

TECHNICAL NOTE

Extended vector data of the International Hydrogeological Map of Europe 1:1,500,000 (Version IHME1500 v1.2)

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Introduction

The printed International Hydrogeological Map of Europe at scale 1:1,500,000 (*IHME1500*) map series consists of 25 map sheets providing generalised overview-information on shallow groundwater conditions across Europe (Gilbrich et al., 2001). Principal features of potential aquifers such as general typology and lithology are reproduced homogenously in *IHME1500*. A variety of further features such as seawater intrusions, groundwater table contours or springs are irregularly distributed on individual map sheets. The printed map sheets are available as hardcopies from BGR's Product Center, or as scanned and georeferenced images in GeoTIFF format entitled *IHME1500 print*.

The synoptic vector data of the published maps sheets is described in Duscher et al. (2015), where the harmonisation of the map sheet-specific information is also presented. To complete the whole area covered by *IHME1500* information including previously unpublished materials, the synoptic vector data was extended in such that information from existing *IHME1500* draft map sheets were included, together with abstracted, *IHME1500*-conform information deduced from the International Geological Map of Europe 1:1,500,000 (*IGME1500*). *IGME1500* has the same topographic base and sheet cut as *IHME1500*, and reveals over extensive areas a very similar geometry.

The extended vector data of *IHME1500* presented here comprises polygon and line features in a shapefile format. The polygon data renders harmonised information on material compositions and general productivity characteristics of potential aquifer assemblages, and the line features display mayor tectonic lineaments.

IHME1500 extensions

The extensions of the synoptic *IHME1500* vector data set consist of *IHME1500*-conform polygon- and line feature information for the five *IHME1500* / *IGME1500* map sheets D1, E1, F1, F5, and F6 (Figure 1). For each sheet, different data sources were used to compile this information (Table 1).

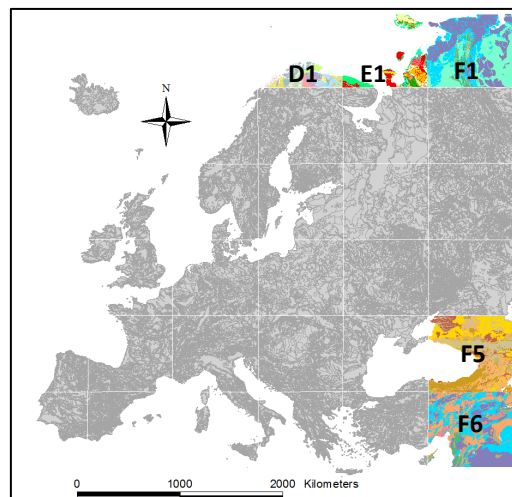


Figure 1: Synoptic vector coverage of published *IHME1500* map sheets (in grey) and extensions (coloured)

Map Sheet	Data Source
D1	Unpublished IHME1500 draft (Russian part), IGME1500
E1	IGME1500
F1	Unpublished IHME1500 printer's copy
F5	IHME1500 drafts
F6	IHME1500 drafts, ACSAD map sheet "Damascus"

Table 1: Data sources for IHME1500 extensions

It has to be acknowledged that especially for map sheets only or mainly covered by *IGME1500* information (parts of sheet D1 and sheet E1), an *IHME1500*-conform attributing of the mapping units can mainly be achieved through inferences from map border information of the adjacent *IHME1500* sheets. This especially causes problems for the derivation of aquifer types since *IHME1500* aquifer typology is largely independent from the lithological classification allowing for different aquifer types in a specific lithology class. Additionally, some important modifications of *IGME1500* geometries were necessary. The integration of sheet F1 is more straightforward since here an already finalized *IHME1500* map sheet is available. For sheets F5 and F6, different map drafts with *IHME1500*-conform descriptions of both lithology and aquifer typology of the mapping units are available that are harmonised using the synoptic *IHME1500* vector data classification.

The five extensional *IHME1500* map sheets D1, E1, F1, F5, F6 will not be published individually, and their thematic content was solely deduced from unpublished *IHME1500* data and additional *IGME1500* information. In this respect, the thematic contents of the extensional map sheets are not validated by regional experts and should therefore be considered preliminary.

IHME1500 v1.2 - Structure and content

Two GIS layers (area theme, line theme) of the *IHME1500 v1.2* are available.

Area Theme

The polygon features (*IHME1500* mapping units) of the area theme comprise attribute information on general material specifications (lithology) and typological information on productivity and general nature of potential uppermost aquifer assemblages across Europe. Additionally, information on seawater intrusions is available.

