

Catalog of LEWS

One of the activities of the WG is to develop a commonly sharable catalog of LEWS that describes the state-of-the-art of territorial and local LEWS. The catalog will be prepared by reviewing existing literature that includes descriptions LEWS (i.e., Stähli et al 2015, Piciullo et al. 2018, Guzzetti et al., 2020, and Pecoraro et al., 2019) and/or by on/off-line interviewing members of the LandAWARE, for those cases not described yet in international literature. The catalog format will be based on common terminology and descriptors.

References

- Ahmed B., Rahman M., Islam R., Sammonds P., Zhou C., Uddin K., Al-Hussaini T. (2018). Developing a dynamic Web-GIS based landslide early warning system for the Chittagong Metropolitan Area. Bangladesh. ISPRS Int. J. Geo-Inf., 7 (12) (2018), p. 485, [10.3390/ijgi7120485](https://doi.org/10.3390/ijgi7120485)
- Arattano M (1999) On the use of seismic detectors as monitoring and warning systems for debris flows. Nat Hazard 20:197–213
- Bacchini, M. and Zannoni, A. (2003). Relations between rainfall and triggering of debris-flow: case study of Cancia (Dolomites, Northeastern Italy), Nat. Hazards Earth Syst. Sci., 3, 71–79, <https://doi.org/10.5194/nhess-3-71-2003>, 2003.
- Badoux A., Graf C., Rhyner J., Kuntner R., Mc Ardell B. W. (2009). A debris-flow alarm system for the Alpine Illgraben catchment: Design and performance [Natural Hazards](https://doi.org/10.1007/s11069-008-9303-x) 49(3):517-539 DOI:[10.1007/s11069-008-9303-x](https://doi.org/10.1007/s11069-008-9303-x)
- Baroň I, Supper R, Ottowitz D (2012) SafeLand deliverable 4.6.: Report on evaluation of mass movement indicators. European Project SafeLand, Grant Agreement No. 226479, 382 pp. Available at: <http://www.safeland-fp7.eu>
- Baum R.L. (2007). Landslide warning capabilities in the United States—2006. Proceedings of the 1st North America Landslide Conference, Vail, Colorado, June 3–8, 2007, Association of Engineering Geologists Special Publication, 23 (2007), pp. 1-13.
- Baum R.L., Godt J.W. (2010). Early warning of rainfall-induced shallow landslides and debris flows in the USA. Landslides, 7 (2010), pp. 259-272, [10.1007/s10346-009-0177-0](https://doi.org/10.1007/s10346-009-0177-0)
- Blahůt J, Lovisolò M, Hartvich F, Tábořík P, Klimeš J, Kusák M (2019) Novel Instrumentation of the Čeranišřtř Landslide – Differential Monitoring of Stability. In Klimeš J, Hartvich F (Eds) Český ráj ´19: State of geomorphological research in 2019 – International annual conference. IRSM CAS, CAG, Geopark Český Ráj, p. 6.
- Brigandì G., Aronica G.T., Bonaccorso B., Gueli R., Basile G. (2017). Flood and landslide warning based on rainfall thresholds and soil moisture indexes: the HEWS (Hydrohazards Early Warning System) for Sicily. Adv. Geosci., 44 (2017), pp. 79-88, [10.5194/adgeo-44-79-2017](https://doi.org/10.5194/adgeo-44-79-2017)
- Broccolato M (2010) I grandi movimenti di massa sul territorio valdostano: Il sistema di monitoraggio (In Italian). In: Conference presentation, Barzio, Italy
- Calvello M., d'Orsi R.N., Piciullo L., Paes N., Magalhaes M., Coelho R., Lacerda W.A. (2014). The community-based alert and alarm system for rainfall induced landslides in Rio de Janeiro, Brazil. Engineering Geology for Society and Territory “Landslide Processes”,

- Proc. XII Int. IAEG Congress, Torino, Italy, 2 (2014), pp. 653-657, [10.1007/978-3-319-09057-3_109](https://doi.org/10.1007/978-3-319-09057-3_109)
- Capparelli G., Tiranti D. (2010). Application of the MoniFLaIR early warning system for rainfall-induced landslides in Piedmont region (Italy). *Landslides* 7(4):401-410. DOI:[10.1007/s10346-009-0189-9](https://doi.org/10.1007/s10346-009-0189-9)
 - Cardellini S, Osimani P (2008) Living with landslide: the Ancona case history and early warning system. In: Proc of the 1st World Landslide Forum, Tokyo, pp 473–476
 - Cardinaletti M, Cardellini S, Ninivaggi A (2011) The Integrate Landslide Managing System of Ancona. <https://www.preventionweb.net/applications/hfa/lgsat/en/image/href/512>. Accessed 23 October 2017. UNISDR PreventionWeb.
