NET-VISA: Evaluation of event location performance compared to SEL3, and NEIC PDE

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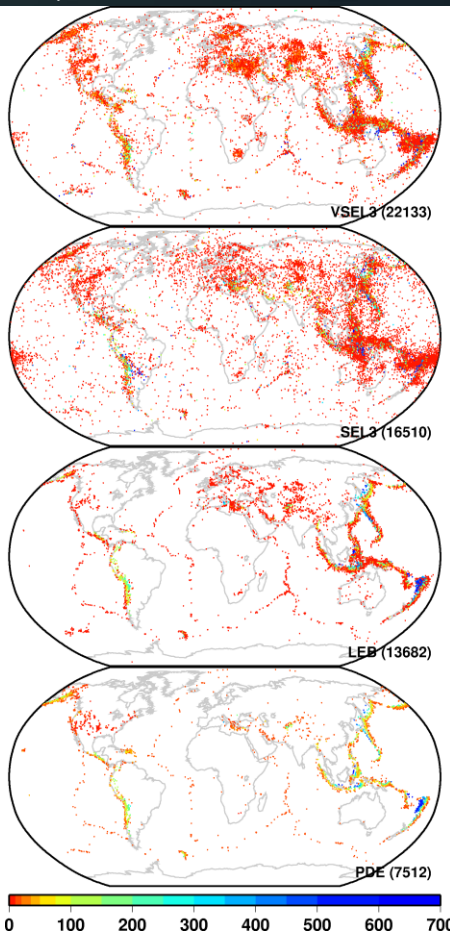
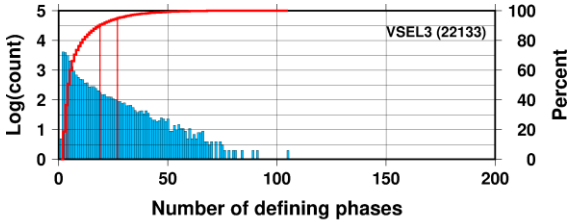
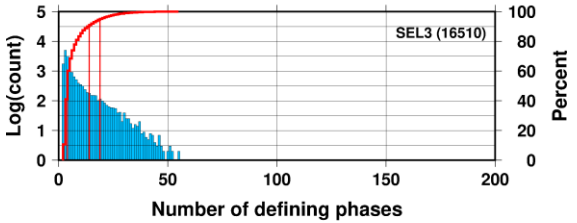
Motivation and data

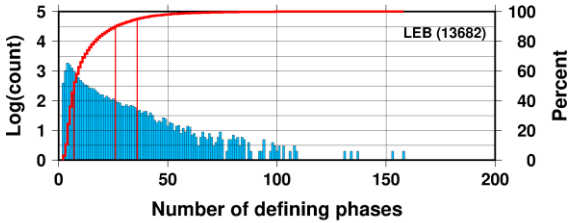


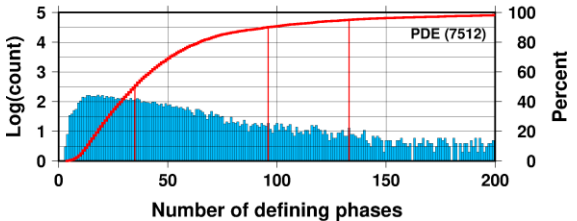
- Evaluate the performance of NetVISA
  - LEB is biased towards SEL3
  - Use PDE instead (No reviewed ISC bulletin yet)
  - NEIC PDE has a higher global magnitude threshold (fewer events) and also uses IMS data
- Data
  - NetVISA 2.3.8, 2018/09/29 – 2018/12/31
  - VSEL3 is available through the external database
- NetVISA 2.3.8, LEB does not use RSTT SSSCs
  - Relocate LEB and VSEL3 with iLoc using RSTT

Depth and number of defining phases

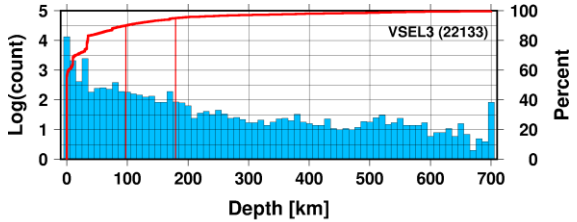


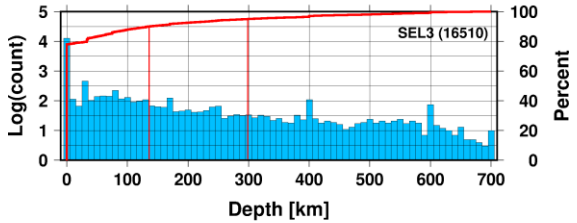


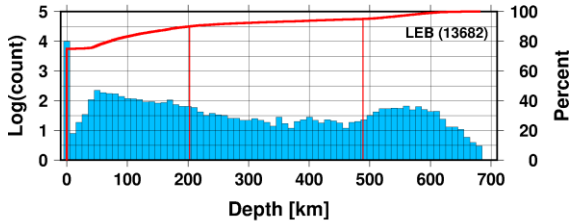


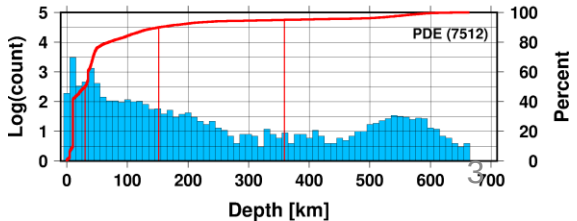


- NetVISA associates more phases and uses more time-defining phases than SEL3
  - Azimuth and slowness are not counted in ndef
- SEL3 has a tendency to put events deep
- LEB produces similar depth distribution to NEIC PDE