○ Aquifer type

The aquifer type information of *IHME1500* defines six generalized classes of potential groundwater resources considering four grades of productivity in terms of general groundwater yield. Additionally, highly or low to moderately productive aquifer types are distinguished whether formed by porous or fissured rock types (Table 2). It has to be noted here that *IHME1500* does not delineate aquifers but rather provides spatial information on potential aquifer system characteristics situated in *IHME1500* mapping units.

Aquifer type	Description	Map colour
<i>I</i>	<i>Porous, less frequently fissured-porous rocks</i>	
Ia	Highly productive aquifers	Dark blue
Ib	Low and moderately productive aquifers	Light blue
<i>II</i>	<i>Fissured rocks, including karstified rocks, less frequently porous-fissured</i>	
IIa	Highly productive aquifers	Dark green
IIb	Low and moderately productive aquifers	Light green
<i>III</i>	<i>Locally aquiferous or practically non-aquiferous, porous or fissured</i>	
IIIa	Locally aquiferous, porous or fissured rocks	Light brown
IIIb	Practically non-aquiferous rocks	Dark brown

Table 2: Aquifer types of the *IHME1500*

- Lithology

Overall, the lithology information of *IHME1500* print maps and draft extensions contains 1220 individual lithological class descriptions. These descriptions comprise petrographic, genetic, stratigraphic and local terminologies that demands generalisation to produce harmonized synoptic map information on different aquifer materials.

A first step geometric aggregation results in 791 seamless lithology classes across the mapped area, where class descriptions of neighbouring sheet classes were always attributed from the largest class to be merged. Additionally, island classes containing only one polygon and classes with a spatial extent of < 100 km² were merged with larger, semantically compatible classes. A subsequent semantic harmonization and grouping of the lithological descriptions following a general lithological taxonomic scheme as described in Duscher et al. (2015) results in five hierarchical aggregation levels (Level 1 to Level 5, Table 3). In these instances, Level 1 comprises the translation of the original seamless class information into the general *IHME1500* taxonomy, removing redundancies in the original class descriptions. Level 2 only allows for primary and secondary consolidated and/or unconsolidated geologic materials to be specified, and Level 3 is only attributed to major lithotypes. Level 4 displays a grouping of the lithologies for major consolidated and unconsolidated petrographic rock groups. Level 5 finally constitutes a ternary distinction of the lithological information between consolidated, unconsolidated and mixed materials. All mapping units of the area theme comprises the information of Level 1 to Level 5. The individual class descriptions from Level 1 to Level 4 are listed in the Appendix. The original, unharmonised lithological descriptions are also available upon request.

Level 1	Level 2	Level 3	Level 4	Level 5
229 classes	86 classes	29 classes	10 classes	3 classes

Table 3: Class numbers of *IHME1500* Lithology-Levels

- Seawater intrusions

Although the mapping of potential aquifers affected by seawater intrusions is not exhaustive in *IHME1500*, this information is incorporated in the attribute table were available. Areas of seawater intrusions merely appear on seven map sheets covering Denmark, The Netherlands, Belgium, Germany, Italy, Croatia, Montenegro, Albania, and Greece.

Line Theme - Faults and overthrusts

The *IHME1500 v1.2* line theme comprises five classes of tectonic fractures depicted in the individual map sheets. The predominating four types of known or supposed faults and overthrusts are supplemented by the boundaries of fractured belts with hydrogeological significance exclusively mapped for *IHME1500* in Iceland.

Versions and Availability

The current synoptic vector dataset will be extended in the future to include areas in North Africa covered by *IGME1500* through *IHME1500*-conform interpretation of the mapping units using auxiliary information. Furthermore, qualified requests on modifications will be considered and the preparation of supplementary feature themes (e.g., location of groundwater springs, groundwater contours etc.) is intended. This requires the distinction of successive versions of the *IHME1500* vector data introducing a version number. The current version in January 2019 is *IHME1500 v1.2*.

IHME1500 v1.2 data and follow-ups are available for download to public via the project website <https://www.bgr.bund.de/ihme1500>, which is also providing explanations and further downloads referring to the other *IHME1500* products. The data is accompanied by the general standard terms and conditions of the BGR and a metadata file specifying e.g. notations, attribute labels, copyright and citation.

