....

IDC Software for NDCs, Status and Future

D. Keda, G. Graham and M. Villagrán

CTBTO IDC, Office of the Director



Presentation Date: 11 September 2025

DISCLAIMER:

The views expressed in this presentation are those of the authors and do not necessarily reflect the view of the CTBTO.

D. Keda, G. Graham and M. Villagrán



Table of Contents

- > IDC services to States [mandate]
- > IDC Software-based services to States (NDCs)
- ➤ NIAB & online Software Development History (1999-2025)
- > NIAB Scope
- > Inventory of IDC applications provided to NDCs (NIAB and online)
- \rightarrow The future of Software-based services to States (2026 \rightarrow)
- Conclusions



D. Keda, G. Graham and M. Villagrán



IDC Services to States (1/2)

Technical assistance [CTBT Protocol Part 1 para 22]

- **22.** The International Data Centre shall, where required, provide technical assistance to individual States Parties:
 - (a) In formulating their requirements for selection and screening of data and products;
 - (b) By installing at the International Data Centre, at no cost to a requesting State Party for reasonable efforts, computer algorithms or software provided by that State Party to compute new signal and event parameters that are not included in the Operational Manual for the International Data Centre, the output being considered products of the requesting State Party; and
 - (C)By assisting States Parties to develop the capability to receive, process and analyse International Monitoring System data at a national data centre.



Training

Capacity Building and Training + Software Development





D. Keda, G. Graham and M. Villagrán



Technical Training Programme

- Training to Station Operators of the IMS
- **Training for NDC Staff**
- IDC Staff

Information/Education/Research Resources

Service to States Signatories

• Provision of information to Permanent Missions, National Authorities, NDCs

• Management of information related to IDC Users and Station Operators

Attending technical requests from NDC users (~1000 tickets/year)

PTS Library Services

Others

E-Learning Platform Services (multi-language)

Provision of NDC-in-a-box Software (NIAB)

IDC Services to States (2/2)



Capacity Building and Training Programme **Vectors of Work**



Multi-Language

• 6 languages of the Commission



Management and Coordination

Technical visits to follow-up (training on-site)

Equipment Support

Provision and Installation of CBS equipment for NDCs

- Coordination of CB across PTS
- Reporting

NDC4All initiative

PTS/CBT Meetings and Events [Organization] 30-40/year

- SnT Conferences
- NDC Workshops (3-5/year)
- Technical Meetings (3-4/year)
- Technology Workshops (4-6/year)
- Station Operator Training (12-15/year)
- NDC Staff Training (7-9/year)
- Workshops in cooperation with CTBTO/ERIC

Software Development

Provision of Web services/tools

Training for NDC Staff

- Access and (basic) Analysis of waveform IMS Data and IDC Products
- NDC Waveform (advanced) Analyst training
- Training on Additional components to the NDC in a box (extended)
- Access and Analysis of RN IMS Data and IDC Products





D. Keda, G. Graham and M. Villagrán





IDC Software-based Services to States (NDCs)

- ☐ The NDC in a Box (or NIAB) is a software suite that the IDC develops in cooperation and under the guidance of States Signatories. It assists the National Data Centres (NDCs) to support their National Authorities in their treaty verification role.
 - The NIAB includes (in principle) the functionality of the IDC, this allows the NDCs to analyze, reproduce the <u>IDC Operational Pipeline</u> products obtained from IDC automatic and human analysis of IMS Data. NDCs can combine with non-IMS data for the use in civil and scientific applications, in accordance with national needs.
 - > The NIAB includes IDC operational software (developed in-house after 2000), guest customized applications and State's contributions.