 - Chan R.K.S., Pang P.L.R., Pun W.K. (2003). Recent developments in the landslip warning system in Hong Kong. Proc. of the 14th Southeast Asian Geotechnical Conference, Balkema, Lisse, The Netherlands (2003), pp. 137-151
 - Chleborad A.F., Baum R.L., Godt J.W., Powers P.S. (2008). A prototype system for forecasting landslides in the Seattle, Washington, area. R.L. Baum, J.W. Godt, L.M. Highland (Eds.), *Landslides and Engineering Geology of the Seattle, Washington, Area.*, Geological Society of America (2008), [10.1130/2008.4020\(06\)](https://doi.org/10.1130/2008.4020(06))
 - Choi K.Y., Cheung R.W. (2013). Landslide disaster prevention and mitigation through works in Hong Kong. *J. Rock Mech. Geotech. Eng.*, 5 (5) (2013), pp. 354-365, [10.1016/j.jrmge.2013.07.007](https://doi.org/10.1016/j.jrmge.2013.07.007)
 - Clark AR, Moore R, Palmer JS (1996) Slope monitoring and early warning systems: application to coastal landslide on the south and east coast of England, UK. In: Senneset (ed) *Landslides, 7th International Symposium on Landslides*. Balkema, Rotterdam, pp 1531– 1538
 - Cole, K. and Davis, G. M. (2002) *Landslide warning and emergency planning systems in West Dorset, England. Instability, Planning and Management.* (Eds: McInnes, R. G. & Jake-ways, J.). London: Thomas Telford
 - Cotecchia V (2006) The Second Hans Cloos Lecture. Experience drawn from the great Ancona landslide of 1982. *Bull Eng Geol Environ* 45: 1–41. <https://doi.org/10.1007/s10064-005-0024-z>
 - Crosta GB, Agliardi F (2003) Failure forecast for large rock slides by surface displacement measurements. *Can Geotech J* 40: 176–191. <https://doi.org/10.1139/t02-08>
 - Crosta GB, di Prisco C, Frattini P et al (2014) Chasing a complete understanding of the triggering mechanisms of a large rapidly evolving rockslide. *Landslides* 11: 747–764. <https://doi.org/10.1007/s10346-013-0433-1>
 - Crosta GB, Frattini P, Castellanza R et al (2015) Investigation, monitoring and modelling of a rapidly evolving rockslide: the Mt. de la Saxe case study. In: *Engineering geology for society and territory—vol 2*. Springer, Berlin, pp 349–354. https://doi.org/10.1007/978-3-319-09057-3_54
 - d’Orsi R.N. (2012). Landslide risk reduction measures by the Rio de Janeiro city government. Improving the assessment of disaster risks to strengthen financial resilience. Special Joint G20 Publication, Government of Mexico and World Bank (2012), pp. 77-91 open publication <https://www.gfdr.org/G20DRM>
 - d’Orsi R.N., D’Avila C., Ortigao J.A.R., Moraes L., Santos M.D. (1997). Rio-watch: the Rio de Janeiro landslide watch. Proc. of the 2nd PSL, Pan-Am Symposium on Landslides, 1, Rio de Janeiro, Brazil (1997), pp. 21-30

- Devoli G., Colleuille H., Sund M., Wasrud J. (2021). Seven Years of Landslide Forecasting in Norway—Strengths and Limitations. In: Springer Nature Switzerland AG 2021, N. Casagli et al. (eds.), *Understanding and Reducing Landslide Disaster Risk, ICL Contribution to Landslide Disaster Risk Reduction*, https://doi.org/10.1007/978-3-030-60311-3_30 (page 267-274)
- Devoli, G., Tiranti, D., Cremonini, R., Sund, M., and Boje, S. (2018). Comparison of landslide forecasting services in Piedmont (Italy) and Norway, illustrated by events in late spring 2013, *Nat. Hazards Earth Syst. Sci.*, 18, 1351-1372, <https://doi.org/10.5194/nhess-18-1351-2018>, 2018.