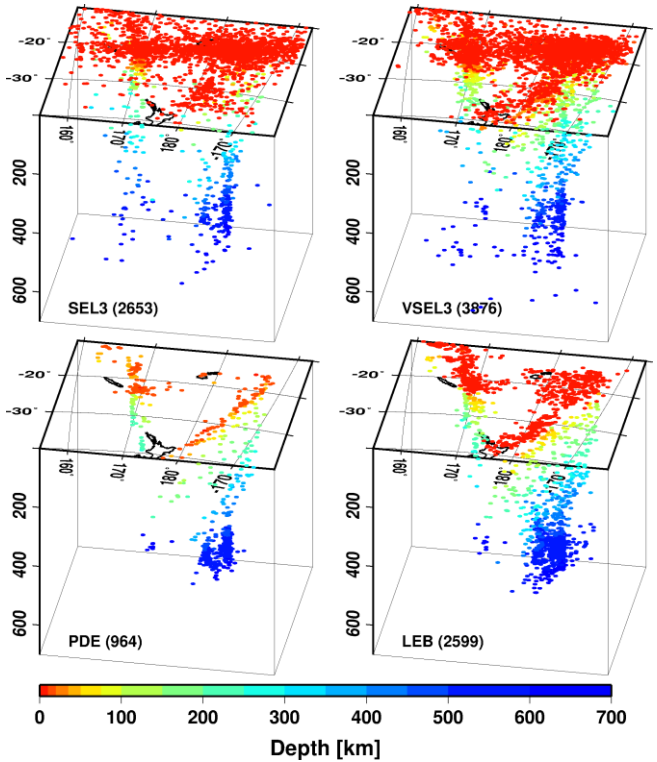






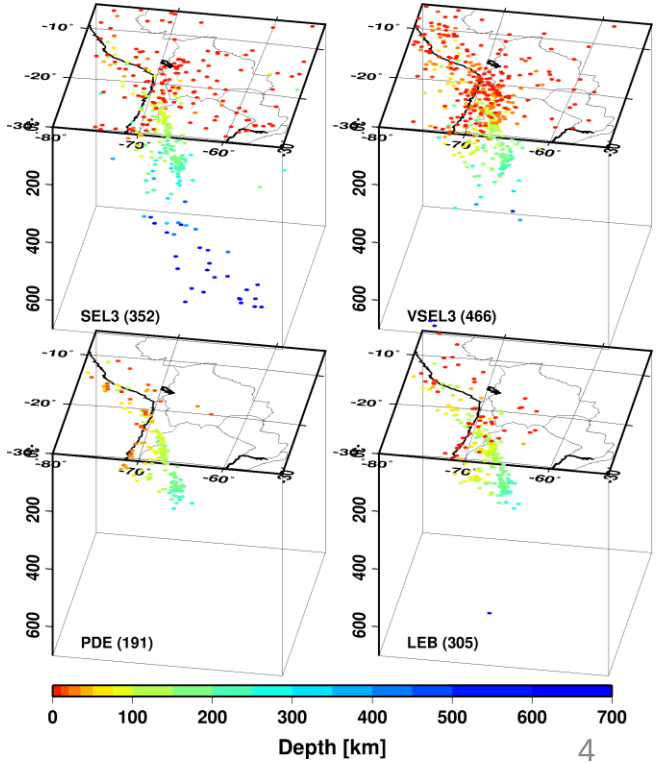
SEL3 – VSEL3 – LEB - PDE

Fiji – Tonga - Kermadec



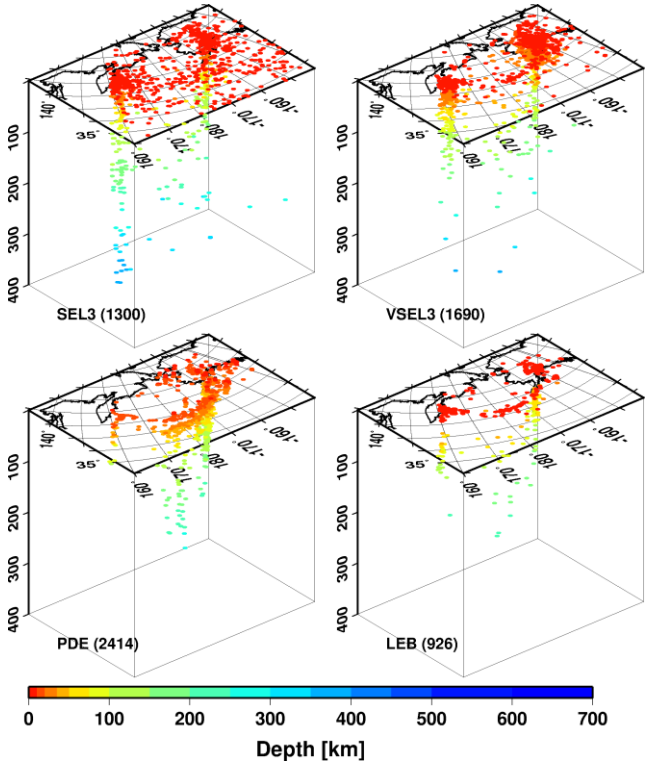
- SEL3 produces many deep events that are later rejected by analysts

