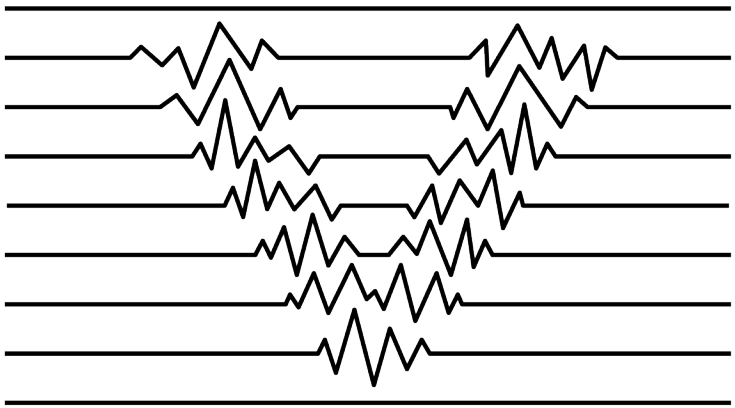


SPIN

MONITORING A RESTLESS EARTH

http://spin-itn.eu

How did we get here..

Convergence:

- seismic interferometry
- time-dependent changes
- new seismic instrumentation

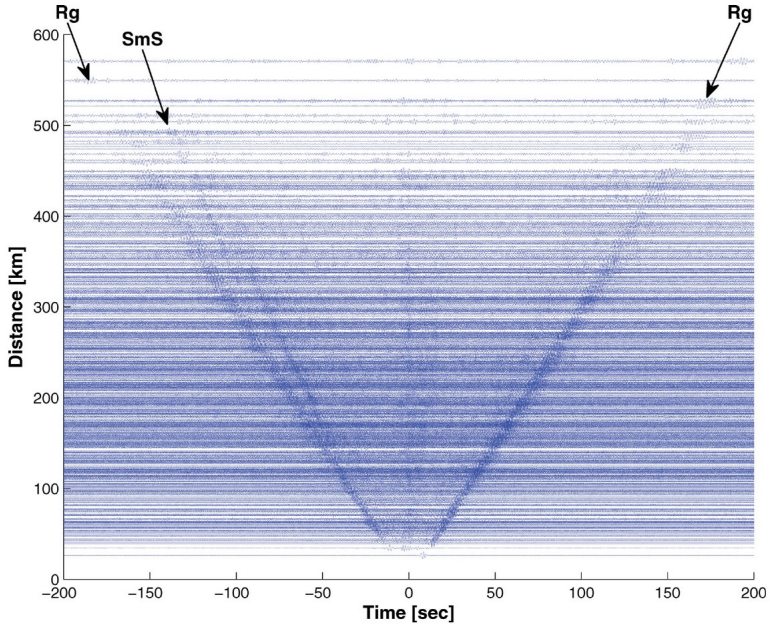
Interferometry: exploit previously unexploited seismic data

- Station-station interferometry

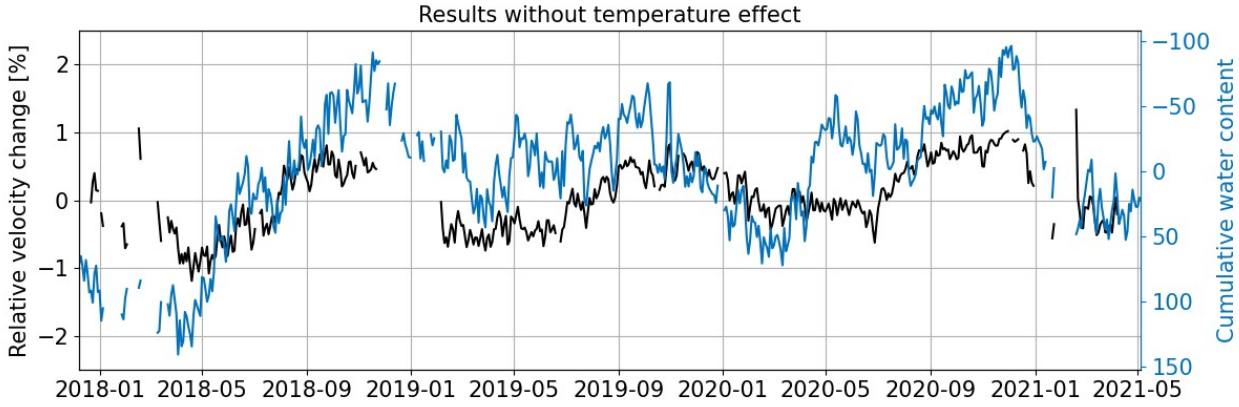
  → many additional paths

- Use ambient seismic noise records

  → continuous structure information



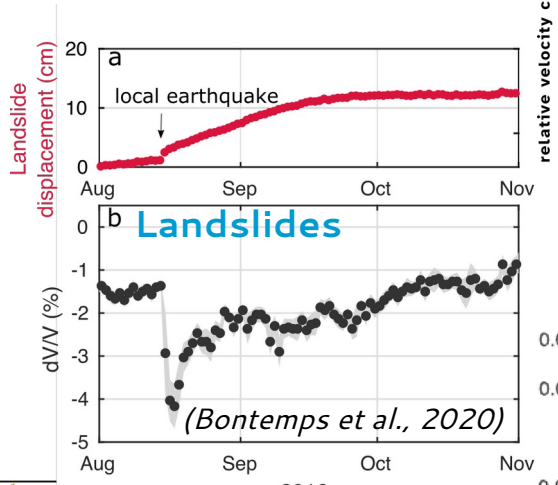
(Poli et al., GJI, 2012)

