The Global Tsunami Model (GTM)

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UNESCAP scientific workshop, Muscat, 20.4 - 2024

Agenda

- ✓GTM – explaining the background, history, and goal
- ✓Examples of past activities, reference products
- ✓Status and present evolution

Why GTM – background for the initiative:

✓Multi-institutional work on hazard and risk for the UN-ISDR (Global Assessment Report, GAR)

GAR

Global Assessment Report on Disaster Risk Reduction

2015

✓**Idea:** Need for a *Collective effort for improved understanding of global tsunami hazard and risk*

- Provide reference maps
- Improve methods, develop guidelines and standards
- Ensure relevance towards stakeholders

✓*Initiative from the tsunami community itself*

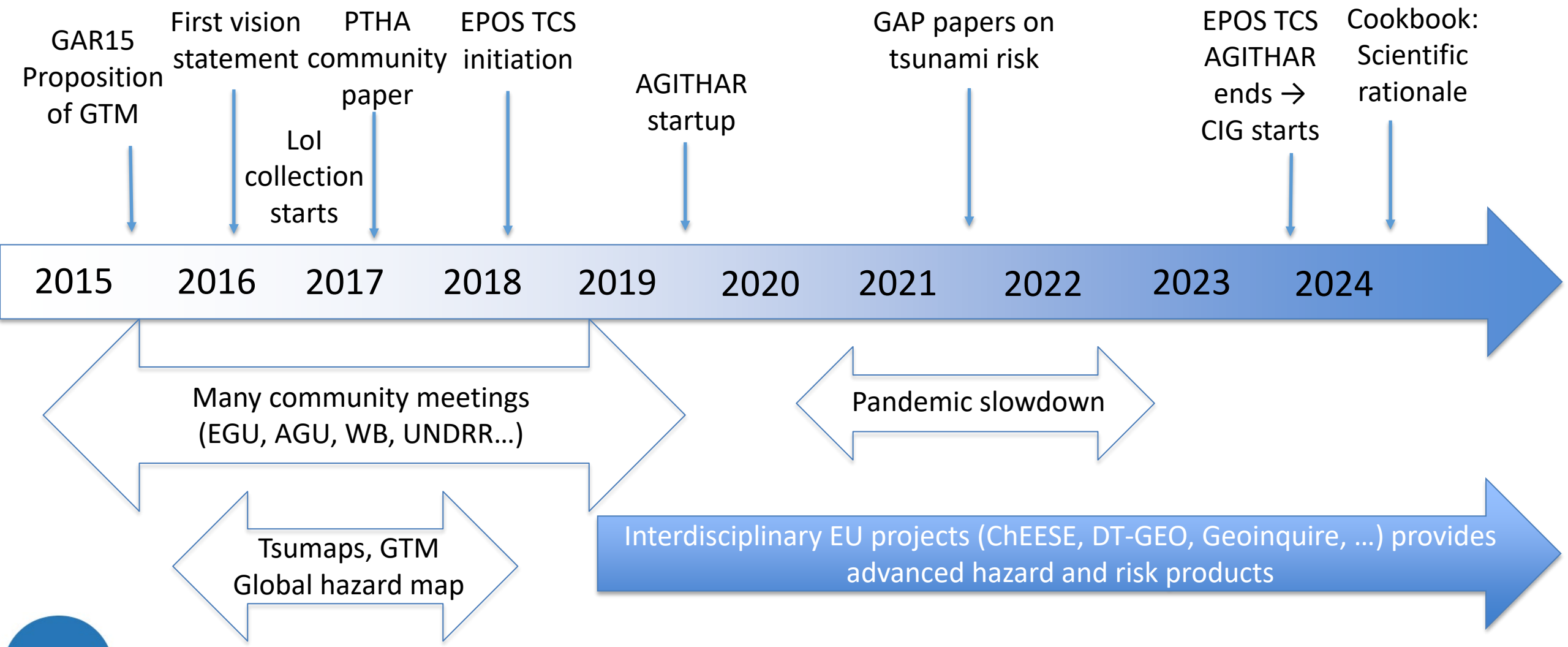
