2. Challenges and ethical questions

- Daily evaluation: uncertainty in rainfall/temperature prognosis, thresholds estimations

  - What are the repercussions for forecasters when erroneous warning messages are issued?
  - What is the most responsible way to describe uncertainties in warnings issued?
  - What is the optimal compromise between avoiding false alarms and not issuing a warning?
  - Is experience and “gut feeling” an acceptable tool for determination of hazard level?

- Communication of warning messages: warning areas, multi-hazards and duration

  - Is it acceptable to issue general warnings for large geographical areas without being able to pinpoint the threat on local scale?
  - What are the challenges in defining spatial extent of the warning area?
  - Separate warnings for flood, debris flows, shallow slides and slush flows?
  - How to communicate the presence of several hazards and the duration? Different hazards with different warning’s duration time and geographical extent.

- Dissemination of warning messages:

  - When and how often should warning messages be issued and updated?
  - Different users have different needs.
  - Is it responsible to notify authorities only in cases of “high hazard level” and no longer in cases of “moderate hazard level”?

- Emergency plans and actions/expectations:

  - What responsibility lies within the early warning system in recommending evacuation or other practical measures to local authorities?

3. Summary

By presenting how floods and landslide early warnings are communicated in Norway and the faced challenges, we add to the discussion some ethical questions that should be addressed by scientists working with the forecast and the communication of natural hazards.