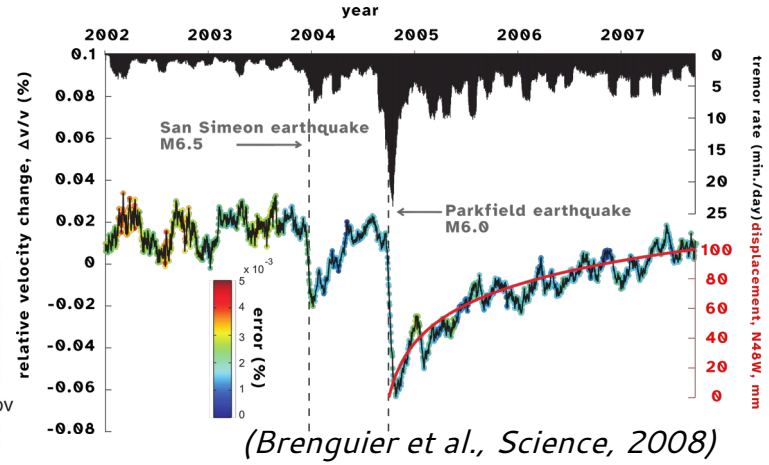


(Steinmann et al., GJI, 2021 & Antonia Kiel)

Time resolution → time dependent changes

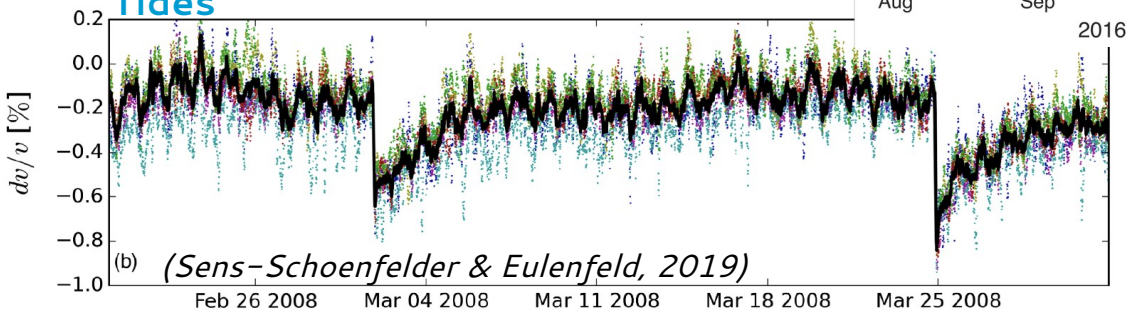
- Observational evidence for **dynamic variations** in the mechanical behaviour of Earth's materials
- Monitoring **natural hazards**