✓*Presently a research network*

GTM global tsunami model

Current GTM structure

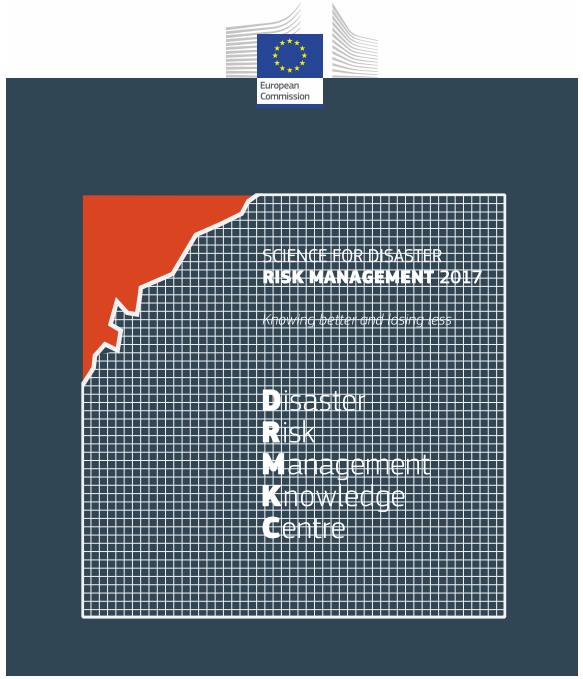
- ✓ proposed to the tsunami community at IUGG June 2015, discussed among partners in several meetings since (AGU, EGU…)
- ✓ **Loose structure committing partners** to the GTM through signing of Letter of Interest (LoI's)
- ✓ **36 Partners signed LoIs, more interested (involved in meetings etc)**
- ✓ INGV and NGI receive LoI's on behalf of GTM and perform majority of secretary work

GTM timeline



Previous activities

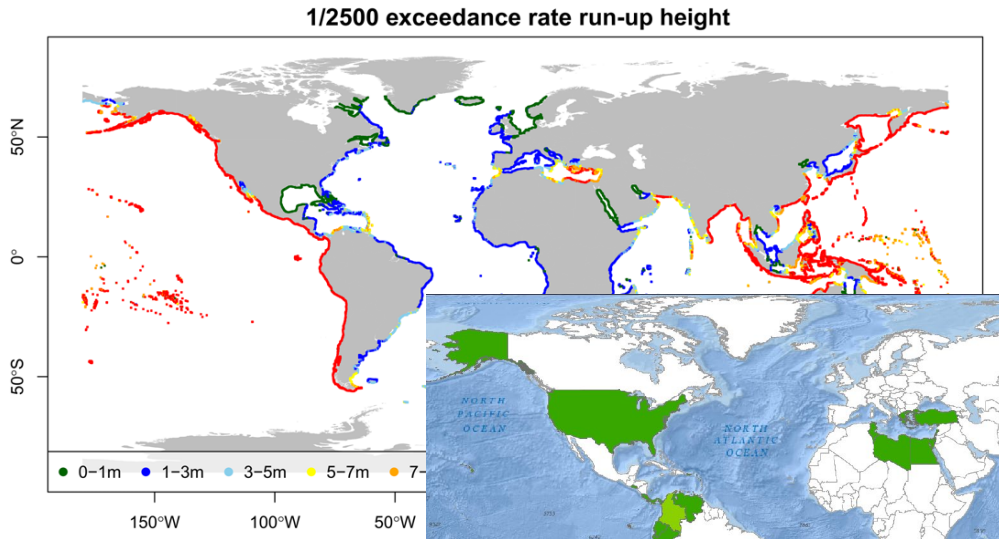
- ✓UNDRR Global Assessment Reports 2009-2019
- ✓ThinkHazard Global maps (GFDRR)
- ✓GFDRR Challenge fund (multihazard)
- ✓Words into action 2017 (UNISDR)
- ✓World tsunami awareness day (UNDRR)
- ✓DRMKC guidelines

