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What exactly is hydrography?

The IHO offers an abstract definition only.
It is high time for more graphicness

An essay by LARS SCHILLER

The term hydrography has different meanings. It describes mainly the science of surveying of waters and of waters-related information, to which the German Hydrographic Society (DHYG) has committed itself to. There are several definitions of the concept depending on the nation and institution. Without doubt, the definition published by the IHO in 2009 has the greatest impact. Still, even this institution hasn't been able to describe comprehensively and convincingly what hydrography is. Most of all, it lacks a vivid description. Therefore, it is about time to point out the weaknesses of the IHO definition and to present a new one. The following definition at least reflects the German understanding of the concept from the DHYG perspective.

hydrography | definition | terminology | lexicography | concept | philosophy of science

Introduction

Imagine you were asked to give a written answer to the following question: »What exactly is hydrography?«

For sure, you know exactly what it is, otherwise you wouldn't read this journal. But to be honest, are you able to write a couple of professional sentences about it? You are able to talk about it, to tell stories of your everyday work and excel with adventures, but are you really able to describe what the scientific characteristics of hydrography are?

Maybe you come up with the idea of looking into a dictionary or encyclopaedia. Leafing through a printed book nowadays? A searching machine would be today's tool presenting an immediate result. From the amount of given answers you just have to pick the best one, and even that isn't an easy task. A glance into a dictionary would offer you only one definition, a reliable one probably, but perhaps you aren't lucky for the following reason: the term »hydrography« implies more than a science (see Fig. 1).

We often talk about hydrography of rivers, which presumably means the form of the surveyed river bed. There exists also the hydrography of a country meaning the total amount of waters in that country, and all these waters can be found in a list – confusingly this dossier is also called hydrography. And hydrography can even be objects of art (see Fig. 2).

Dictionaries don't tell us that the word »hydrography« has several meanings. A non-hydrographer would be happy with the definition and accept the given answer. In Germany, most people believe that hydrography is, according to the most widely used German dictionary *Duden*, the »descriptive hydrology«. We are experts and see it quite differently, stating that this is true from a hydrologist point of view. German lexicographers don't have a clue what the science of hydrography really is, or maybe they just ignore us. Luckily, this is different in English dictionaries, which

mention mainly the scientific aspect. In the *Oxford Dictionary of English* you can read: »the science of surveying and charting bodies of water, such as seas, lakes, and rivers.«

English dictionaries are on the right track. Still, this sparse sentence isn't very satisfying and that is why we will search for a detailed explanation.

Search for definition

You begin searching and gathering several definitions from dictionaries, standards and Internet sites of diverse institutions. However, very soon you start wondering: all these definitions are to describe the same concept of hydrography as a science. Well, either they have different focuses or they contradict each other in concrete details. (You don't believe that? Then compare the definition of the IHO of 2009 with the definition of the current DIN standard *18709-3:2012*, which uses parts of the United Nations definition of 1978).

For sure, you stick to the latest and most popular definition which the IHO published in 2009. It was about time to adapt the outdated one published in the 5th edition of the *Hydrographic Dictionary* in 1994. Definitions need to be up to date because science moves on.

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Fig. 1: One term with eleven meanings. This could be an entry in a technical dictionary

hy-drog-ra-phy -ies, | hʌɪˈdrɒɡrəfi | noun,

- 1 no pl., science of surveying of bodies of water and waters-related information;
- 2 no pl., **a**) depth measurement of waters (esp. of oceans), bathymetry;
b) surveying of bodies of water;
- 3 no pl., **a**) descriptive hydrology; **b**) characteristic features of bodies of water, descriptive set of waters-related data and information;
- 4 no pl., (register of the) totality of the waters in an area, waters index;
- 5 no pl., **a**) map element; **b**) cartographic depiction of waters;
- 6 shape of the bottom of a water, topography covered by water, morphology;
- 7 **a**) no pl., art technique; **b**) artwork.

Definition published by the United Nations in 1978

»Hydrography may be defined as the science of measuring and depicting those parameters that are necessary to describe the precise nature and configuration of the seabed, its geographical relationship to the landmass, and the characteristics and dynamics of the sea. The parameters encompass bathymetry, geology, geophysics, tides, currents, waves and certain other physical properties of sea water« (UN 1978, p. 67)

Definition in the Hydrographic Dictionary of 1994

»That branch of applied science which deals with the measurement and description of the physical features of the navigable portion of the EARTH's surface and adjoining coastal areas, with special reference to their use for the purpose of NAVIGATION« (IHO 1994, p. 108)

Definition in the DIN standard 18709-3:2012

»Wissenschaft und Praxis der Messung und Darstellung der Parameter, die notwendig sind, um die Beschaffenheit und Gestalt des Bodens der Gewässer, ihre Beziehung zum festen Land und den Zustand und die Dynamik der Gewässer zu beschreiben« (DIN 2012, p. 5)

The definition of 2009 is:

»Hydrography is the branch of applied sciences which deals with the measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defence, scientific research, and environmental protection.«

It may well be that you couldn't grasp the entire meaning of the sentence. No wonder, as linguists say that a sentence shouldn't have more than 25 words in order to grasp it right away. This definition consists of 64 words and all of them in one sentence.