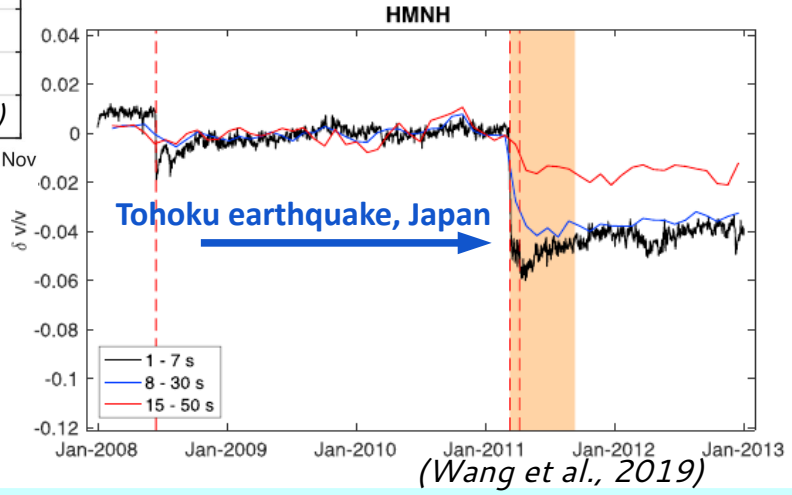




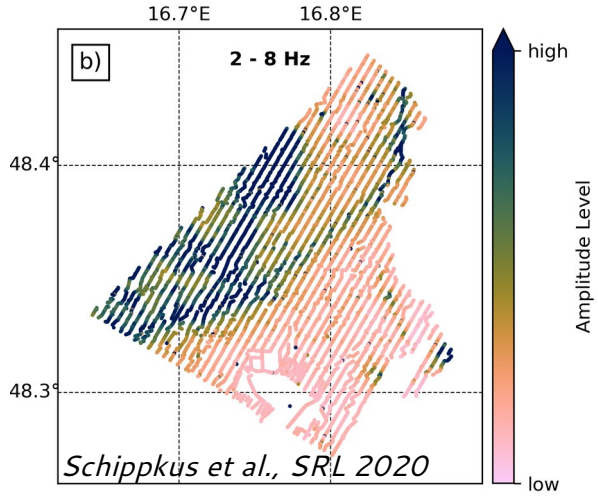
Earthquakes

Tides





New ways of sensing ground motion



Rapid development in **seismic instrumentation:**

- **„large N" arrays**, inexpensive seismic sensors

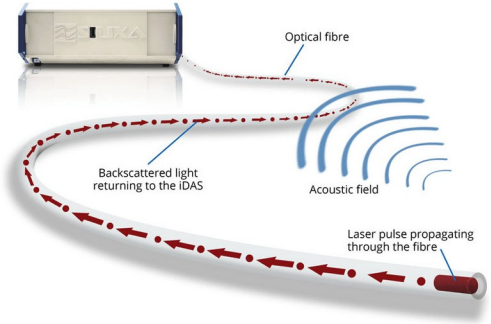
  → very dense deployments

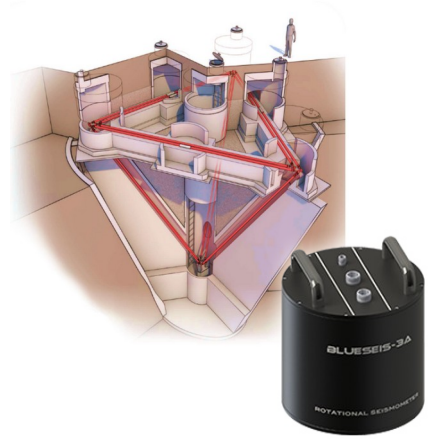
- Use of **optical telecommunication fiber**: „DAS"

  → extremely high spatial resolution

- Towards measurements of the full ground motion wave field: **Rotations**

  → 3 additional degrees of freedom





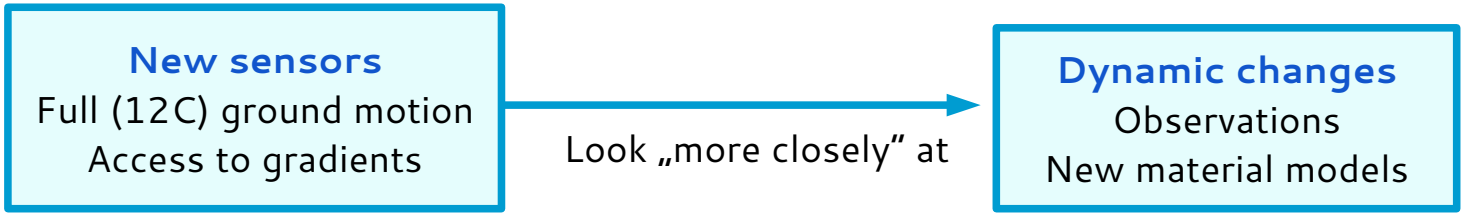
Measure wavefield in **more (spatial) detail**
including **gradients** of wavefield
→ increased sensitivity to complex structure and changes

What's the plan?

New sensors
Full (12C) ground motion
Access to gradients

Dynamic changes
Observations
New material models

What's the plan?



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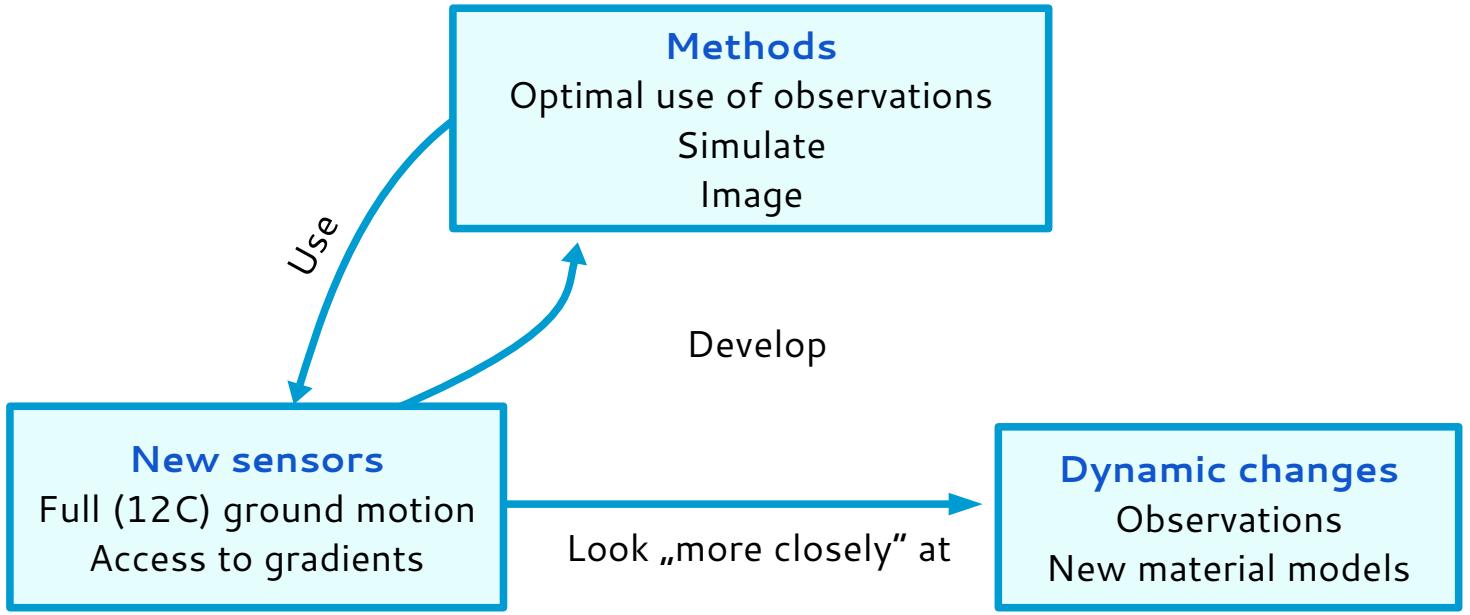