- Di Biagio, E., Kjekstad, O. (2007). In: *Early Warning. Instrumentation and Monitoring Landslides*. 2nd Regional Training Course, RECLAIM II. Phuket, Thailand, 29th January–3rd February 2007.
- DOGAMI (2005). *Oregon's Debris-Flow Warning System and How It Works*. Oregon Department of Geology and Mineral Industries (2005). <http://www.oregongeology.com/sub/Landslide/debrisflow.htm>
- Egger P, Mair V (2009) Innovative Maßnahmen zur gefahrenreduktion am beispiel Grissianerbach. *J für Wildbach-, Lawinen-, Erosion- und Steinschlagschutz* 161:1–15
- Farina, P, Catani, F, Rosi, A, Setiawan, I, Junaidi, A, Afrizal, K & Wijayanto, A 2020, 'Development of an early warning system for shallow landslide hazard in the Grasberg area, Indonesia', in PM Dight (ed.), *Proceedings of the 2020 International Symposium on Slope Stability in Open Pit Mining and Civil Engineering*, Australian Centre for Geomechanics, Perth, pp. 1425-1438, https://doi.org/10.36487/ACG_repo/2025_98
- Flentje P, Chowdhury RN (2005) Managing landslide hazards on the Illawarra escarpment. In: *Proc of the GeoQuest Symp on Planning for Nat Hazards*, pp 65–78
- Flentje P, Chowdhury RN (2006) Observational approach for urban landslide management, engineering geology for tomorrow's cities. In: *Proc of the 10th International Association of Engineering Geology and the Environment Congress, Nottingham* (Paper no. 522).
- Froese CR, Moreno F (2014) Structure and components for the emergency response and warning system on Turtle Mountain, Alberta, Canada. *Nat Hazards* 70: 1689–1712. <https://doi.org/10.1007/s11069-011-9714-y>
- Fustos-Toribio, I., Manque-Roa, N., Vásquez Antipan, D., Hermosilla Sotomayor, M., and Letelier Gonzalez, V.: Rainfall-induced landslide early warning system based on corrected mesoscale numerical models: an application for the southern Andes, *Nat. Hazards Earth Syst. Sci.*, 22, 2169–2183, <https://doi.org/10.5194/nhess-22-2169-2022>, 2022.
- Giuliani A, Bonetto S, Castagna S et al (2010) A Monitoring System for Mitigation Planning: The Case of "Bagnaschino" Landslide in Northern Italy. *Am J Environ Sci* 6(6): 516–522. <http://dx.doi.org/10.3844/ajessp.2010.516.522>
- Guzzetti F., Gariano S., Peruccacci S., Brunetti M.T., Marchesini I., Rossi M., Melillo M. (2020). Geographical landslide early warning systems. *Earth-Science Reviews* (2020) 102973 <https://doi.org/10.1016/j.earscirev.2019.102973>
- Hidayat, R., Sutanto, S.J., Hidayah, A., Ridwan, B., Mulyana, A., 2019. Development of a landslide early warning system in Indonesia. *Geosciences* 9 (10), 451. <https://doi.org/10.3390/geosciences9100451>.