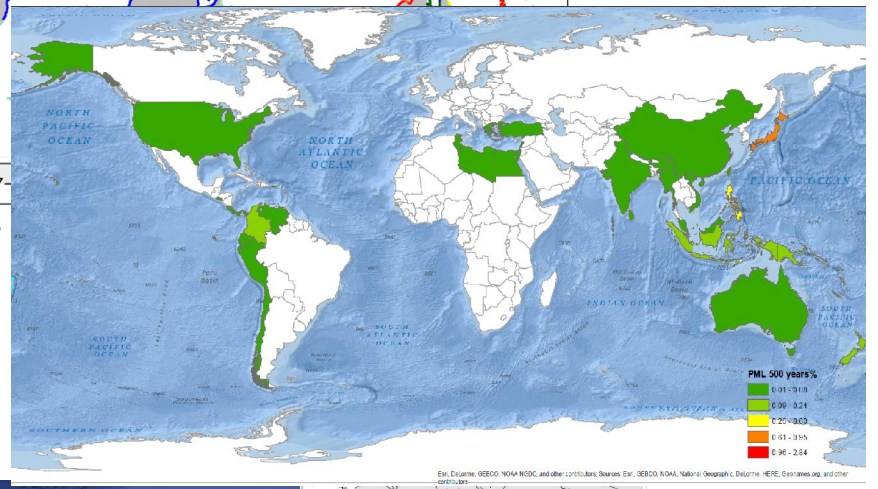


GTM global tsunami model

Past reference products

- ✓Global tsunami map – risk map
  - →Global Assessment Report 2015 – economic loss
  - →Updated hazard map (Davies et al. 2018)
- ✓TSUMAPS-NEAM (http://www.tsumaps-neam.eu/)
  - →Tsunami hazard maps for DG-ECHO (European Civil Protection)
  - →Rigorous uncertainty treatment
  - →“Local” amplification factors
  - →Makes use of GTM pool of experts





Community papers

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Reviews of Geophysics
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Review Article

Probabilistic Tsunami Hazard Analysis (PTHA): multiple sources and global applications†

Anita Grezio, Andrey Babeyko, Maria Ana Baptista, Jörn Behrens, Antonio Costa, Gareth Davies, Eric L. Geist, Sylfest Glimsdal, Frank I. González, Jonathan Griffin, Carl B. Harbitz, Randall J. LeVeque, Stefano Lorito, Finn Løvholt, Rachid Omira, Christof Mueller, Raphaël Paris, Tom Parsons, Jascha Polet, William Power, Jacopo Se Mathilde B. Sørensen, Hong Kie Thio

Accepted manuscript online: 14 November 2017 Full publication history

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†This article has been accepted for publication and undergone full peer review but has not been through the c and proofreading process, which may lead to differences between this version and the Version of Record. Plea 10.1002/2017rg000579

frontiers in Earth Science

ORIGINAL RESEARCH
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The Making of the NEAM Tsunami Hazard Model 2018 (NEAMTHM18)

Roberto Basili[1]*, Beatriz Brizuela[1], André Herrero[1], Sarfraz Iqbal[2], Stefano Lorito[1], Francesco Emanuele Maesano[1], Shane Murphy[3], Paolo Perfetti[2], Fabrizio Romano[1], Antonio Scala[1,4], Jacopo Selva[2], Matteo Taroni[1], Mara Monica Tiberti[1], Hong Kie Thio[5], Roberto Tonini[1], Manuela Volpe[1], Sylfest Glimsdal[6], Carl Bonnevie Harbitz[6], Finn Løvholt[6], Maria Ana Baptista[7], Fernando Carrilho[8], Luis Manuel Matias[9], Rachid Omira[9], Andrey Babeyko[10], Andreas Hoechner[10,11], Mücahit Gürbüz[12], Onur Pekcan[12], Ahmet Yalçıner[12], Miquel Canals[13], Galderic Lastras[13], Apostolos Agalos[14], Gerassimos Papadopoulos[15], Ioanna Triantafyllou[16], Sabah Benchekroun[17], Hedi Agrebi Jaouadi[18], Samir Ben Abdallah[18], Atef Bouallegue[18], Hassene Hamdi[18], Foued Oueslati[18], Alessandro Amato[1], Alberto Armigliato[19], Jörn Behrens[20], Gareth Davies[21], Daniela Di Bucci[22], Mauro Dolce[22,23], Eric Geist[24], Jose Manuel Gonzalez Vida[25], Mauricio González[26], Jorge Macias Sánchez[25], Carlo Meletti[27], Ceren Ozer Sozdinler[28], Marco Pagani[29], Tom Parsons[24], Jascha Polet[30], William Power[31], Mathilde Sørensen[32] and Andrey Zaytsev[33]