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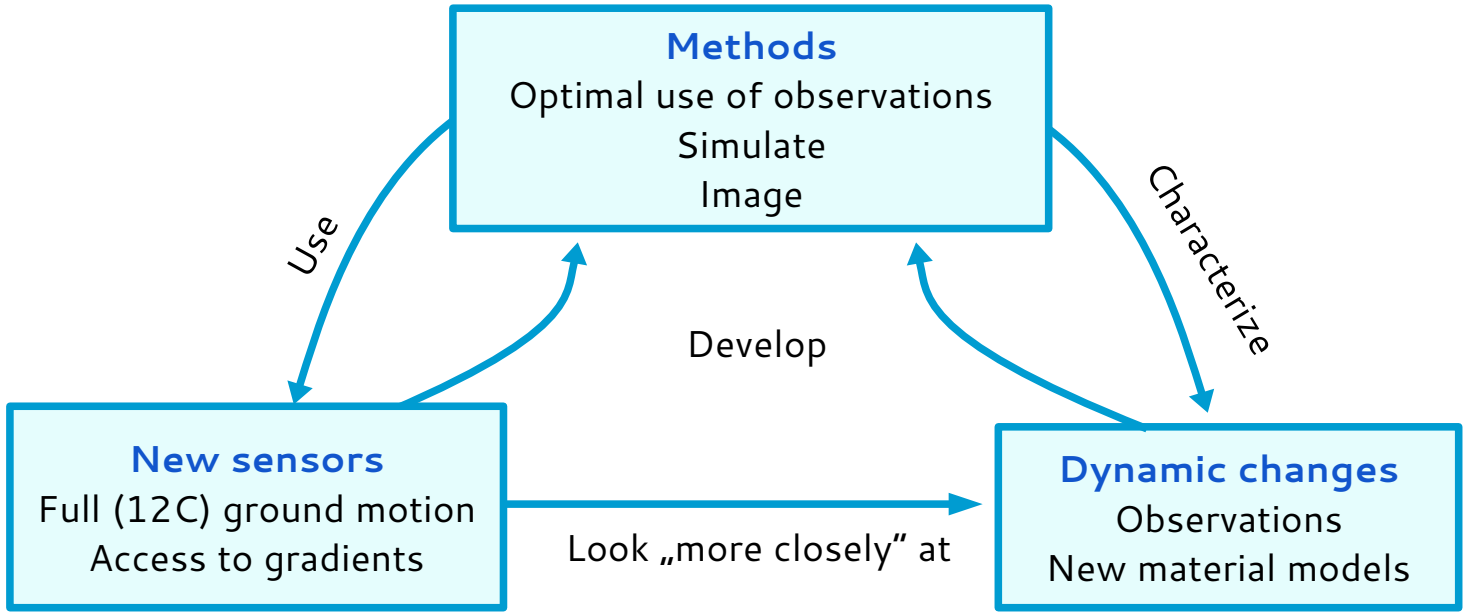

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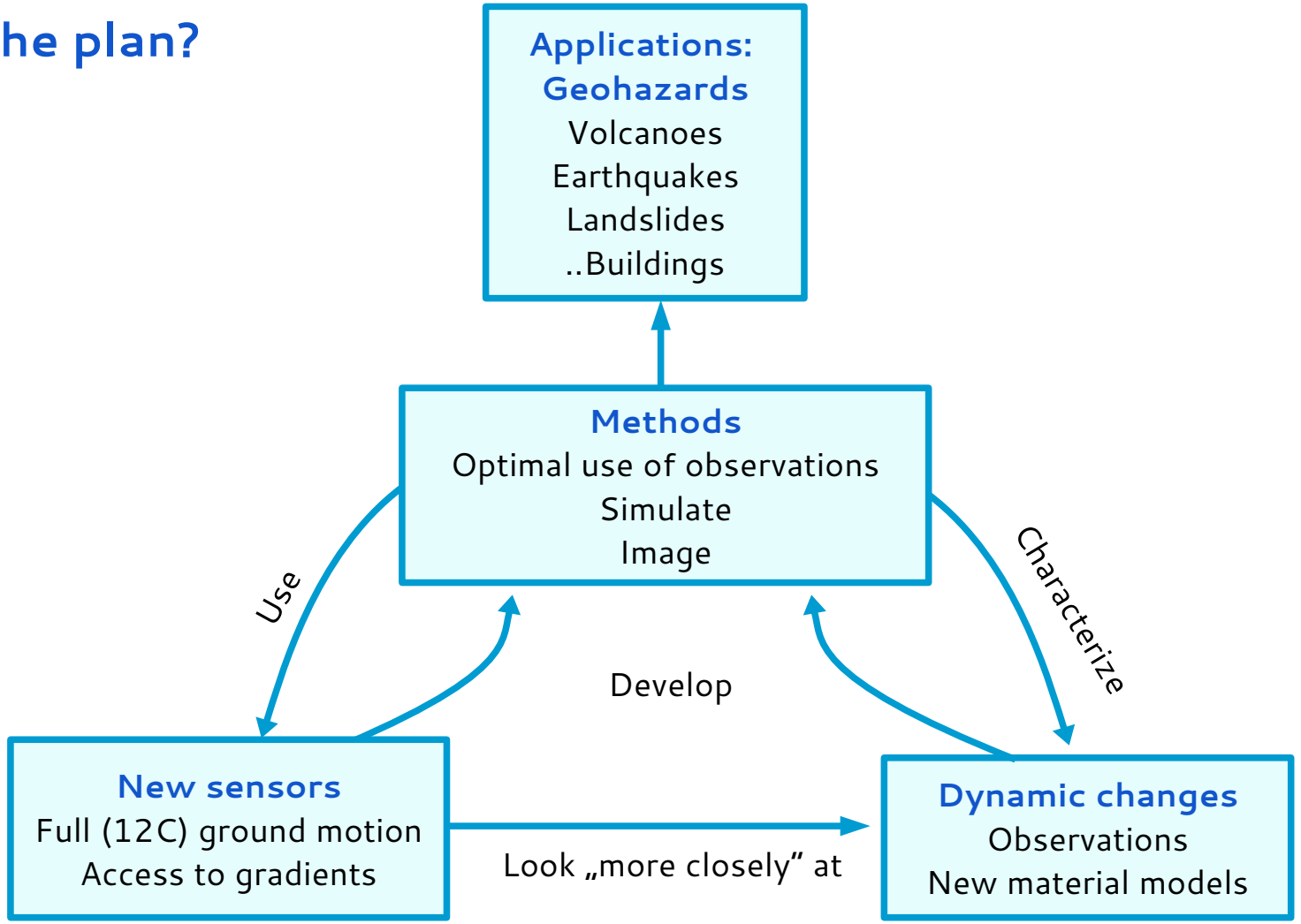