Since the definition was presented on the 4th Extraordinary International Hydrographic Conference in Monaco there was little protest, and even during voting process there were no opposing votes. Nonetheless, I assume that it was difficult to find an unanimous solution which all representatives of IHO member states could accept. In the meantime, criticism was uttered, but whether it reached the IHO is still questionable. I believe it is time to collect the critical comments and to offer a counterproposal.

Critical aspects of the definition

To be brief: the definition shows deficits in the content and form. It doesn't reflect the full spectrum of hydrography, nor does it fulfil the requirements of lexicographers. You could argue that a definition doesn't necessarily have to comply with formal aspects and that a reduced definition that only mentions carefully selected aspects is good

enough. I would agree, but only if the definition fulfils its duty and that is to explain what hydrography is. I doubt that and I ask you: does this definition really offer an adequate and satisfying answer?

We will find out as we have a closer look at each of the definition's aspects.

... branch of applied sciences ...

Hydrography apparently is a »branch of applied sciences«. Is that really true, is hydrography an applied science?

Yes and no. Without doubt hydrography is very practice-oriented, as it should be (for application in the present time), but there are also theoretical components. Just think about research and development (always with regard to the future) or the discussions about hydrography itself (often regarding the past). Of course, hydrography is neither a theory-based nor a mere applied science. So much to the content.

Let's look at the form: including hydrography into applied sciences isn't very useful. Lexicographers recommend to name the hypernym in order to provide a clear position. (Oncology is an applied science as well, but it belongs far more to medicine. The cocker spaniel is a living being, but it makes more sense to call him a dog.)

From the German perspective hydrography is a discipline of the science of surveying and geoinformation.

... measurement and description ...

Hydrography deals with measuring and describing waters. That is correct. Measuring includes not only complex surveying, like calculating depths and extents of bodies of water, but also the comparably simple measuring of e.g. water temperature.

»Describing«, what exactly does that mean? Is it sufficient to say »description« or isn't it better to also mention »depiction« as hydrography doesn't only deal with oral or written representation, but also with visualisation? The cartographic aspect is about to disappear in the formulation. And also the information by means of charts, information systems and other media doesn't come through.

... physical features ...

Hydrography measures and describes »physical features« of waters, so it is said. Do you have a clear picture of these features? For sure, the statement isn't wrong, but it remains vague and imprecise. Such a basic formulated definition doesn't fulfil its goal. The parameters are of interest.

By the way, the United Nations already talked of »physical properties« in 1978. The expression still remains too abstract, and I presume that it is to »avoid« pointing out the concrete.

Furthermore, the expression seems to be concrete as only the *physical* features are mentioned, but this is too narrow. The chemical parameters (think about salinity or radioactivity) and the bio-

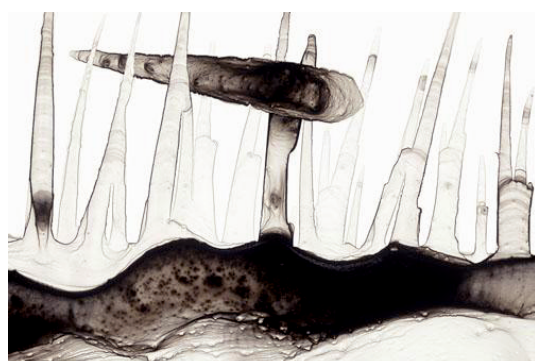
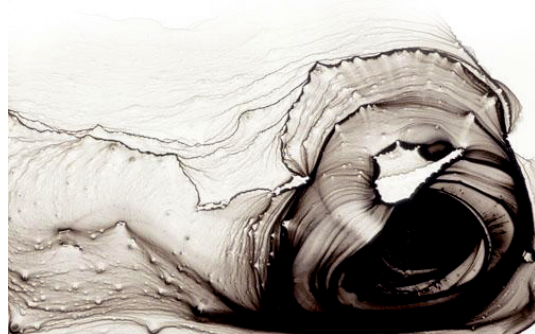


Fig. 2: Two examples for hydrographies by the German artist Thomas Michel: Capricci Genesis Nr. 25, Cyclus Cerealis Genesis Nr. 130

logical characteristics aren't mentioned although »habitat survey« and »biomass detection« have been keywords for quite a while now.