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Probabilistic Tsunami Hazard Analysis: High Performance Computing for Massive Scale Inundation Simulations

Steven J. Gibbons[1]*, Stefano Lorito[2], Jorge Macías[3], Finn Løvholt[1], Jacopo Selva[4], Manuela Volpe[2], Carlos Sánchez-Linares[3], Andrey Babeyko[5], Beatriz Brizuela[2], Antonella Cirella[2], Manuel J. Castro[3], Marc de la Asunción[3], Piero Lanucara[5], Sylfest Glimsdal[1], Maria Concetta Lorenzino[2], Massimo Nazaria[2], Luca Pizzimenti[2], Fabrizio Romano[2], Antonio Scala[7], Roberto Tonini[2], José Manuel González Vida[3] and Malte Vöge[1]

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REVIEW
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Probabilistic Tsunami Hazard and Risk Analysis: A Review of Research Gaps

Jörn Behrens[1]*, Finn Løvholt[2], Fatemeh Jalayer[3], Stefano Lorito[4], Mario A. Salgado-Gálvez[5,6], Mathilde Sørensen[7], Stephane Abadie[8], Ignacio Aguirre-Ayerbe[9], Iñigo Aniel-Quiroga[9], Andrey Babeyko[10], Marco Baiguera[11], Roberto Basili[4], Stefano Belliazzi[3], Anita Grezio[12], Kendra Johnson[13], Shane Murphy[14], Raphaël Paris[15], Irina Rafliana[16,17], Raffaele De Risi[18], Tiziana Rossetto[11], Jacopo Selva[12], Matteo Taroni[4], Marta Del Zoppo[3], Alberto Armigliato[19], Vladimír Bureš[20], Pavel Cech[20], Claudia Cecioni[21], Paul Christodoulides[22], Gareth Davies[23], Frédéric Dias[24], Hafize Başak Bayraktar[3], Mauricio González[9], Maria Gritsevich[25,26,27], Serge Guillas[11], Carl Bonnevie Harbitz[2], Utku Kânoğlu[28], Jorge Macías[29], Gerassimos A. Papadopoulos[30], Jascha Polet[31], Fabrizio Romano[4], Amos Salamon[32], Antonio Scala[3], Mislav Stepinac[33], David R. Tappin[11,34], Hong Kie Thio[35], Roberto Tonini[4], Ioanna Triantafyllou[36], Thomas Ulrich[37], Elisa Varini[38], Manuela Volpe[4] and Eduardo Vyhmeister[39]

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Tsunami risk communication and management: Contemporary gaps and challenges

Irina Rafliana[a,b,*], Fatemeh Jalayer[c], Andrea Cerase[d,e], Lorenzo Cugliari[e], Marco Baiguera[f], Dimitra Salmanidou[g], Öcal Necmioğlu[h,1], Ignacio Aguirre Ayerbe[i], Stefano Lorito[e], Stuart Fraser[j], Finn Løvholt[k], Andrey Babeyko[l], Mario A. Salgado-Gálvez[m,n], Jacopo Selva[o], Raffaele De Risi[p], Mathilde B. Sørensen[q], Jörn Behrens[r], Iñigo Aniel-Quiroga[i], Marta Del Zoppo[c], Stefano Belliazzi[c], Ignatius Ryan Pranantyo[s], Alessandro Amato[e], Ufuk Hancilar[h]

