02427 Advanced Time Series Analysis
Computer Exercise 4

Navigation on a Lake

Assume you are out fishing on a lake (or in an archipelago). After an intense morning of battling the beasts of the deep, you take a nap in the boat. You wake up several hours later, completely disoriented. You can safely assume you have drifted around quite a lot. What is even more troubling is that a thick fog has settled over the water. You approximate the visibility to about five meters.
Looking around in your boat, you find the following objects:

- One topological map of the lake/archipelago.
- One laptop running MatLab, R, or similar.
- One depth gauge of lower quality. The instructions on the back reveal: "Measurement error 15%."
- (Optional) One compass.

Sitting in the boat you try to assess the surrounding conditions. The rippling of the water surface reveals some wind. However, you know that there are some currents as well. You assume that the effects of wind and current are of the same size on average, i.e., the drift has zero expectation. However, the variance can be assumed proportional to time.

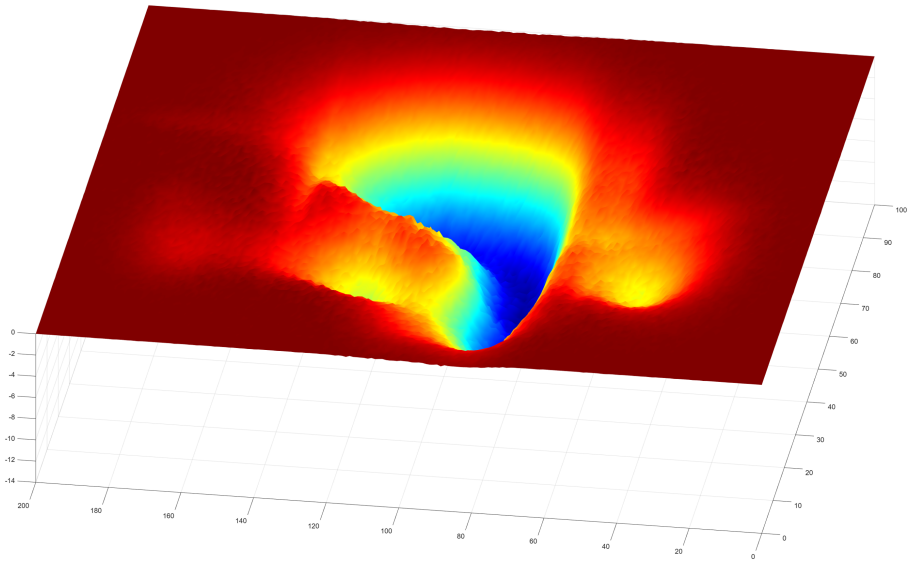


Figure 1: Vombsjön topological map.

The maps are given in the files “Bolmen”, “Ringsjon”, and “Vombsjon” for the lakes, and “Oresund”, and “Skagerack” for the sea. Each lake (or sea) contains a small blue bar. This is home. Your task is, starting anywhere on the lake, to find your way back. Accordingly, pick a position in the lake for reference. Next, using only the equipment found in the boat, try to locate yourself. At this stage, you of course assume that the position is unknown. Use it only to read off the map. If you are so inclined, you can also try to sail back home. You can choose to use the compass or not. Naturally, a solution without using the compass is more advanced than one with compass and is not expected for a pass. However for the higher grades, creativity will be rewarded. Feel free to add extra complications of your own design. We encourage you to supplement the report with executable program code and/or visual illustrations. To draw topological maps in MatLab one can use the following:

```
>> contour(xscale, yscale, Depth, 10);
>> hold on;
>> line([harbour(1) - 4, harbour(1)] , [harbour(2), harbour(2)] , 'LineWidth', 4);
```

Also the routine plotlake.m, found on the course home page, can make nice 3D plots. Navigation of this type is usually referred to as inertia navigation, see, e.g., Wikipedia.