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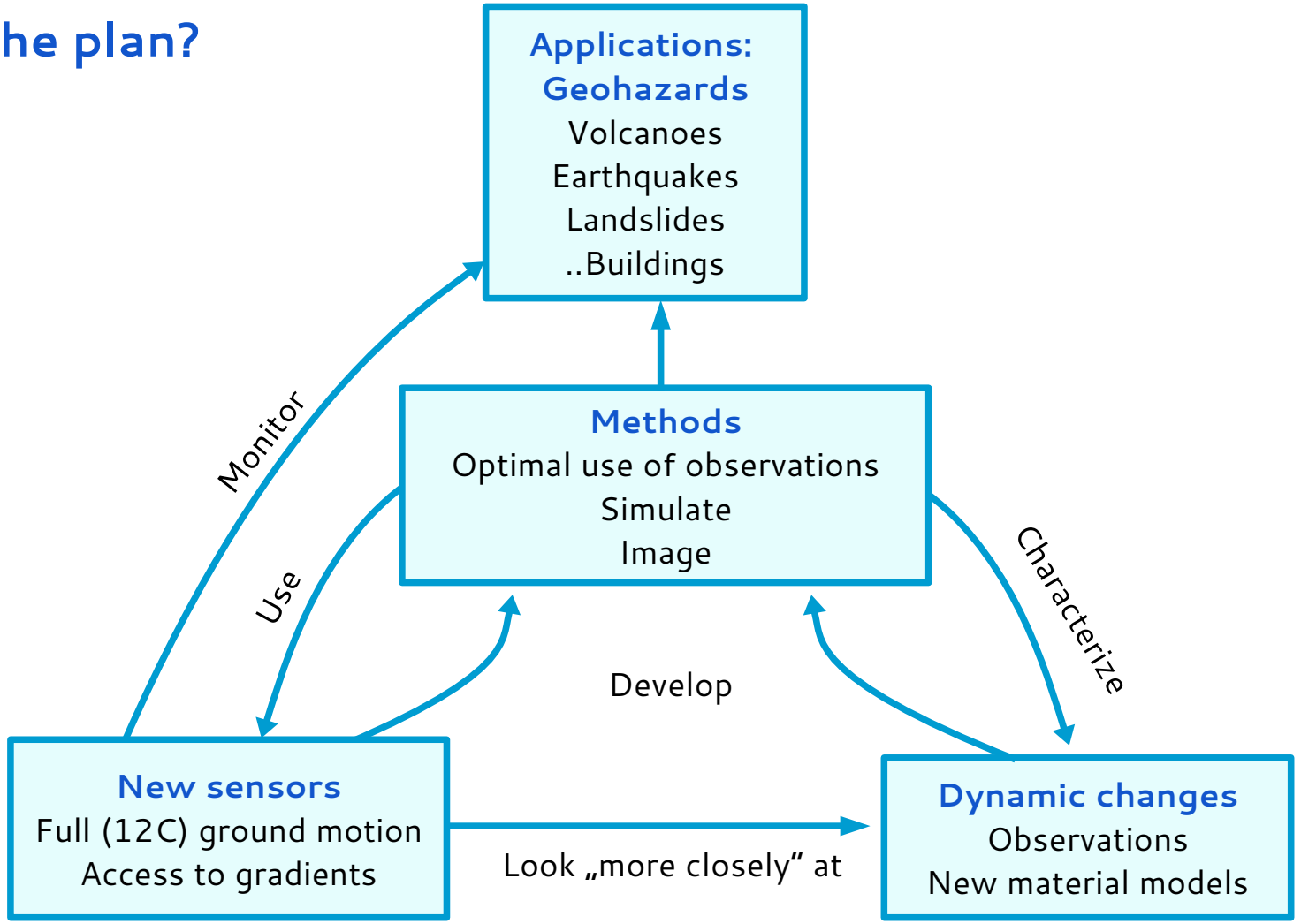