Online Services

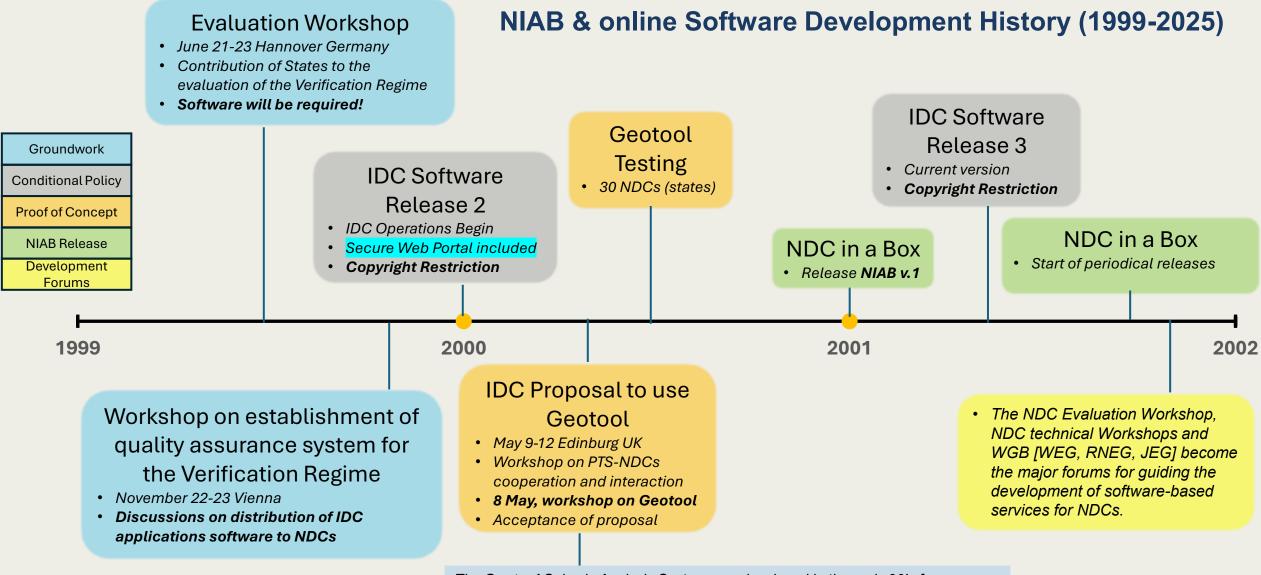
- ☐ Single-Sign-On SSO mechanism for access to online services.
- ☐ The CTBTO Web Portal (through SSO). Provides links to:
 - > IDC Secure Web Portal: Access to IMS Data and IDC Products
 - > NDC Forum, Expert Communication System (ECS)
 - Knowledge and Training Portal (KTP e-learning)
 - > Tools: Web-GRAPE IBS (ATM), RNToolkit, PRTool, SoH, VDMS, PKI-Portal
 - > IMS Information and ticketing: DOTS, IRS
 - > vDEC Virtual Data Exploitation Centre