- Honda K, Aadit S, Rassarin C et al (2008) Landslide early warning system for rural community as an application of Sensor Asia. In: *Proc of the World Conference on Agricultural Information*. Tokyo, pp 283–288

- Hong Y., Adler R.F. (2007). Towards an early-warning system for global landslides triggered by rainfall and earthquake. *Int. J. Remote Sens.*, 28 (2007), pp. 3713-3719, [10.1080/01431160701311242](https://doi.org/10.1080/01431160701311242)
- Huang R, Huang J, Ju N, He C, Li W (2013) WebGIS-based information management system for landslides triggered by Wenchuan earthquake. *Nat Hazards* 65: 1507–1517. <https://doi.org/10.1007/s11069-012-0424-x>
- Huat L.T. , Ali F., Osman A.R. , Rahman N.A. (2012). Web Based Real Time Monitoring System Along North-South Expressway, Malaysia. 17 (2012), pp. 623-632
- Huggel C., Khabarov N., Obersteiner M., Ramírez J.M. (2010). Implementation and integrated numerical modeling of a landslide early warning system: a pilot study in Colombia. *Nat. Hazards*, 52 (2010), pp. 501-518, [10.1007/s11069-009-9393-0](https://doi.org/10.1007/s11069-009-9393-0)
- Intrieri E., Gigli G., Mugnai F. , Fanti R., Casagli N. (2012). Design and implementation of a landslide early warning system. *Eng. Geol.*, 147–148 (2012), pp. 124-136, [10.1016/j.enggeo.2012.07.017](https://doi.org/10.1016/j.enggeo.2012.07.017)
- Itakura, Y., Koga, Y., Takahama, J., and Nowa, Y. (1997). Acoustic detection sensor for debris flow, in: *Debris-flow hazards mitigation*, edited by: Chen, C., ASCE, American Society of Civil Engineers, New York, NY, 747–756, 1997.
- Itakura Y, Fujii N, Sawada T (2000) Basic characteristics of ground vibration sensors for the detection of debris flow. *Phys Chem Earth, Part B* 25(9):717–720. [https://doi.org/10.1016/S1464-1909\(00\)00091-5](https://doi.org/10.1016/S1464-1909(00)00091-5)
- Jakob, M., Holm, K., Lange, O., and Schwab, J. W.: Hydrometeorological thresholds for landslide initiation and forest operation shutdowns on the north coast of British Columbia, *Landslides*, 3, 228–238, 2006.
- Jakob M, Owen T, Simpson T (2012) A regional real-time debris-flow warning system for the District of North Vancouver, Canada. *Landslides* 9(2): 165–178. <https://doi.org/10.1007/s10346-011-0282-8>
- JMA HP, <https://www.jma.go.jp/bosai/#pattern=default>
- Ju NP, Huang J, Huang RQ et al (2015) A real-time monitoring and early warning system for landslide in southwest China. *J Mt Sci* 12(5): 1219–1228. <https://doi.org/10.1007/s11629-014-3307-7>
- Kaihara, S., Tadakuma, N., Saito, H., Nakaya H. (2023) Influence of below-threshold rainfall on landslide occurrence based on Japanese cases. *Nat Hazards* 115, 2307–2332. <https://doi.org/10.1007/s11069-022-05639-7>
- Keefer D.K., Wilson R.C., Mark R.K., Brabb E.E., Brown W.M., Ellen S.D., Harp E.L., Wieczorek G.F., Alger C.S., Zarkin R.S. (1987). Real-time landslide warning during heavy rainfall. *Science*, 238 (1987), pp. 921-925
- Keys HJR, Green PM (2008) Ruapehu Lahar New Zealand 18 March 2007: Lessons for Hazard Assessment and Risk Mitigation 1995-2007. *J Disaster Res* 3: 284–285. <https://doi.org/10.20965/jdr.2008.p0284>
- Kirschbaum D. , Adler R.F. , Hong Y. , Kumar S., Peters-Lidard C. , Lerner-Lam A. (2012). Advances in landslide nowcasting: evaluation of a global and regional modeling approach. *Environ. Earth Sci.*, 66 (2012), pp. 1683-1696, [10.1007/s12665-011-0990-3](https://doi.org/10.1007/s12665-011-0990-3)
- Kirschbaum D., Stanley T. , Simmons J. (2015). A dynamic landslide hazard assessment system for Central America and Hispaniola. *Nat. Hazards Earth Syst. Sci.*, 15 (2015), pp. 2257-2272, [10.5194/nhess-15-2257-2015](https://doi.org/10.5194/nhess-15-2257-2015)

- Kirschbaum D., Adler R., Hong Y., Lerner-Lam A. (2009). Evaluation of a preliminary satellite-based landslide hazard algorithm using global landslide inventories. *Nat. Hazards Earth Syst. Sci.*, 9 (2009), pp. 673-686, [10.5194/nhess-9-673-2009](https://doi.org/10.5194/nhess-9-673-2009)
- Kirschbaum D., Stanley T. (2018). Satellite-based assessment of rainfall-triggered landslide hazard for situational awareness. *Earths Future*, 6 (2018), pp. 505-523, [10.1002/2017EF000715](https://doi.org/10.1002/2017EF000715)
- Kong, V.W.W., Kwan, J.S.H., Pun, W.K. Hong Kong's landslip warning system—40 years of progress. *Landslides* 17, 1453–1463 (2020). <https://doi.org/10.1007/s10346-020-01379-6>
- Krøgli, I. K., Devoli, G., Colleuille, H., Boje, S., Sund, M., and Engen, I. K. (2018). The Norwegian forecasting and warning service for rainfall- and snowmelt-induced landslides, *Nat. Hazards Earth Syst. Sci.*, 18, 1427–1450, <https://doi.org/10.5194/nhess-18-1427-2018>, 2018.