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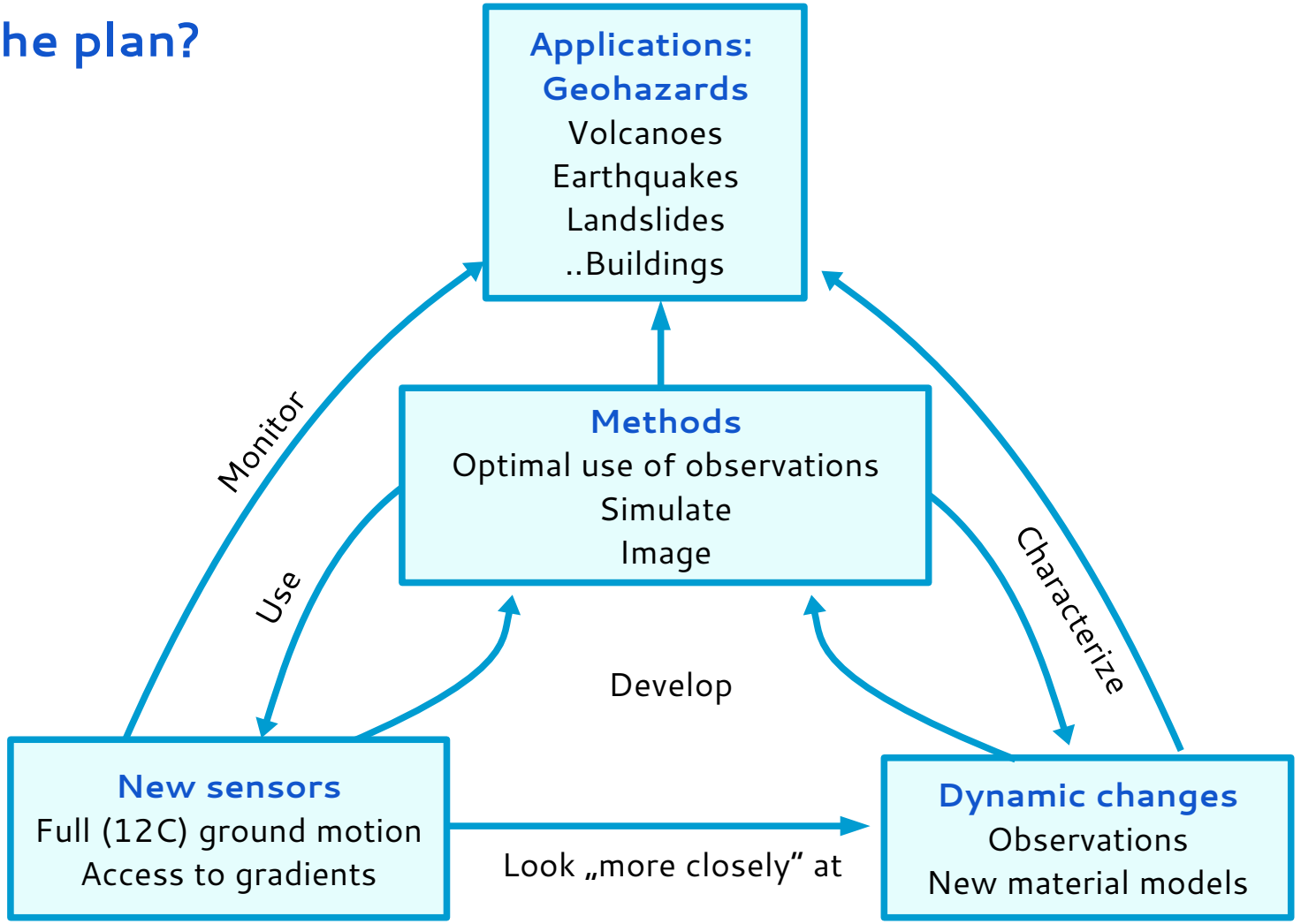