Peru – Bolivia - Chile

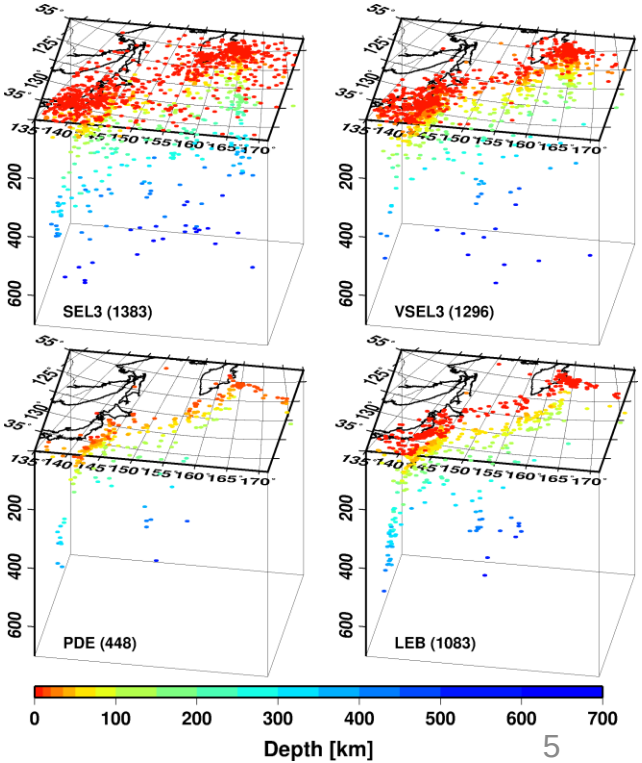


SEL3 – VSEL3 – LEB - PDE

Alaska – Aleutians – Andreanoff Islands – Kuriles - Japan

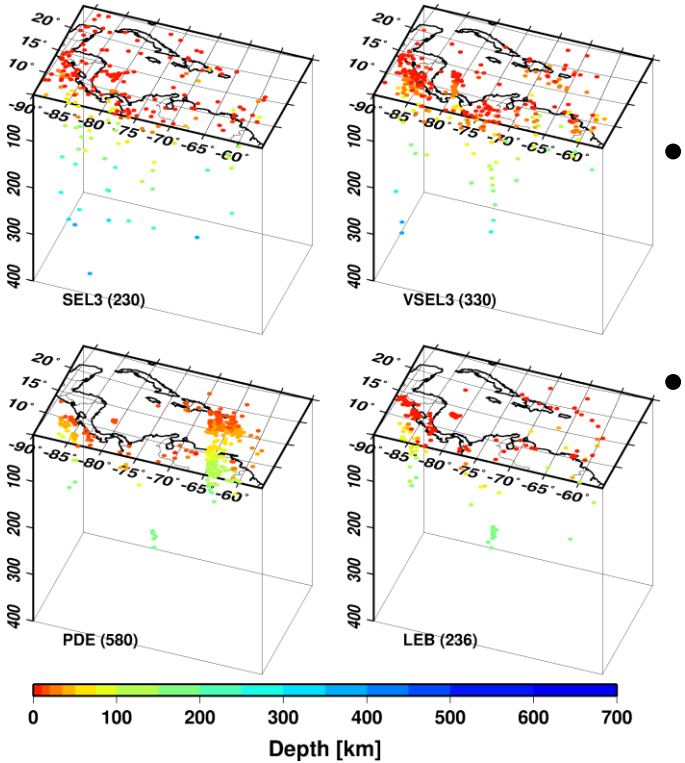


- NetVISA produces tighter seismicity than SEL3
- PDE is more complete in Alaska



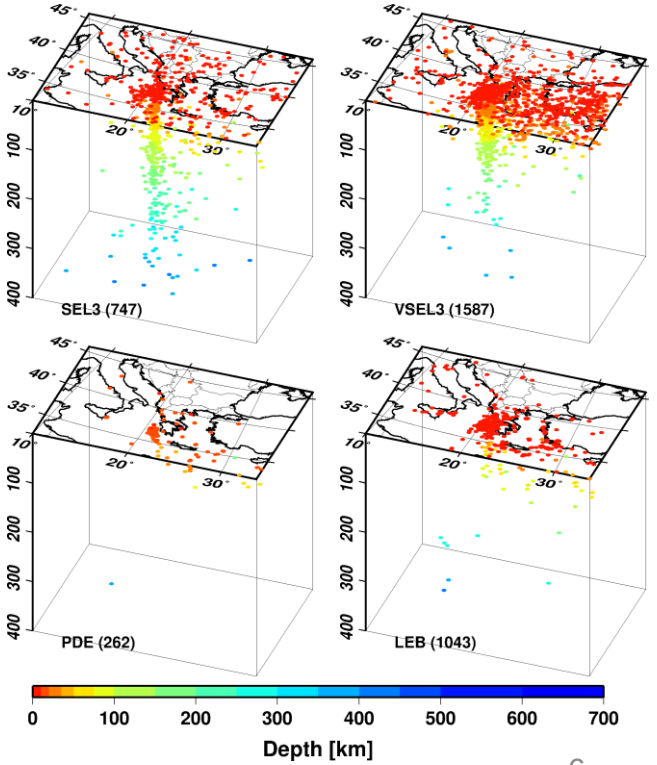
SEL3 – VSEL3 – LEB - PDE

Caribbean



- IDC misses seismicity in the Windward Islands
- NetVISA goes overdrive in the Eastern Mediterranean

Mediterranean



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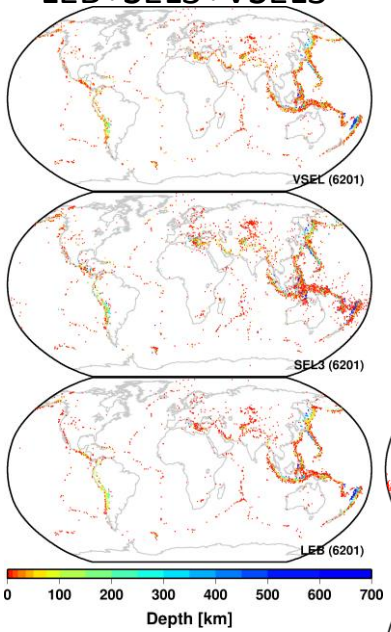
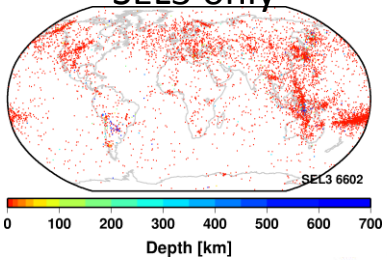
SEL3 – VSEL3 – LEB