D. Keda, G. Graham and M. Villagrán





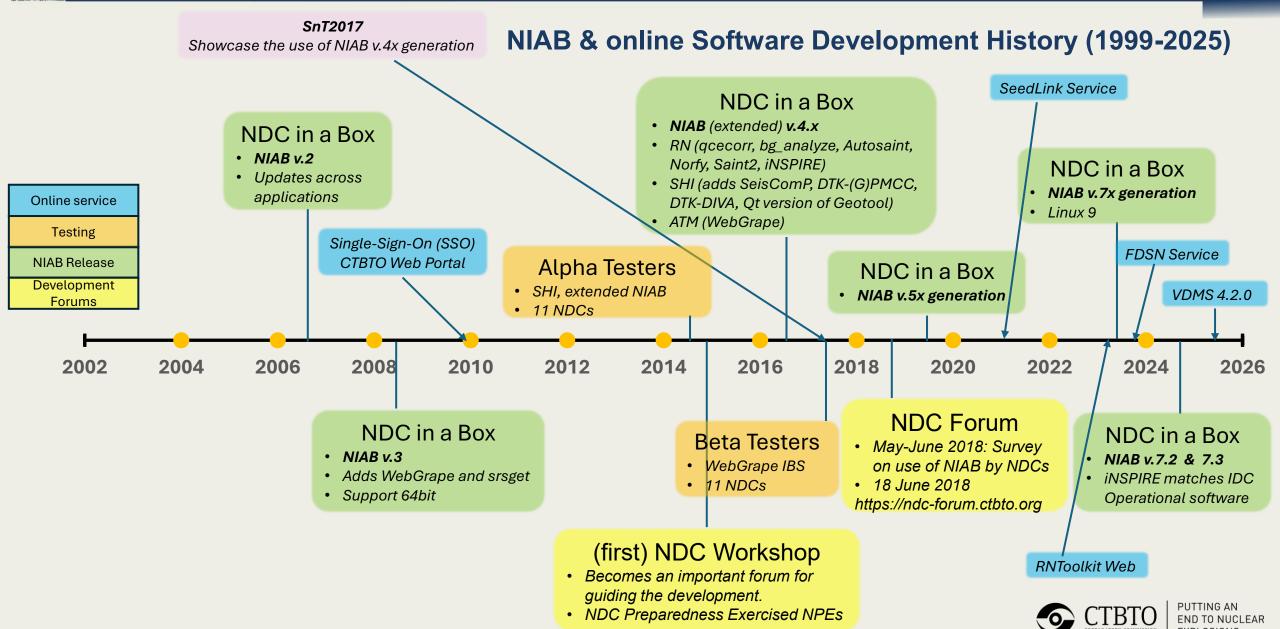
The **Geotool** Seismic Analysis System was developed in the early 90's for ARPA/NMRO under the Nuclear Monitoring Research and Development (NMRD) and later enhanced (1993-1995) at the Phillips Laboratory (US Air Force).





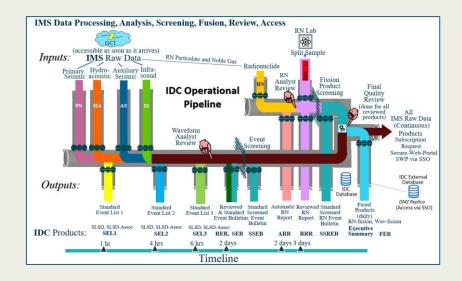
D. Keda, G. Graham and M. Villagrán





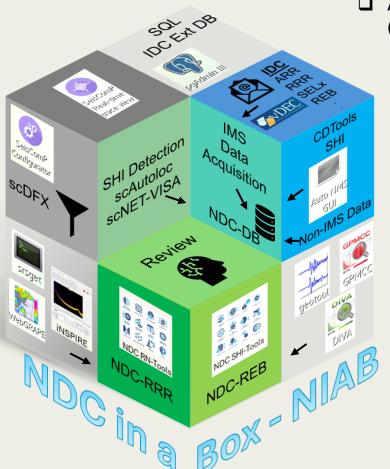
D. Keda, G. Graham and M. Villagrán





- ☐ In analogy to the IDC operational pipeline, the NIAB has been designed for IMS data acquisition.
- ☐ It has also been empowered with capability of acquisition of non-IMS Data and IDC Products.
- The suite includes a relational NDC database

NIAB Software Scope



- ☐ The NIAB includes SHI Detection (scDFX)
- Automatic seismoacoustic event location (scAutoloc and scNET-VISA)