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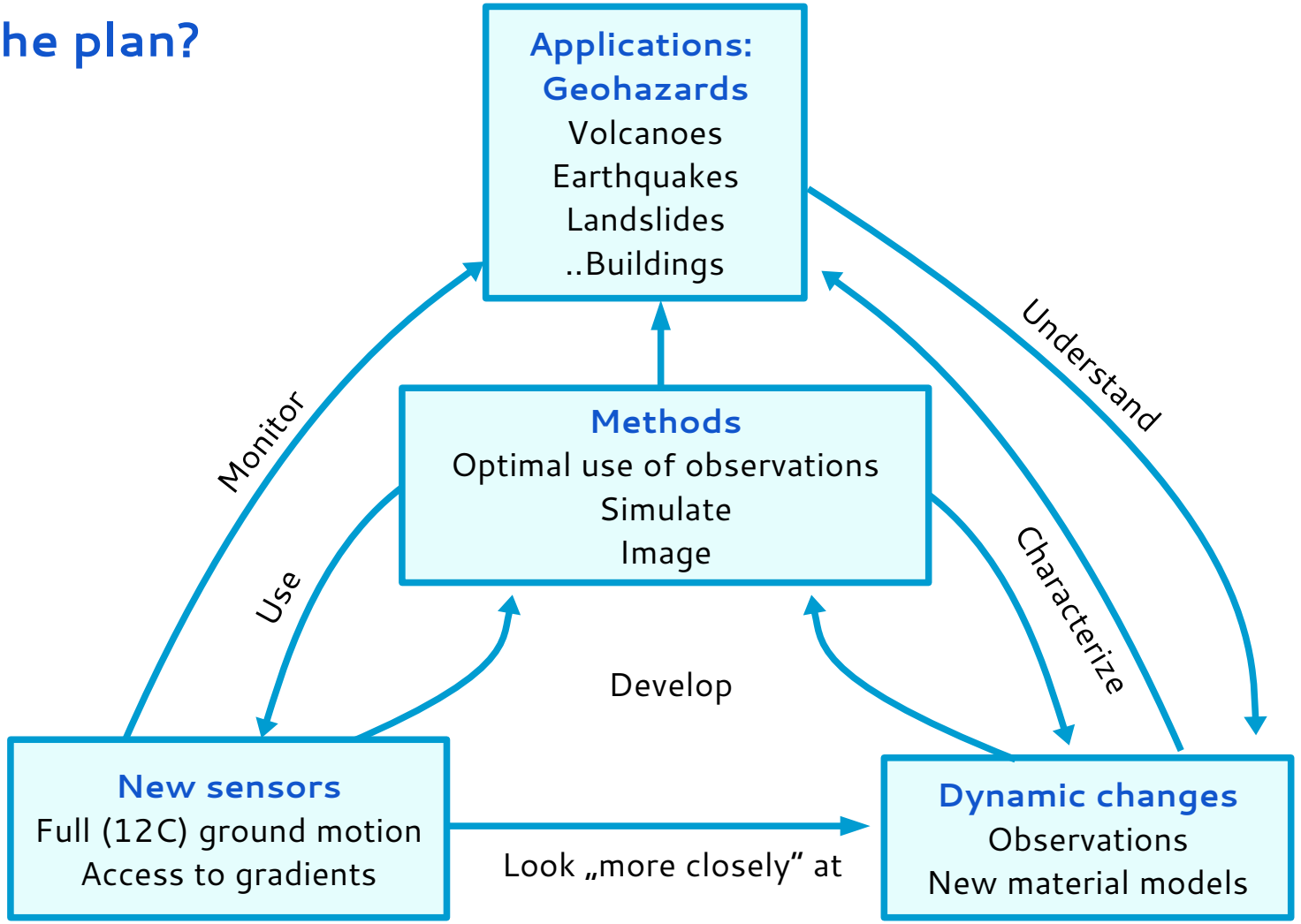

SPIN – the science

- Implement high-quality **complete ground motion measurements with new sensing technology** for seismological applications (WP1)

WP1
ground-motion **sensing technology** (fiber-optic cables (DAS), large-N arrays, rotation sensors)

SPIN – the science

- Implement high-quality **complete ground motion measurements with new sensing technology** for seismological applications (WP1)
- Develop **models of wave propagation** that extend to the nonlinear and transient elastic properties of micro-inhomogeneous materials under low strain, and characterize these nonclassical effects (WP2)

WP1
ground-motion **sensing technology** (fiber-optic cables (DAS), large-N arrays, rotation sensors)

WP2
Observations of **dynamic variations** in mechanical behaviour materials

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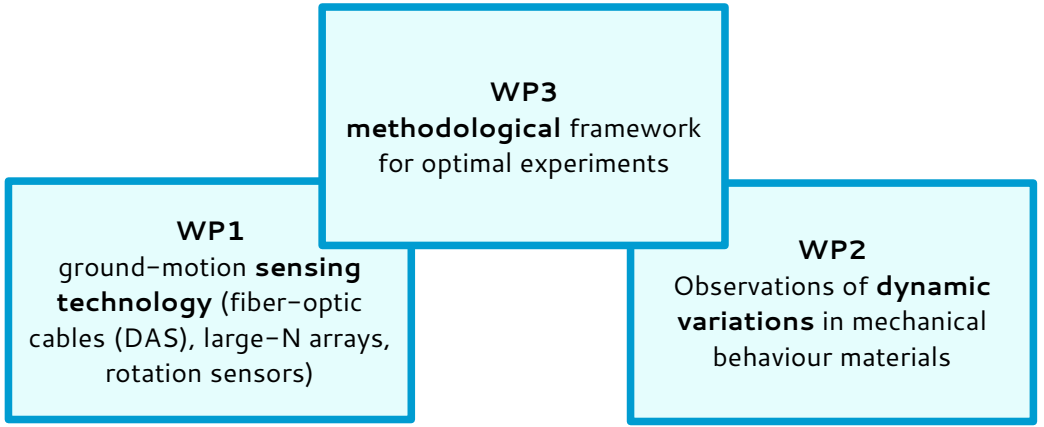
- Design experiments using the new sensing technologies, **optimizing 'heterogeneous' sensor networks** that combine different instrumentation types (WP3)