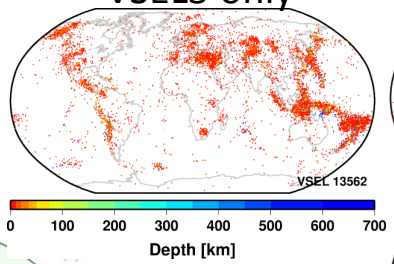
LEB+SEL3+VSEL3



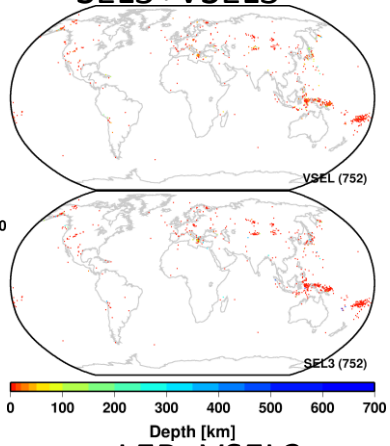
SEL3 only

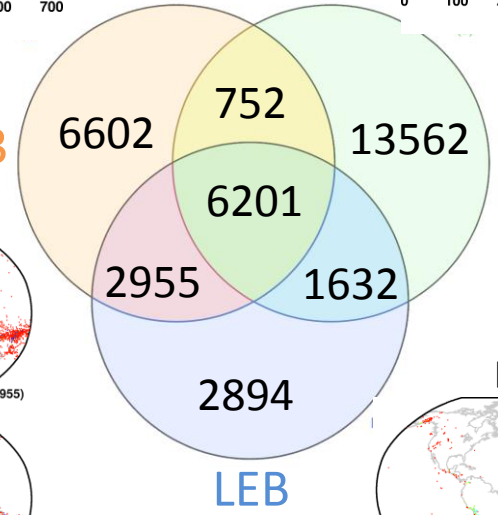


VSEL3 only

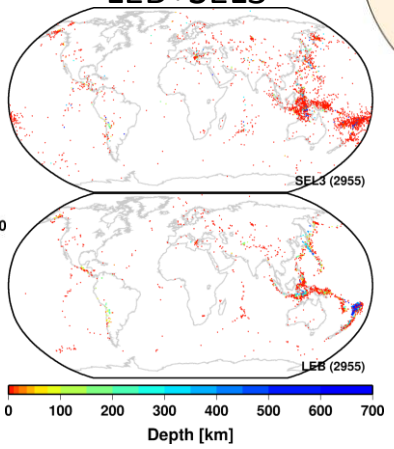


SEL3+VSEL3

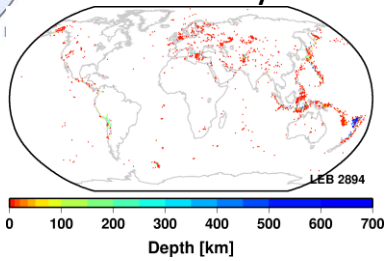




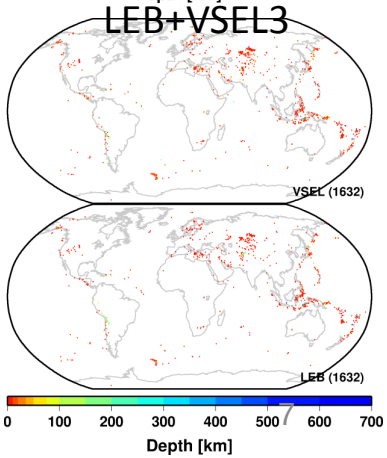
LEB+SEL3



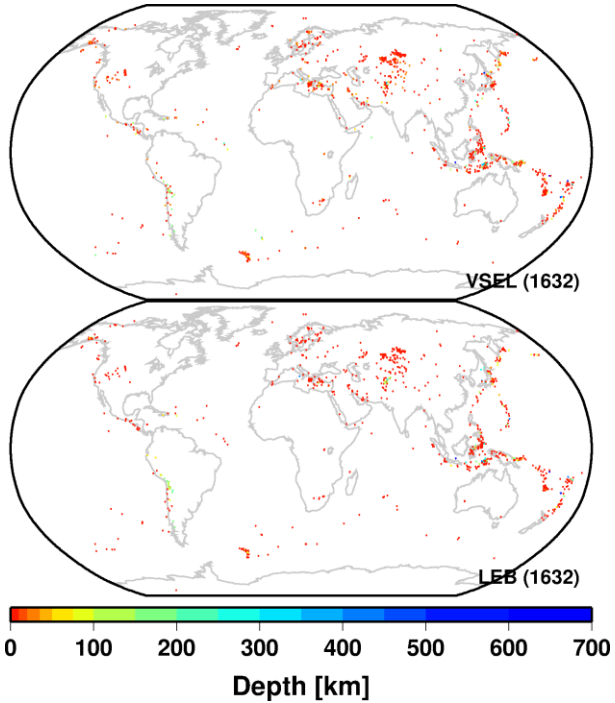
LEB only



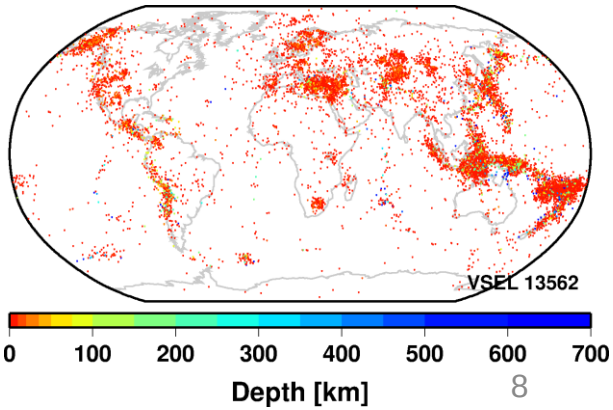
LEB+VSEL3



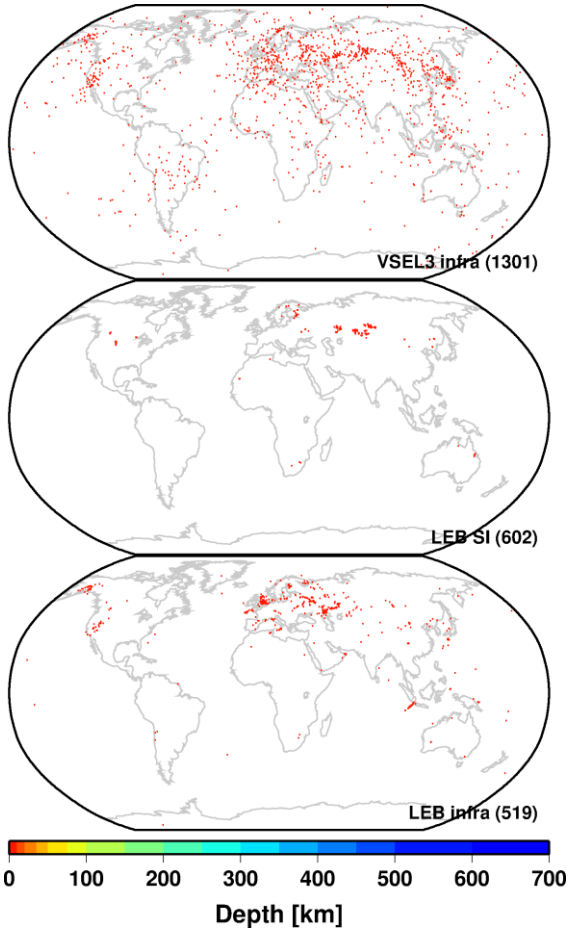
Seismic



- LEB is produced using the SEL3 as a starting point
  - LEB is biased towards the SEL3
- Many events that are not found in the LEB could be real
  - It would be interesting to see a LEB built from NetVISA VSEL3