GTM Path forward - the AGITHAR networking initiative

- ✓AGITHAR – Accelerating Global Science in Tsunami Hazard and Risk Analysis
- ✓European networking project – funds meetings – facilitates discussions
- ✓Goal - facilitate the formation of GTM
- ✓Gather scientific community to document
  - →Scientific state of the art
  - →Science GAPs
  - →Pose challenges and directions for future tsunami practitioners
- ✓Duration 2019-2023
- ✓Additional year funded for 2024 – COST Innovators Grant (CiG)
  - →***Focussed on forming the GTM entity***
  - →***Presently the main arena for shaping GTM***
  - →***A key ambition is to engage more non-European partners***

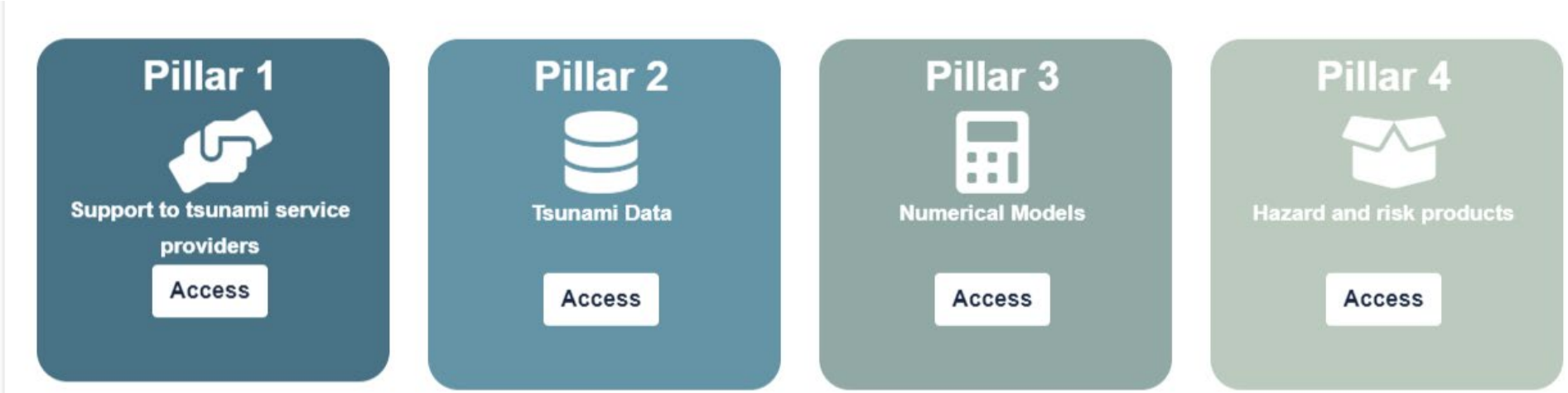
GTM (draft) vision

Saving lives, reducing losses, and enhancing resilience, through the advancement of tsunami science, provision of expert information, and promoting dialog about tsunami hazard and risk

GTM service provision - EPOS Tsunami TCS

- ✓EPOS – European Plate Observing System – an infrastructure that hosts services and data related to solid earth sciences and natural hazards
- ✓Tsunami TCS - provision of a series of tsunami services made available publicly