- Tools for
 - Database Administration
 - Data analysis and
 - □ Reporting







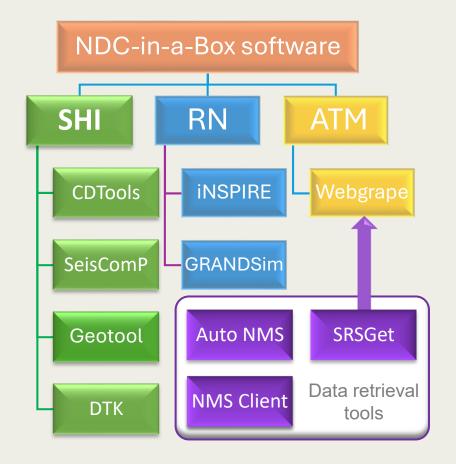
PTS talk #881

D. Keda, G. Graham and M. Villagrán

NDC in a Box - NIAB				
Software	Operating System	Major Components	Release Date	
SHI-NIAB Version 7.2	Rocky Linux 9.5	SeisComP v.6.6.3 Geotool v.3.2.4 Geotool Qt v 5.2_3.1.0 NET-VISA v.2.5.15 DTK-PMCC v.7.4.1 DIVA v.4.5.2 CDTools v.2.5.10rcl (LibCD 2.6.2) NMS_client v.1.0	February 2025	
RN-NIAB Version 7.2	Rocky Linux 9.5	iNSPIRE v.2.30.0 GRANDSim v.1.0.42	February 2025	
WebGRAPE (ATM)	Windows and Linux	Webgrape Desktop v.3.2.4 srsget v 0.26	July 2025	

Other tools and services provided to NDCs (online)			
Technology	Service	Release Date	
SHI	FDSN web service SeedLink service VDMS 4.2.0 / VDMS Client 1.4.8	December 2023 January 2021 July 2025	
RN	RNToolkit web https://rntoolkit.ctbto.org	March 2021	
WebGRAPE (ATM)	Webgrape Internet Based Service (IBS) v.3.2.4 https://webgrape.ctbto.org	July 2025	

SnT2025 Snapshot of NIAB (Inventory) + additional online services





D. Keda, G. Graham and M. Villagrán



The Future of Software-based Services to States (2026→)

- ☐ The methods of interaction between the IDC and NDCs on software development for NDCs include
 - > NDC Forum (https://ndc-forum.ctbto.org)
 - NDC Support (email: <u>support@ctbto.org</u>)
 - > NDC Workshop hosted by states (every 2 years, 2026 is being planned)
 - > NDC Training courses, feedback from participants
 - WGB NDC Issues and Capacity Building
 - WGB [Waveform Expert Group (EG), Radionuclide Expert Group, Joint Expert Group (JEG)]
 - Support to the NDC Preparedness Exercises (NPEs)
- Several areas for improvement are identified
 - > The NIAB needs to (eventually) replicate the IDC Operational software results
 - □ SHI-NIAB is pending on the IDC SHI Software re-engineering project (ongoing since 2011)
 - □ RN-NIAB needs a mechanism acquire the same automatic processing results of IDC Operations
 - > The future role of AI in the NDC software is to be explored
 - Additional online services
 - > Other features in accordance to needs
- ☐ **Proposal:** An additional (highly focused) Technical Meeting on NDC Software to be established on ad hoc basis
 - Sponsored by the PTS and States
 - > Bring together participants from NDCs (with recognized experience on the use of the NIAB)
 - Define additional software-based services online
 - > i.e. Implementation of NIAB online for emerging NDCs [alternative to Capacity Building System (CBS)]
 - Promote exchange of NDC-tools and feasibility to be part of the NIAB



D. Keda, G. Graham and M. Villagrán



CONCLUSIONS

The provision of software-based services for NDCs is a fundamental part of the technical assistance, as it provides the States with the capability to use the IMS Data and IDC Products for treaty verification related issues, as well as for issues of national interest by combining IMS data and IDC information to local available resources.
 The NDC-in-a-Box (NIAB) is a software suite that has been tailored for (and under the guidance of) experts from States. The strategic approach for developing the NIAB has proven to be efficient, as a result, the NIAB has reached an advanced development status (matureness) but there is a path to follow and more milestones to achieve. The software-based online services provide the NDCs with a window into the IDC Operational Pipeline and additional educational and information resources.
The NDC Workshop and WGB technology groups serve as forums for guidance on the needs of NDCs, but they are not fully dedicated to this task.
The NDC forum is an excellent resource for discussion on the existing software-based services, but it is limited in terms of providing further guidance (it requires dedicated human resources and interaction).
The IDC plans to continue with the same development approach, but some areas have been identified to require special attention (a spinoff). To achieve this objective, the IDC is planning to create a new chapter of technical meetings, focusing on the intermediate and far future of the NIAB and online services.
To be announced in 2026!