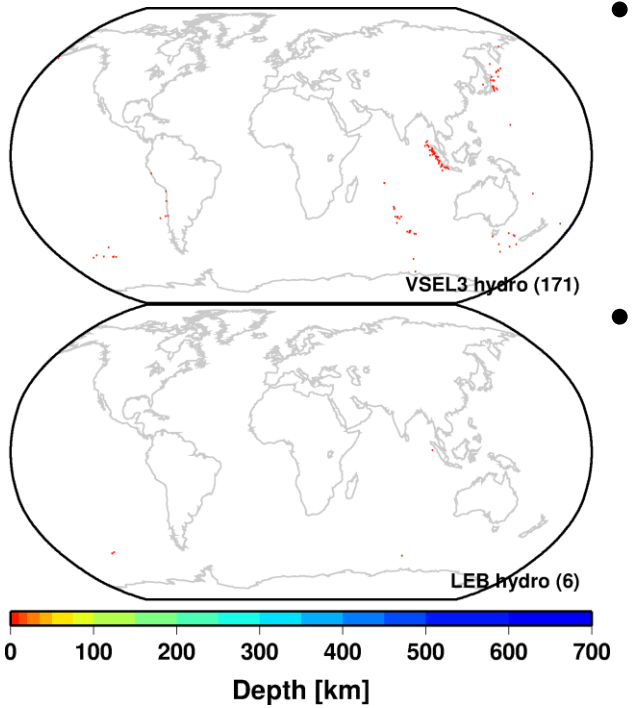


Infrasound



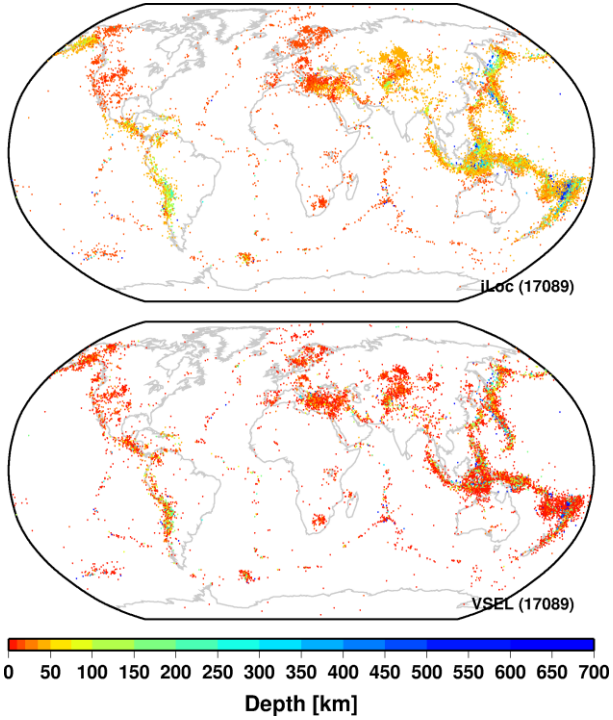
- NetVISA builds quite a number of infrasound only events, from mostly two or three infrasound observations
  - Many of them appear to be fake
- NetVisa, although associates infrasound picks to seismic events, did not build a single seismo-acoustic event
  - Procedural issues? If a phase made non-defining, azimuth and slowness also becomes non-defining
- Analyst build both seismo-acoustic and infrasound only events

Hydroacoustic

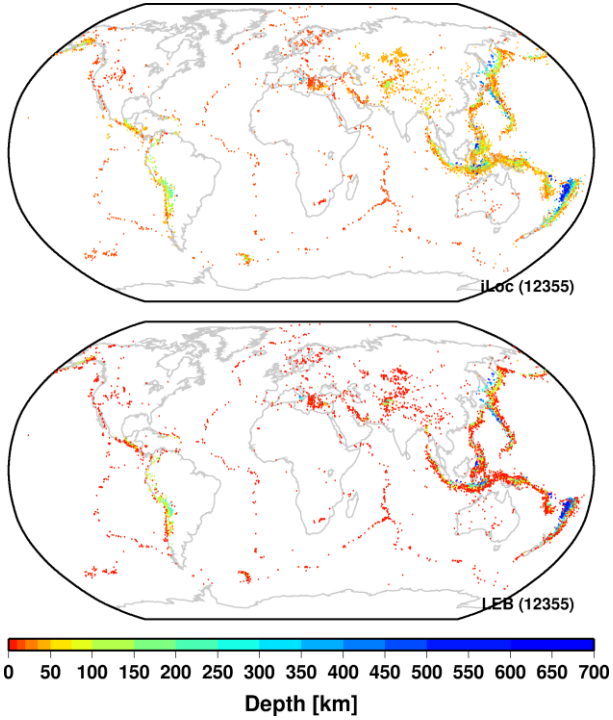


- NetVISA builds a number of events from hydroacoustic (H) phases
  - These appear to be earthquakes that are also built from seismic phases separately
- LEB has the same arrivals associated to earthquakes, but renamed to T phases and made non-defining
  - Procedural issues? Even though these phases are not H phases in the strict sense, they carry valuable information

Relocations with iLoc using RSTT



- LEB or NetVISA do not uses RSTT predictions at the moment
  - Current SSSCs exist for a subset of stations in the Northern hemisphere
- iLoc uses RSTT by default
- Relocations can show what improvements can be expected from a 3D velocity model