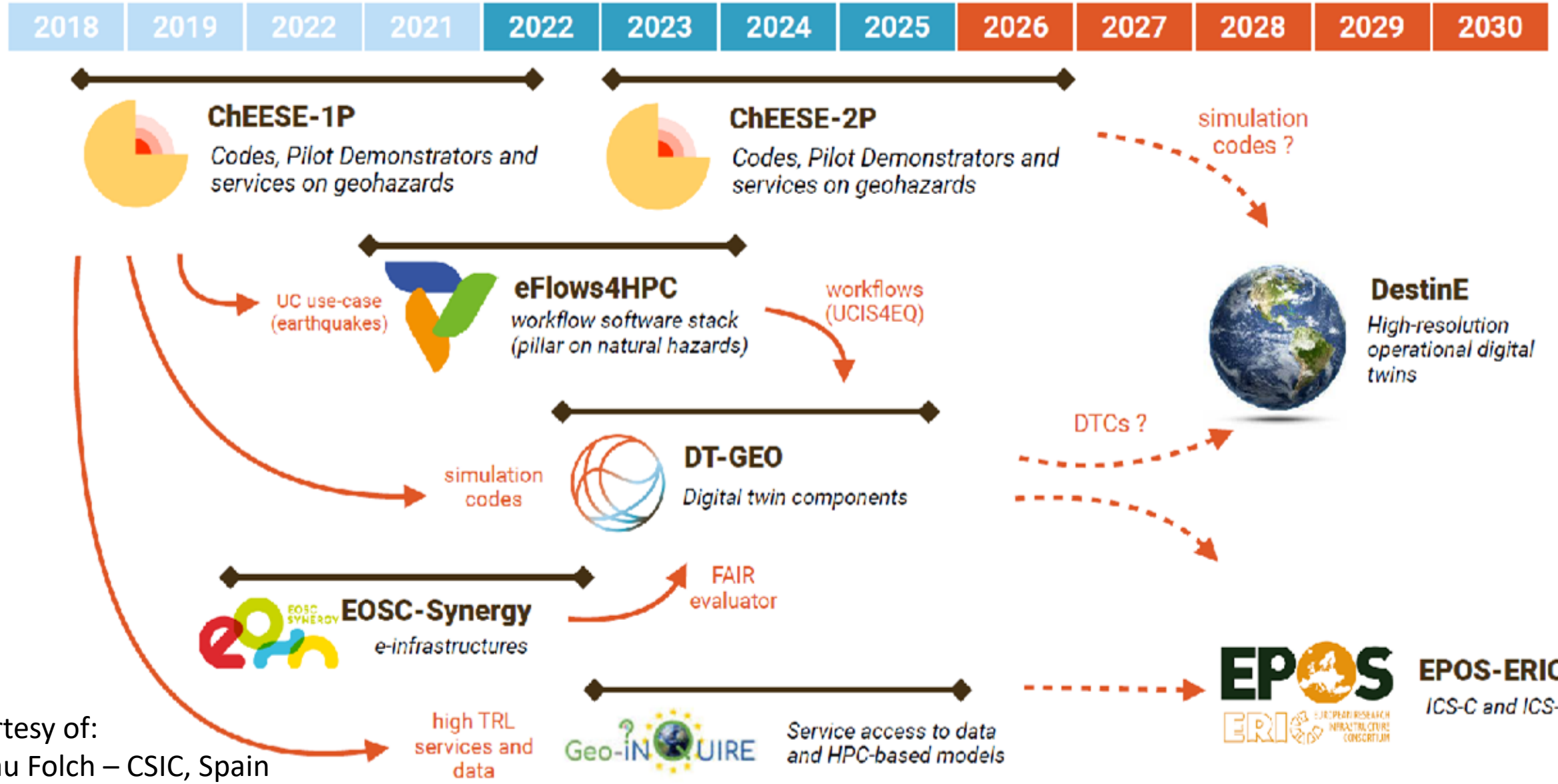
  →https://tsunamidata.org/



GTM global tsunami model

EPOS EUROPEANPLATEOBSERVINGSYSTEM

The EU project's ecosystem – providing tomorrows GTM models



Courtesy of:
Arnau Folch – CSIC, Spain

Related EU projects - examples

- ✓**ChEESE** (2018-2022, finished) – HPC CoE in Solid Earth applications
- ✓**ChEESE-2P** (Horizon / EuroHPC, Coord: CISC) – Continuation of the ChEESE CoE
- ✓**eFlows4HPC** – adopting workflow managers for HPC (2020 – 2023, H2020/EuroHPC, Coord: BSC)
- ✓**Geo-Inquire** (2022-2026, Horizon, GFZ-Potzdam) – eInfrastructure within Solid Earth and Geophysics
- ✓**ARISTOTLE** – post event assessments – rapid tsunami modelling (hosted by INGV)
- ✓**DT-GEO** - (2022 - 2025) – Digital Twins in solid earth science
- ✓**EPOS-ON** (2024→) Community building, service provision
- ✓Substantially sized projects. Knowhow and products from these projects provide important backbone for GTM