References:

Duscher, K., Günther, A., Richts, A., Clos, P., Philipp, U., Struckmeier, W. (2015): The GIS layers of the International Hydrogeological Map of Europe 1:1,500,000 in a vector format. - Hydrogeol J 23(8): 1867-1875
 Gilbrich, W.H., Krampe, K., Winter, P. (2001): Internationale hydrogeologische Karte von Europa 1,1500000. Bemerkungen zum Inhalt und Stand der Bearbeitung. Hydrologie und Wasserbewirtschaftung 45, 122-125. (in German).

Appendix: Hierarchical structuring of IHME1500 lithology information

1. Consolidated Lithologies

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Limestones	Limestones	Limestones	Calcareous rocks
Limestones, marbles			
Dolomitic limestones			
Travertines			
Dolomitic limestones, plutonic rocks			
Gypsum, anhydrite, dolomitic limestones			
Limestones (jointed, karstified)	Limestones (jointed, karstified)		
Dolomitic limestones (jointed, karstified)			
Chalkstones, limestones (jointed, karstified)			
Limestones, marlstones	Limestones, marlstones		
Dolomitic limestones, marlstones, claystones			
Limestones, marlstones, sandstones, conglomerates			
Limestones, marlstones, schists			
Limestones, claystones, sandstones, conglomerates	Limestones, sandstones		
Limestones, sandstones			
Limestones, cherts, sandstones, shales			
Limestones, sandstones, claystones			
Dolomitic limestones, sandstones, conglomerates			
Limestones, shales			
Dolomitic limestones, shales, sandstones	Limestones, shales		
Limestones, claystones, shales			
Limestones, shales, sandstones			
Limestones, shales, conglomerates, sandstones			
Marlstones, claystones with gypsum and salt			

Marlstones, claystones, shales, phyllites	Marlstones, claystones	Marlstones	Siliciclastic rocks
Marlstones, sandstones	Marlstones, sandstones		
Conglomerates	Conglomerates	Conglomerates	
Conglomerates, limestones, sandstones, marlstones			
Conglomerates, quartzites, sandstones, shales, dolomitic limestones			
Conglomerates, sandstones, cherts, shales, dolomitic limestones, ophiolitic series	Conglomerates, sandstones		
Sandstones, phyllites, quartzites	Sandstones	Sandstones	
Sandstones			
Diatomaceous rocks			
Sandstones, claystones	Sandstones, claystones		
Siltstones, claystones, sandstones			
Sandstones, claystones, lignites			
Sandstones, claystones, marlstones, limestones with gypsum			
Sandstones, conglomerates	Sandstones, conglomerates		
Sandstones, conglomerates, shales, quartzites			
Sandstones, conglomerates, claystones, shales, marlstones			
Sandstones, limestones, shales, lignites	Sandstones, limestones		
Sandstones, marlstones	Sandstones, marlstones		
Sandstones, marlstones, limestones, volcanic rocks (basic)			
Sandstones, shales	Sandstones, shales		
Sandstones, shales, limestones			
Sandstones, shales, conglomerates, phyllites, volcanic rocks (basic)			

Sandstones, siltstones, claystones, limestones	Sandstones, siltstones	Shales	
Sandstones, siltstones, claystones			
Sandstones, siltstones, claystones with gypsum			
Shales	Shales		
Shales, limestones	Shales, limestones		
Shales, phyllites, schists, sandstones	Shales, phyllites		
Shales, phyllites, sandstones, quartzites, limestones			
Shales, quartzites, volcanic rocks	Shales, quartzites		
Shales, quartzites, sandstones			
Shales, quartzites, sandstones, phyllites, schists			
Shales, sandstones, limestones	Shales, sandstones		
Shales, sandstones			
Shales, sandstones, conglomerates			
Shales, sandstones, cherts, volcanic rocks			
Plutonic rocks (acid to intermediate)	Plutonic rocks (acid)	Plutonic rocks	Magmatic rocks
Plutonic rocks (acid to intermediate, gneissic)			
Plutonic rocks			
Plutonic rocks (ultrabasic)	Plutonic rocks (basic)		
Plutonic rocks (basic)			
Volcanic rocks (jointed)	Volcanic rocks		
Volcanic rocks			
Volcanic rocks, shales, sandstones, conglomerates, claystones, limestones			
Volcanic rocks, sandstones, shales, dolomitic limestones			
Volcanic rocks, limestones, conglomerates, sandstones			
Volcanic rocks (acid)			