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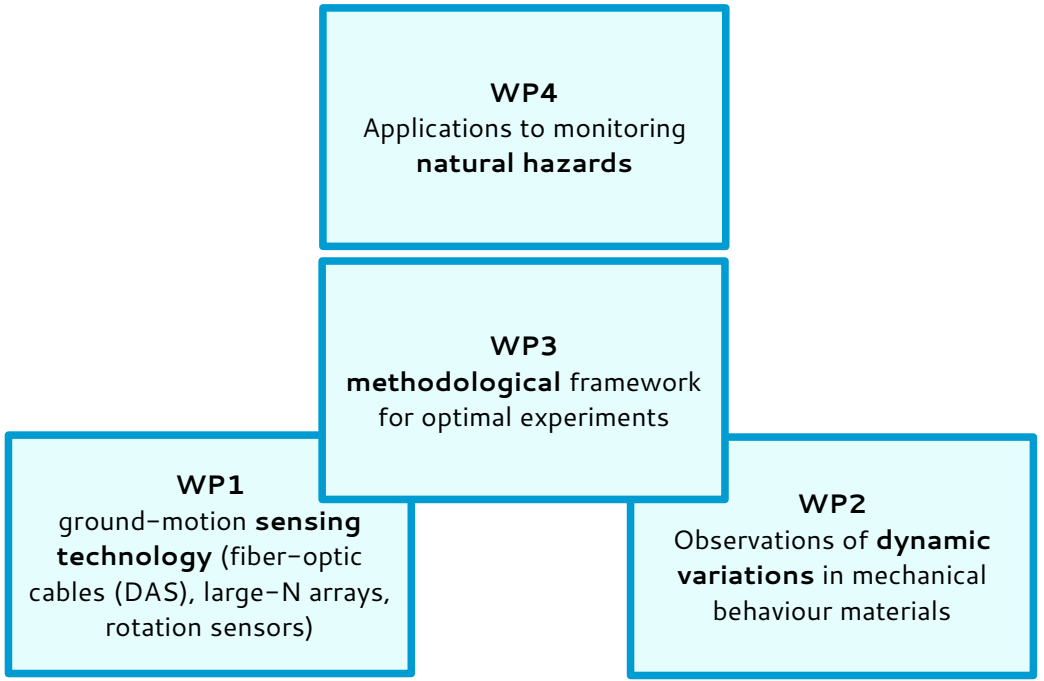

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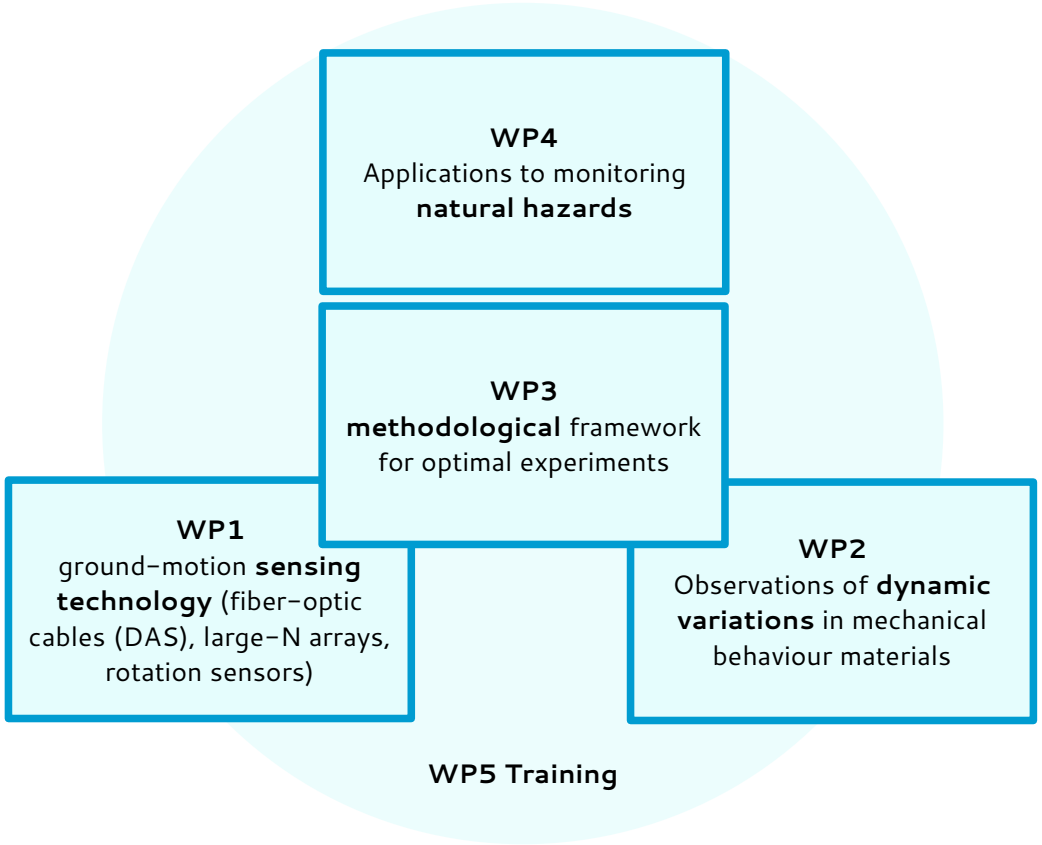
- „**Training** of the next generation of researchers who can incorporate new sensor types into widespread, societally-relevant applications."

→ 15 PhD candidates



Where are we headed?

What is currently going on at your insitute?

- Which experiments are planned that could be interesting for SPIN?
- What are major projects with links to SPIN?

  (ongoing and near-future)
- What new/original instrumentation types are you using?
- Which instrumentation is necessary to address your scientific issues?
  (and/or: does the right instrumentation exist to address them?)
- What are ongoing theoretical developments relevant to SPIN?
- Any new aspects on the horizon?

SPIN – Monitoring a Restless Earth