGIAR\_SRTM90\_V4 | SRTM v4 elevation data | meter |
| landcover | GEE – CGLS\_LC100\_C3 | Land cover classification | Discrete classification |
| Water occurrence | GEE – JRC\_GSW1\_3 | Water Occurrence | Percentage occurrence |
| LST day / night | GEE – Oxford\_MAP\_LST\_Day\_5km\_Monthly  GEE – Oxford\_MAP\_LST\_Night\_5km\_Monthly | Mean monthly temperature climatology | Degree / month |
| EVI | GEE - Oxford\_MAP\_5km\_Monthly | Vegetation index climatology | 0 to 1 / month |
| precipitation | IMERG (https://gpm.nasa.gov/data/imerg/precipitation-climatology) | Monthly precipitation climatology | Mm / month |
| Precipitation | Imerg\_sum\_20210515 – in ilwis format. Aggregated 24 hr precipitation | Daily rainfall | Mm/day |
| NDVI | VHP\_P20210301\_SMN.tif – smoothed weekly ndvi (https://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/vh\_ftp.php) | NDVI | 0 to 1 / week |

**Vector data:**

|  |  |  |  |
| --- | --- | --- | --- |
| name | source | description | unit |
| \*\_country / \*\_name | GADM country and subdivisions | 2 polygon files per country | Discrete classification |
| Inland rivers | ILWIS subset of river basemap, in Pseudo Mercator | Vector file covering AoI | Attribute table |
| Inland lakes | Natural Earth – Lakes and reservoirs, both as lat-lon and Pseudo Mercator | Inland water bodies | Attribute table |
| Caspian sea | Marineregions.org, in lat-lon coordinates | Caspian sea shape file | Discrete classification |

**Projection information:**

Aoi\_metric\_PM: Pseudo Mercator: for DEM, pixel size 1000 m

EVI\_Clim: LatLon WGS84: all other maps, pixel size 32.34 seconds, approx. 1 km

Exercises using data from Central Asia, reference to ILWIS 386 Exercises by B. Maathuis & B. Retsios, version 20-11-2019

Execute the exercises as described in the manual but now using the data from your own region. In the table below the instructions for the various exercises are provided using the local data sets prepared.

**Data processing details:**

|  |  |  |
| --- | --- | --- |
| Chapter | description | data set |
| 3.1 | Review all existing data layers, including details on georeference and coordinate system. Note difference in projections used, e.g. lat-lon and pseudo Mercator | All vector and raster data sets, also ilwis service objects |
| 3.2 | Import VHP\_P20210301\_SMN.tif, check values, resample and clip to selected country. | VHP\_P2021031\_smn.tif, country vector file of AZE, KAZ or TKM |
| 3.3 | Calculate average PCP per district using daily imerg pcp “Imerg\_sum\_20210515” | Imerg\_sum\_20210515 and district vector file of selected country of AZE\_name, KAZ\_name or TKM\_name |
| 3.4 | Create STI over DEM.  To calculate slope map from DEM, resample to metric coordinate system (Pseudo Mercator). Note slope map has to be modified, if slopes are 0, assign these to 0.01, else TSI formula returns ‘0’, use:  slopedeg\_mod:=iff(slopedeg=0,0.01,slopedeg)  Calculate Fd and Fa from DEM\_hydro\_optimized. | Dem  Dem\_hydro\_optimized  Vector files:  Caspian\_sea, lakes\_area\_pm, riv\_pm\_sub |
| 3.5 | Display as animations all the time series available, also as synchronized animations. All maps have monthly temporal interval | Map lists of:  EVI\_clim  PCP  LST\_Day  LST\_Night |
| 3.6 | Create a new time table with time domain when displaying a Hovmöller Diagram of a time series | Map lists of:  EVI\_clim |
| 3.9 | Derive if there is a relation between elevation and temperature for your country. First derive the average monthly temperature. Create a grid –group fact of 20, using the number of columns of the grid maps for your country. | Dem  LST\_Day |
| additional calculations, results to be provided in a report | Create a track-profile over the Aral Lake and then calculate the water occurrence at 12 % and overlay this map with lakes\_area polygon map. Derive some statistics about the changes in lake dimensions / extent.  Calculate the mean annual precipitation climatology  Which areas have the greatest yearly mean temperature difference / amplitude  When is the EVI below or above the average EVI    Calculate the area cultivated for your country  Clip map to your country, e.g. using the land cover map, first resample the map the Pseudo Mercator projection. Create a good quality output map, including scale bar, coordinates, grid lines, legend, etc. Under global tools add white space for legend!  Use also the colour shaded map as background |  |