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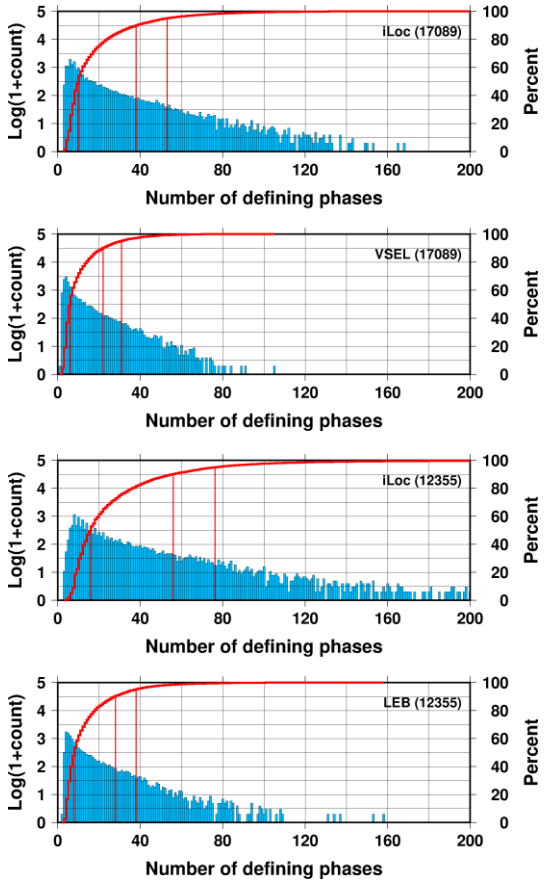
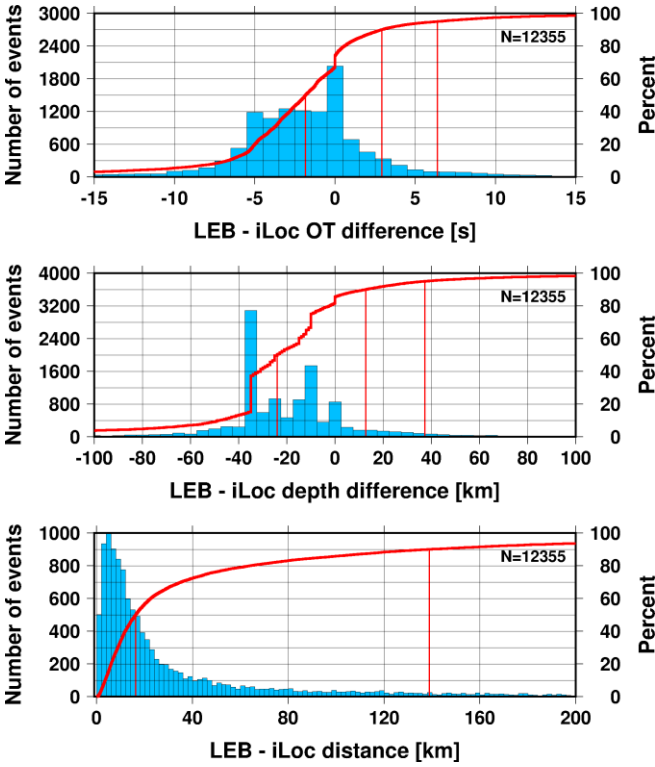
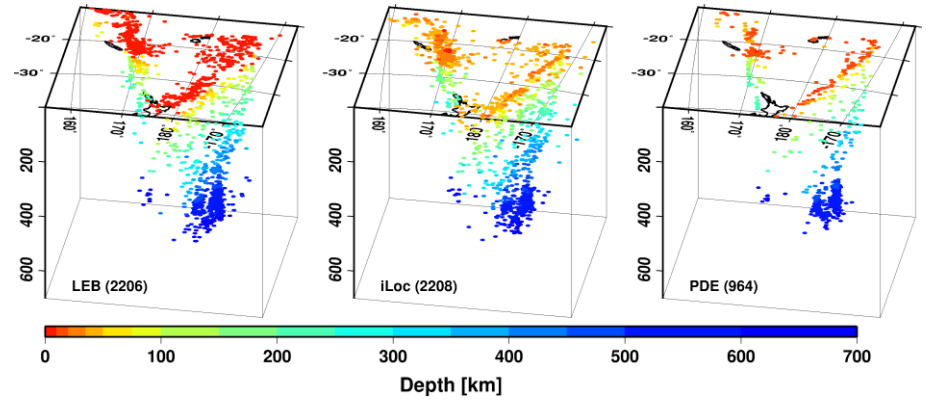


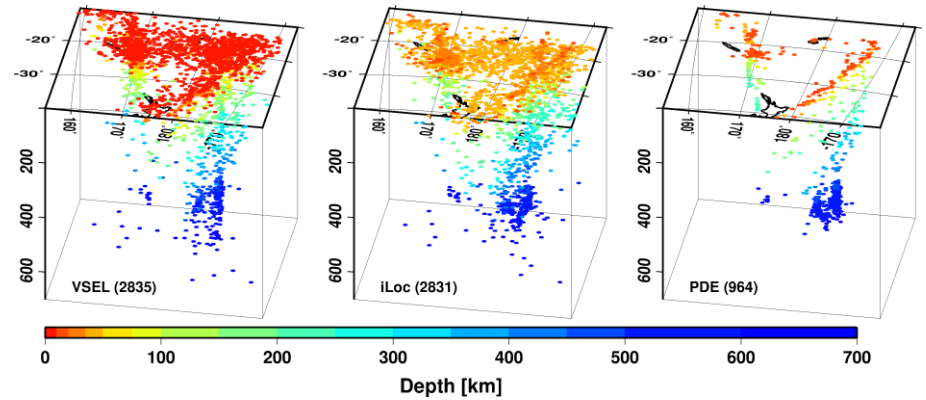
- Better travel-times from RSTT allow the use of more regional phases in the locations
- Difference in depth and OT are explained by different strategies for fixing the depth
- iLoc doesn't move much away from LEB but there is a long tail