Volcanic rocks (acid to intermediate)	Volcanic rocks (acid)		
Volcanic rocks (basic)	Volcanic rocks (basic)		
Volcanic rocks (basic), ophiolitic series			
Volcanic rocks (basic to intermediate)			
Pyroclastic rocks	Volcanic rocks, pyroclastic rocks		
Volcanic rocks, pyroclastic rocks			
Pyroclastic rocks, volcanic rocks, marlstones			
Volcanic rocks (acid), pyroclastic rocks, sandstones, shales			
Gneisses, mica schists, amphibolites	Gneisses, mica schists	Gneisses	Metamorphic rocks
Gneisses, mica schists, migmatites			
Gneisses, plutonic rocks (acid)	Gneisses, plutonic rocks		
Marbles	Marbles	Marbles	
Marbles, schists, quartzites	Marbles, schists		
Phyllites, gneisses, shales, sandstones, volcanic rocks	Phyllites, gneisses	Phyllites	
Phyllites, schists, quartzites	Phyllites, schists		
Quartzites, shales	Quartzites	Quartzites	
Quartzites			
Quartzites, conglomerates, sandstones, shales (jointed)			
Quartzites, conglomerates, phyllites, shales			
Quartzites, sandstones, shales, volcanic rocks			
Quartzites, sandstones, shales, limestones			
Quartzites, sandstones, shales			
Quartzites, sandstones, phyllites	Quartzites, sandstones		
Quartzites, sandstones			
Schists, gneisses		Schists	
Serpentinities, ophiolitic series	Serpentinities		

2. Partially Consolidated Lithologies

LEVEL1	LEVEL2	LEVEL3	LEVEL4
Limestones and sands	Limestones and sands	Limestones and sands	Calcareous rocks and coarse sediments
Limestones, conglomerates, sandstones, marlstones and sands			
Dolomitic limestones, marlstones, siltstones, sandstones and sands	Limestones, marlstones and sands		
Limestones (sandy), sandstones and sands, silts	Limestones, sandstones and sands		
Limestones, sandstones and sands			
Limestones, sandstones and sands, gravels			
Limestones, sandstones and sands, clays			
Limestones, sandstones and sands, clays with gypsum			
Limestones, sandstones and sands, silts, clays			
Marlstones, limestones, sandstones and sands, clays, marls			
Marlstones, sandstones and sands, clays	Marlstones, sandstones and sands, clays		
Clays and dolomitic limestones	Limestones and clays	Limestones and clays	
Gypsum, anhydrite and clays			
Limestones and clays, fine sands			
Clays, marls and limestones	Limestones and clays, marls		
Limestones, conglomerates, sandstones and clays	Limestones, conglomerates and clays		
Clays, sands and dolomitic limestones, marlstones, sandstones	Limestones, marlstones and clays, sands		
Dolomitic limestones, marlstones and clays with gypsum			

Limestones, marlstones and clays, sands, silts with gypsum			Calcareous rocks and fine sediments			
Clays and limestones, sandstones	Limestones, sandstones and clays					
Clays, sands, gravels, marls and limestones, sandstones, conglomerates, pyroclastic rocks						
Limestones, sandstones, conglomerates, ophiolitic series and clays						
Chalkstones and marls				Limestones and marls	Limestones and marls	
Dolomitic limestones and marls						
Limestones and marls						
Marls and limestones	Limestones and marls, clays					
Dolomitic limestones and marls, clays						
Dolomitic limestones and marls, clays with gypsum						
Limestones, ophiolitic series and marls, clays						
Marls, clays and limestones with gypsum and anhydride	Limestones, claystones and marls					
Limestones, claystones, sandstones, conglomerates and marls, sands						
Limestones, claystones, sandstones, conglomerates and marls						
Marls and claystones, limestones	Limestones, sandstones and marls					
Limestones, calcarenites, sandstones and marls						
Limestones, sandstones and marls						
Limestones, sandstones, siltstones and marls						
Limestones, shales, sandstones and marls						
Limestones, siltstones, sandstones and marls, clays						
Marls and limestones, sandstones						
Marls, clays, sands and limestones, sandstones						
Clays, sands and marlstones, pyroclastic rocks with gypsum	Marlstones, pyroclastic rocks and clays, sands		Marlstones and clays			
Marlstones, sandstones, conglomerates with lignites and clays	Marlstones, sandstones and clays					