And also the geographical features remain unmentioned, that is the relation of waters to land. The information about water depths is only of value when the coordinates are given as well.

... oceans, seas, coastal areas, lakes and rivers ...

Hydrography is concerned about »oceans, seas, coastal areas, lakes and rivers«. The list gives the impression of completeness, but there are gaps. Not all bodies of water are being mentioned, probably on purpose. Why are waters like creeks and channels, wadis (e.g. in Israel) and riviere (e.g. in Namibia) not mentioned? An explanation would be very interesting. If *all* bodies of water are to be included – except maybe underground waters – then it should be expressed quite clearly.

It is surprising that »coastal areas« are listed; such a foreign matter makes us wonder. On the other hand, the question is why shorelines are excluded from the list.

A lexicographer would definitely say: It isn't correct to make a list and not mention everything, but it is even worse to mention a wrong element.

... prediction of their change over time ...

The physical parameters are not only measured and described, but the definition courageously offers »the prediction of their change over time«. Very clearly it is about future changes and forecasts. This is a laudable supplement to the previous definition of 1994. Finally, the view is turned towards the future instead of the present time. However, which changes and time span is thought of? Is it only about calculating the water level which depends on the tides? Or the global sea level rise? Probably the formulation is imprecise in order to have both interpretations.

I miss the comparison between past and present although I welcome the view toward future prospects. The analysis of developments plays an enormous role (e.g. after a dredging activity) – the knowledge about changes is the basis for any extrapolation into the future.

... primary purpose of safety of navigation ...

We are told that the most important purpose is save navigation. If I may say so, this is a very conservative point of view. What does surveying of the deep sea has to do with navigation? Why should seafaring be interested in the formation of the sea-floor in 50, 1,000 or 4,000 metres depth?

Of course, seafaring profits from the insights of hydrography and captains depend on our nautical charts. However, is it really good to declare that as main issue of a modern definition? Maybe a broader view is better. Waters are used in manifold ways: energy is gained, natural resources are exploited, aqua farming is cultivated. Last but not least, hy-

drography provides epistemological progress by making the invisible visible to the human eye. All humanity profits from it, not only navigation.

Of course, I am aware of the hydrographical roots. Already from an etymological point of view it is obvious that bodies of water are the object of description. Dangerous places or reliable seafaring routes were drawn into charts. But are the roots of such value that hydrography cannot do without safety of navigation? Nevertheless, the IHO decided to mention explicitly other purposes which in 1994 wasn't the case or only implied.

... in support of all other marine activities ...

Hydrography supports »all other marine activities«, it is said, followed by some exemplary keywords. Lexicographers would criticise the incompleteness of the list. Moreover, the list remains abstract – so does the entire definition. The keywords are not able to create an image. What is meant with »marine activities«? In what way does hydrography contribute to the economic development? What is the relationship to security and defence? What does the scientific research include? And what is the role of hydrography in environmental protection? There are no answers to these questions, on the contrary: more questions come up.

Bringing together as many broad and vague keywords in order to satisfy all interests, is doomed to fail. Such an approach will not result in a serious definition.


And last but not least: why are only *marine* activities mentioned? What about the activities in inland waters?

What can be improved?

Enough of criticism, the question remains what can be made better? I come back to my initial question: How would you define hydrography, completely and clearly?

For sure, non-hydrographers and hydrographers would take an interest in the answer. A definition may also be helpful when research funds are at stake and when explaining the difference between hydrography and oceanography for example. It can support us as well by clarifying our profession. And a definition can be of use in public relations.

At this point, I don't want to explain how lexicographers would write a definition nor do I point out the hydrographers' fields of work. The answer can partly be found in this journal, and in the *Manual on Hydrography* or in the *Standards of Competence*, both published by the IHO. Instead I present my idea of a definition that does not stand in contrast to the academic contents, which the IHO demands in the *Standards of Competence*.

Make the practical test! Next time when you are asked to explain what hydrography is then please offer your conversation partner both the IHO definition and the definition on the next page. 

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hydrography, n.

Hydrography is a branch of the science of surveying and geoinformation. It investigates the surface waters of the earth and collects the related data and information. Its goal is to expand the knowledge of waters in order to use them responsibly and safely and to protect the habitat.