Relocations with iLoc using RSTT

Fiji – Tonga - Kermadec





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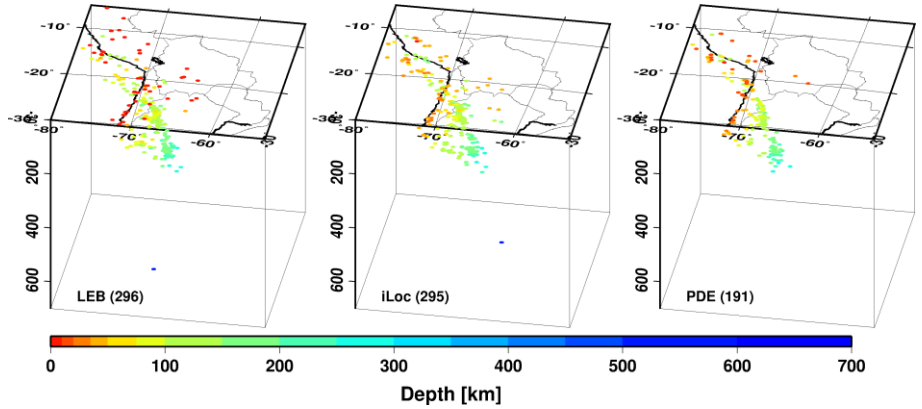
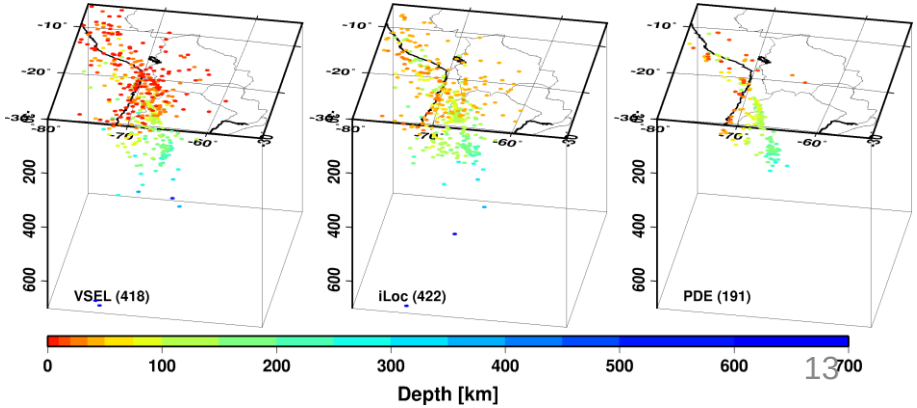
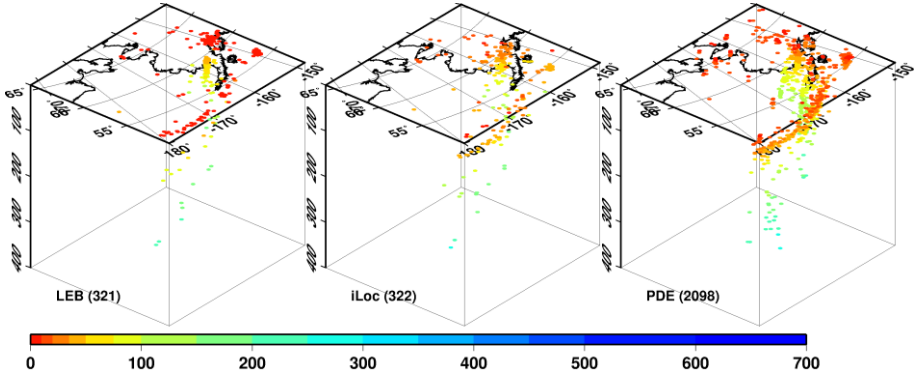
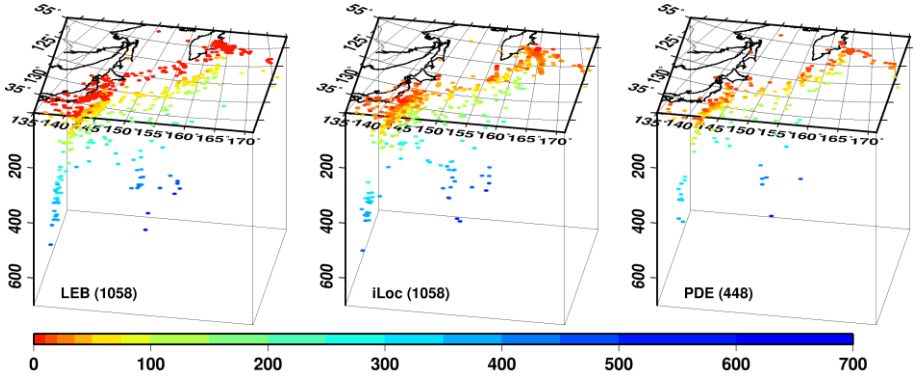