Marlstones, sandstones, limestones and clays			
Marlstones, sandstones and marls, clays	Marlstones, sandstones and marls, clays	Marlstones and marls	
Silts, clays, sands, gravels and conglomerates	Conglomerates and sands, silts	Conglomerates and sands	Siliciclastic rocks and coarse sediments
Conglomerates, sandstones, limestones and sands, clays	Conglomerates, sandstones and sands, clays		
Conglomerates, sandstones and sands, clays	Conglomerates, sandstones and sands, clays		
Conglomerates (calcareous), sandstones and sands, clays, gravels	Conglomerates, sandstones and sands, gravels		
Conglomerates, sandstones and gravels, sands			
Calcarenites and sands			
Pyroclastic rocks and sands, clays	Sandstones and sands	Sandstones and sands	
Sands and sandstones			
Sandstones, shales and silts			
Sands, clays and sandstones			
Sands, silts, clays and sandstones	Sandstones and sands, clays		
Siltstones, sandstones and sands, clays			
Clays, marls, sands and sandstones			
Sands, clays and sandstones, conglomerates			
Sands, clays and sandstones, limestones	Sandstones, limestones and sands, clays		
Sands, clays, marls and sandstones, phosphorites, lignites			
Clays and claystones, marlstones	Claystones and clays		Claystones and clays
Clays and shales (combustible)			
Clays and claystones, sandstones, conglomerates	Claystones, sandstones and clays		
Clays, sands, gravels, marls and claystones, sandstones, conglomerates			
Claystones, sandstones, limestones and clays			
Claystones, sandstones, siltstones and clays			

Claystones, sandstones and clays			Siliciclastic rocks and fine sediments
Conglomerates, sandstones, claystones and clays	Conglomerates, sandstones and clays	Conglomerates and clays	
Conglomerates, limestones, sandstones and marls, clays	Conglomerates, sandstones and clays, marls		
Conglomerates, sandstones and marls, clays			
Conglomerates, sandstones and marls, clays with gypsum			
Clays, silts and sandstones, marlstones	Sandstones and clays		
Sandstones, limestones and clays			
Clays and sandstones, conglomerates			
Sandstones, shales (combustible) and clays			
Sandstones, siltstones, conglomerates and clays	Sandstones and clays		
Clays, marls and sandstones		Sandstones and clays, marls	
Clays, marls and sandstones, conglomerates			
Clays, marls and sandstones, siltstones, limestones			
Clays, marls and sandstones, siltstones, limestones with gypsum			
Sandstones and clays, marls			
Clays, sands and sandstones	Sandstones and clays, sands		
Clays, sands and sandstones with gypsum			
Clays, sands and siltstones, sandstones			
Clays, sands, gravels and sandstones with gypsum			
Clays, sands, marls and sandstones, shales			
Marls and sandstones	Sandstones and marls	Sandstones and marls	
Marls, sands and sandstones			
Sandstones and marls, clays			
Marls, sands, clays and sandstones	Sandstones and marls, sands		

Marls, clays and sandstones, conglomerates, limestones with gypsum	Sandstones, conglomerates and marls		
Sandstones, shales, conglomerates, limestones and marls			
Marls and sandstones, limestones with gypsum	Sandstones, limestones and marls		
Marls and sandstones, limestones, claystones			
Sandstones, limestones and marls			

3. Unconsolidated Lithologies

LEVEL1	LEVEL2	LEVEL3	LEVEL4
Gravels, sands	Gravels, sands	Gravels	Coarse sediments
Gravels, sands, silts			
Valley fillings			
Gravels, sands covered by clays, silts	Gravels, sands, clays		
Gravels, sands, clays			
Gravels, sands, clays, marls and sandstones, conglomerates, limestones			
Sands	Sands	Sands	
Sands (glauconitic)			
Sands, clays	Sands, clays		
Sands, silts, clays			
Sands, gravels	Sands, gravels		
Sands, gravels, silts			
Sands, gravels, boulders, clays, silts			
Sands, silts, gravels			
Sands, gravels covered by clays, silts	Sands, gravels, clays		
Sands, gravels, silts, clays			
Sands, gravels, clays			
Clays	Clays		Clays
Clays, marls with gypsum	Clays, marls		
Clays, marls			
Clays, boulder clays, silts, sands, gravels	Clays, boulder clays		
Clays, sands	Clays, sands		
Clays, sands, gravels			
Clays, sands, marls			
Clays, silts, sands	Clays, silts		
Clays, silts, sands, gravels			
Marls, clays	Marls, clays	Marls	
Silts, clays, gravels, boulders	Silts, clays	Silts	
Silts, clays, sands, boulders			
Silts, clays, sands			
Silts, sands	Silts, sands		
Silts, fine sands, clays, gravels			
Silts, fine sands			