- LaHusen R (1998) Detecting debris flows using ground vibrations. USGS Fact Sheet 236-96, USGS (ed)
- Li D, Meng S, Sun J (2016) Prediction Analysis of Large-scale Landslides in the Three Gorges Reservoir. *EJGE* 21: 2053–2063
- Liao, Z., Hong, Y., Wang, J., Fukuoka, H., Sassa, K., Karnawati, D., Fathani, F., (2010) Prototyping an experimental early warning system for rainfall-induced landslides in Indonesia using satellite remote sensing and geospatial datasets. *Landslides* 7, 317–324. <https://doi.org/10.1007/s10346-010-0219-7>
- Lloyd D., Othman M.A., Anderson M.G. (2001). Predicting landslides: assessment of an automated rainfall based landslide warning system. 14th South East Asian Geotechnical Conference, Hong Kong (2001)
- Loew S, Gischtig V, Moore J, Keller-Signer A (2012) Monitoring of potentially catastrophic rockslides. In: Proc of the 11th International & 2nd North Am Symp on Landslides. Taylor & Francis, London, pp 101–116
- Manconi A, Giordan D (2015) Landslide early warning based on failure forecast models: the example of the Mt. de la Saxe rockslide, northern Italy. *Nat Hazards Earth Syst Sci* 15(7):1639–1644. <https://doi.org/10.5194/nhess-15-1639-2015>
- Martelloni G., Segoni S., Fanti R., Catani F. (2012). Rainfall thresholds for the forecasting of landslide occurrence at regional scale. *Landslides*, 9 (4) (2012), pp. 485-495, [10.1007/s10346-011-0308-2](https://doi.org/10.1007/s10346-011-0308-2)
- Massey C, Manville V, Hancox GT et al (2010) Out-burst flood (lahar) triggered by retrogressive landsliding, 18 March 2007 at Mt. Ruapehu, New Zealand—a successful early warning. *Landslides* 7: 303–315. <https://doi.org/10.1007/s10346-009-0180-5>
- Moreno F and Froese CR (2010) ERCB/AGS Roles and Responsibilities Manual for the Turtle Mountain Monitoring Project, Alberta. ERCB. http://ags.aer.ca/publications/OFR_2017_04.html. Accessed 23 October 2017
- Mulyana A.R., Sutanto S.J., Hidayat R., Ridwan B.W. (2019). Capability of Indonesian Landslide Early Warning System to detect landslide occurrences few days in advance. *Geophys. Res. Abs.*, 21 (2019). EGU2019-18102
- Nakaya H (2020). Landslide Early Warning and its Systems: Current challenges in Japan. Presentation at LEWS 2020, Perugia Italy.
- Current challenges in Japan NOAA-USGS 2005. NOAA-USGS Debris Flow Task Force. NOAA-USGS Debris-Flow Warning System—Final Report (U.S.G.S. Circular No. 1283) U.S. Geological Survey Circular. U.S. Geological Survey, Washington, DC (2005)

- NVE report 77/2016. Fare- og risikoklassifisering av ustabile fjellparti Faresoner, arealhåndtering og tiltak. Norges vassdrags og energi direktorat. Oslo, Norway (in Norwegian) [Report \(nve.no\)](https://nve.no/).
