**Actual ET of Hupsel – step 1**

**Answer sheet**

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| Student (name) |  |

In the boxes in this answer sheet you can include your answers, reasonings, graphs, etc. The boxes scale with what you enter (so there is more than enough space).

## 1. Characterize weather conditions

Characterize the weather conditions during the period in which the data in this historic dataset were gathered.

Do this in very broad terms (do not study individual days, but rather in terms of e.g. 'in the first 5 days the weather was sunny'. Think of it as a report to your family or friends when you return from field work. Select the variables that you think will characterize the weather best (e.g. sunshine duration, precipitation, ....), plot a time series of that variable and summarize that in words.

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| --- | --- | --- |
| **Variable** | **Graph** | **Description** |
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Based on your analysis above, try to identify a number of periods of similar weather and concisely describe them. Try to formulate a one-sentence description of characteristic periods (e.g. 10-12 May: 'windy weather, mostly overcast with maximum temperatures around 18 °C and most days a few mm of rain per day')

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| **Start date** | **End date** | **Characterize in words** |
| 12-04 |  |  |
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## 2. Complete the functions

The main work needs to be done in the notebook. In the table below you can briefly document your progress (did it work at once, or after some iterations, what were the hurdles)

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| --- | --- | --- | --- |
| **Function** | **Progress** | | |
|  | **OK at once** | **OK some tries** | **Challenges** |
| f\_Lv(T) |  |  |  |
| f \_esat(T) |  |  |  |
| f\_s(T) |  |  |  |
| f\_gamma(T,p,q) | - | - | None: this function was made available to you. |
| f\_makkink(Kin,T,p,q) |  |  |  |

## 3. Reference evapotranspiration

Compute the reference evapotranspiration in mm/day based on the current data set (check what is the unit of the flux you computed with your f\_makkink function).

First summarize below how you arrived at fluxes in mm/day, starting from the output of the f\_makkink function.

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Subsequently, make a time series graph that you can include below. Also discuss if these values make sense (in terms of order of magnitude, and in terms of day-to-day variability.

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## 4. Actual evapotranspiration

Include your values below and/or include a graph that shows the time series of actual ET.

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## 5. Comparing actual ET and reference ET

How do actual and reference evapotranspiration compare? Are they identical, is there a fixed offset, or is the difference variable over time. If so, can you related those differences to specific conditions? Discuss values, possibly show a graph.

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## 6. CSM/crop factor for grass

Compute the CSM/crop factor for the current data. Copy a graph of the values in the box below

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## 7. Variation of CSM/crop factor – model for grass evapotranspiration

What is the overall magnitude the crop factor? Is the crop factor constant over time, and if not, can you explain the variations using the characterization of the conditions you made in question 1 (e.g. the crop factor is around … when the weather conditions are …)?

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|  | **Comment** |
| **Typical value of the CSM/crop factor (mean, median, …)** |  |
| **Variability of CSM/crop factor from day to day (how much, how, when)** |  |
| **What determines the day-to-day variation?** |  |

Summarize your findings regarding the CSM/crop factor for grass in such a way that you could use it as simple model to derive grass evapotranspiration from the reference ET, based on a limited number of variables (e.g. rainfall history, air humidity, temperature, wind speed, ...). There is no need to come with a model in the form of an equation. What we need, is some sort of look-up table.

In the table below, distinguish a number of situations with distinct values for the CSM/crop factor.

* Give the typical value for the CSM/crop factor in the first column
* Characterize the conditions with typical values for the relevant variables (columns 2 and further) (e.g. crop factor = … (column 1) when no rain (column 2) and high temperatures (column 3). It is up to you to see how many conditions you distinguish (i.e. how many rows you fill) and how many variables you need to describe a given condition (how many columns you need).

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| --- | --- | --- | --- | --- |
| **Value of**  **CSM/Crop factor** | **Variable:** | **Variable** | **Variable** | **Variable** |
| … | … | … | … |
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