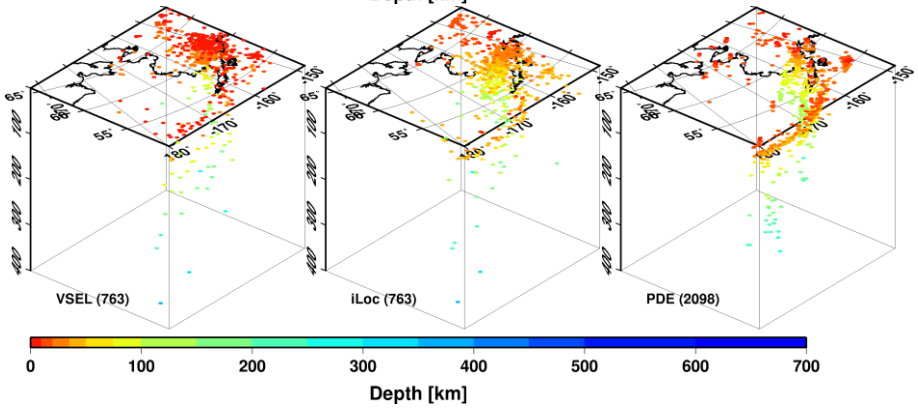


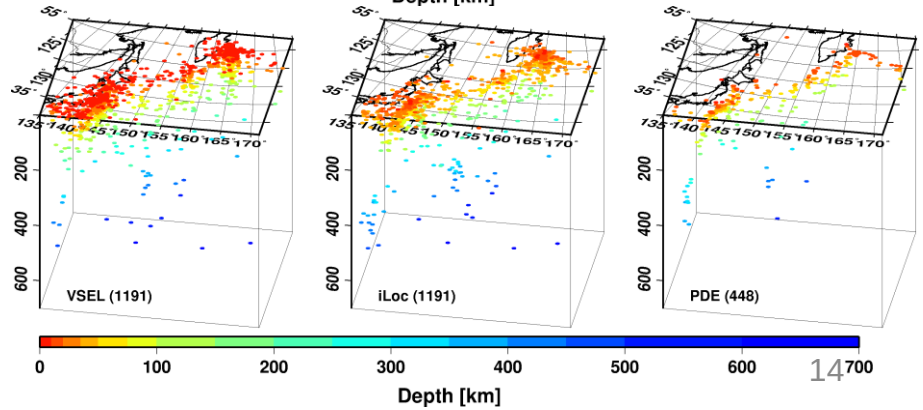
Relocations with iLoc using RSTT

Alaska – Aleutians – Andreanoff Islands – Kuriles - Japan



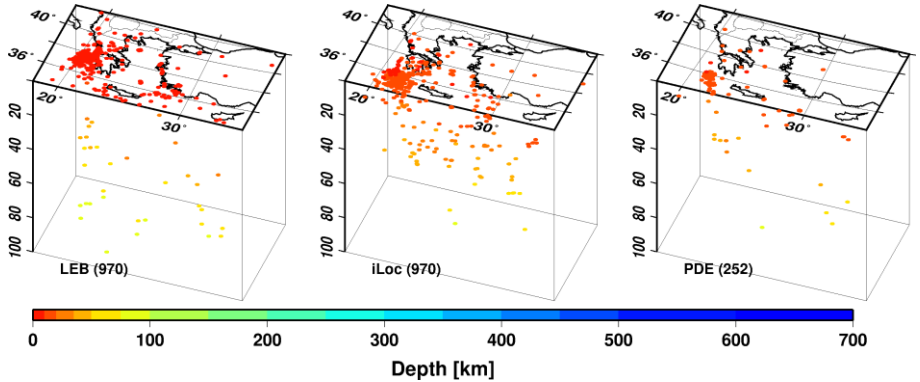


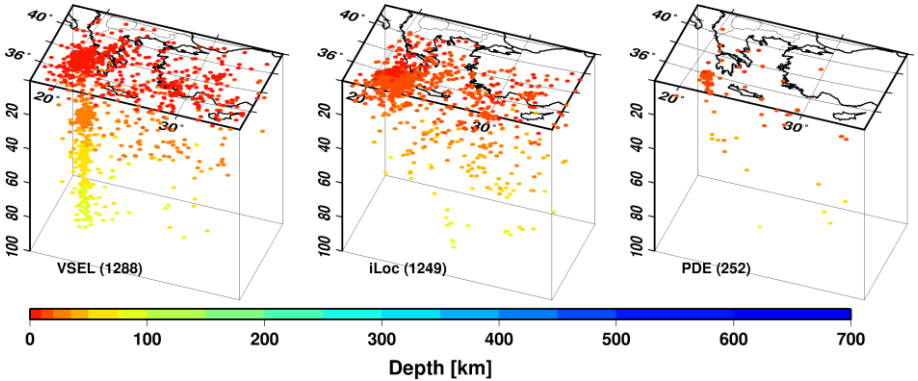




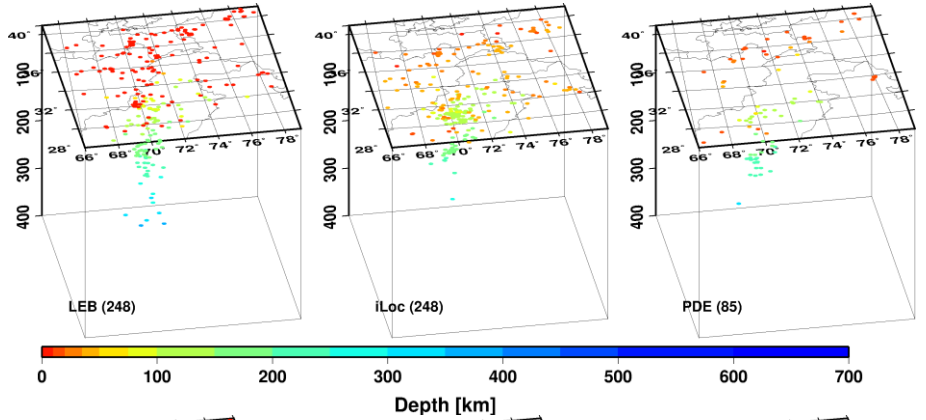
Relocations with iLoc using RSTT

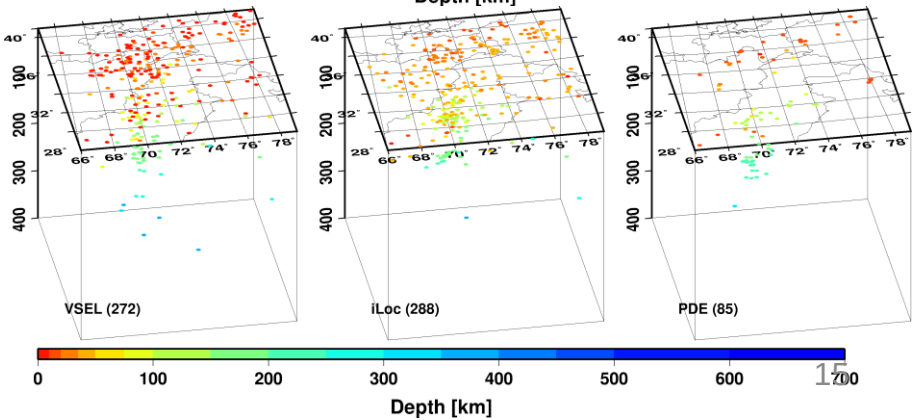
Mediterranean





Pamir-Hindu Kush





Conclusions

- NetVISA provides improvements over SEL3
  - Does not put shallow events deep
  - Associates and uses more phases in the location
  - Even those events that are not in the LEB look reasonable
  - There are remaining issues to be resolved in hydro and infrasound
- RSTT provides further improvements
  - Significantly more regional phases are used
  - Improvements in both location and depth
- NetVISA together with RSTT will provide a much better automatic bulletin
  - We would look at a quite different LEB if it were produced from VSEL3 using RSTT