GTM global tsunami model

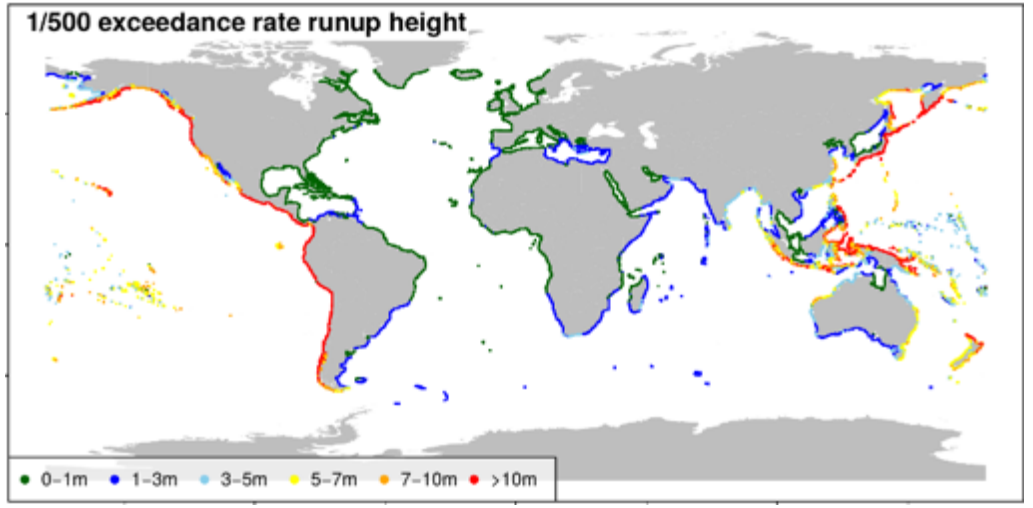
CHEESE 2 GTM PTHA MODEL

Background / input

- Previous Global Tsunami Hazard model
- TSUMAPS-NEAM hazard model
- ChEESE1P – local hazard workflow

Objectives

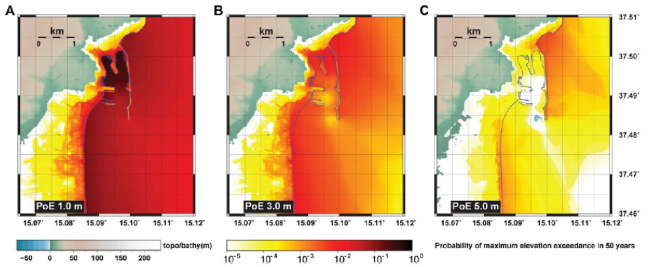
- New higher resolution global hazard maps
- Expand local probabilistic tsunami hazard service in Europe to be global
- Scalable (from global to local) PTHA at any location worldwide
- Integration with OpenQuake
- Uncertainty treatment



Highly collaborative activity: **INGV, UMA, NGI, TUM, LMU**

GAR Global Assessment Report on Disaster Risk Reduction 2015

TSUMAPS NEAM Probabilistic TSUnami Hazard MAPS for the NEAM Region



OPENQUAKE calculate share explore

GTM global tsunami model

GTM present status

- ✓Several work group in European COST Innovation Grant working for establishing a GTM entity
- ✓Finalization of tsunami “cookbook” that gives guidelines to practitioners
- ✓Several working groups
  - →Vision WG
  - →Legal WG
  - →Business Plan WG
  - →Products WG
  - →Target Groups WG
  - →Training WG
- ✓Emphasis on finalizing plan for concretizing GTM by fall 2024
- ✓https://edanya.uma.es/gtm/

Thank you!

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model