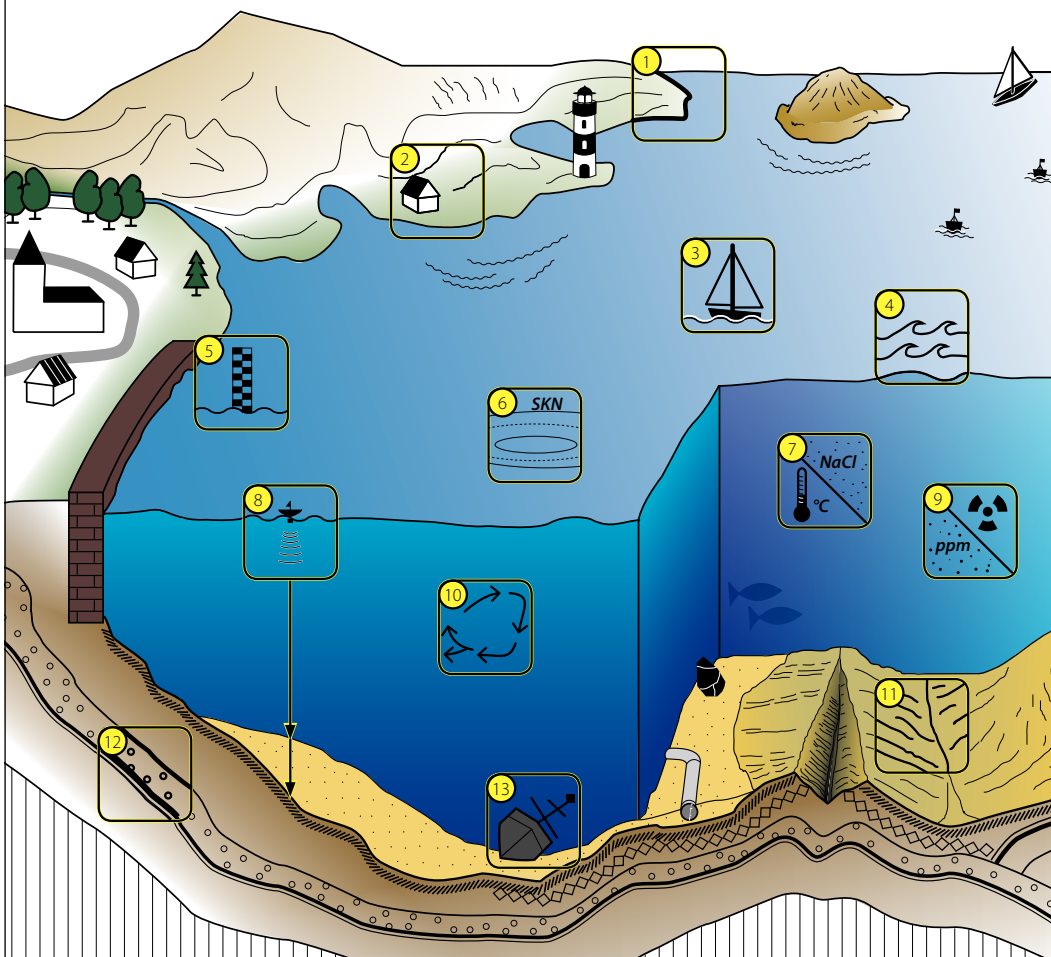
The practical engineering and geoscientific work is divided into three main fields of activity:

1. *Surveying* of waters, and *recording* of aquatic data;
2. *Processing* of the data, *administering* the data in information systems, and *analysing* the total set of data;
3. *Visualising* the waters on charts and in information systems, and *informing* about the waters.

After the examination of a surface water hydrography provides information about its current state and about past and future changes.

Hydrography makes statements about:

- the water depths in relation to a reference horizon,
- the positions of shoals,
- the positions of magnetic anomalies,
- the shape and structure of the bottom,
- the material composition of the bottom,
- the structure of the deeper soil layers,
- the location of deposits,
- the uniform change of the water level (tides),
- the short-term and long-term change of the water level (storm surge, sea level rise),
- the height profile of the water surface (orthometric height),
- the characteristics of waves,
- the characteristics of currents,
- individual parameters of the water column (temperature, salinity),
- the structure of the water body,
- the water quality (particle concentration, radioactivity),
- the natural and artificial objects in and on the waters,
- the traffic situation on the waters,
- the course of the water's limit,
- the course of boundaries within the waters,
- the nature of the adjacent land strip (coastal zone resp. shoreline).



Object of investigation of hydrography

- 1 Course of the water's limit
- 2 Nature of the adjacent land strip (coastal zone resp. shoreline)
- 3 Traffic situation on waters
- 4 Characteristics of waves
- 5 Water level
- 6 Height profile of the water's surface
- 7 Individual parameters of the water column (temperature, salinity)
- 8 Water depths
- 9 Water quality (particle concentration, radioactivity)
- 10 Characteristics of currents
- 11 Nature of the bottom
- 12 Structure of the deeper soil layers
- 13 Natural and artificial objects in and on the waters