- Olivieri W, Lovisolo M, Crosta GB (2012) Continuous geotechnical monitoring for alert thresholds and hazard management. In: Landslides and Engineered Slopes, CRC Press, Taylor and Francis Group, pp. 1929–1934
- Ortigao J.A.R. , Justi M.G. , D’Orsi R., Brito H. (2001). Rio-watch 2001: the Rio de Janeiro landslide alarm system. Proceedings 14th Southeast Asian Geotechnical Conference, Hong Kong. Balkema (2001), pp. 237-241
- Osanai N. , Shimizu T. , Kuramoto K. , Kojima S., Noro T. (2010). Japanese early-warning for debris flows and slope failures using rainfall indices with radial basis function network. *Landslides*, 7 (2010), pp. 325-338, [10.1007/s10346-010-0229-5](https://doi.org/10.1007/s10346-010-0229-5)
- PCEM (2018). Pierce County – Outdoor warning system. Available at <https://www.piercecountywa.org/5888/Lahar-Warning-System>.
- Pecoraro G., Calvello M., Piciullo L. (2019). Monitoring strategies for local landslide early warning systems. *Landslides* 16, 213-231 (2019). <https://doi.org/10.1007/s10346-018-1068-z>
- Piciullo, L., Calvello, M., Cepeda, J.M. (2018). Territorial early warning systems for rainfall-induced landslides. *Earth-Sci. Rev.* 179, 228–247. <https://doi.org/10.1016/j.earscirev.2018.02.013>
- Pierson, T.C., Wood, N.J. & Driedger, C.L. (2014) Reducing risk from lahar hazards: concepts, case studies, and roles for scientists. *J Appl. Volcanol.* 3, 16. <https://doi.org/10.1186/s13617-014-0016-4>
- Ponziani F., Berni N., Stelluti M., Zauri R. , Pandolfo C., Brocca L. , Moramarco T. , Salciarini D., Tamagnini C. (2013). LANDWARN: an operative early warning system for landslides forecasting based on rainfall thresholds and soil moisture. C. Margottini, P. Canuti, K. Sassa (Eds.), *Landslide Science and Practice*, Springer, Berlin, Heidelberg (2013), pp. 627-634, [10.1007/978-3-642-31445-2_82](https://doi.org/10.1007/978-3-642-31445-2_82)
- Racek O, Blahůt J, Hartvich F (2021) Observation of the rock slope thermal regime, coupled with crackmeter stability monitoring: initial results from three different sites in Czechia (Central Europe). *Geoscientific Instrumentation, Methods and Data Systems*, 10: 203-218. <https://doi.org/10.5194/gi-10-203-2021>
- Read RS, Langenberg W, Cruden D et al (2005) Frank Slide a century later: the Turtle Mountain monitoring project. In: Hungr O, Fell R, Couture RR, Eberhardt (eds), *Landslide Risk Management*. Balkema, Rotterdam, pp 713–723
- Reyes M., Garcia-Urquia E., Gutierrez C., Quesada-Roman A., Devoli G., (2020). Overview of LEWS in Central America region. Presentation at the LandAware kick-off online meeting. Available at LandAware youtube channel.
- Rosi, A, Segoni, S, Battistini, A, Rossi, G, Catani, F & Casagli, N. (2017). Definition of a fully functional EWS based on rainfall thresholds, the case of study of Tuscany Region, *Proceedings of the Workshop on World Landslide Forum*, Springer, Cham, pp. 169–174.
- Rosi, A., Segoni, S., Canavesi, V., Monni, A., Gallucci, A., & Casagli, N. (2020). Definition of 3D rainfall thresholds to increase operative landslide early warning system performances. *Landslides*, 1-13.
- Rossi M., Peruccacci S. , Brunetti M.T. , Marchesini I. , Luciani S. , Ardizzone F. , Balducci S.V. , Bianchi C., Cardinali M., Fiorucci F., Mondini A.C. , Reichenbach P., Salvati

- P., Santangelo M., Bartolini D., Gariano S.L., Palladino M., Vessia G., Viero A., Antronico L., Borselli L., Deganutti A.M., Iovine G., Luino F., Parise M., Polemio M., Guzzetti F. (2012). SANF: national warning system for rainfall-induced landslides in Italy. E. Eberhardt, C. Froese, K. Turner, S. Leroueil (Eds.), *Landslides and Engineered Slopes: Protecting Society Through Improved Understanding*, Taylor & Francis, London (2012), pp. 1895-1899
- Rossi M., Marchesini I., Tonelli G., Peruccacci S., Brunetti M.T., Luciani S., Ardizzone F., Balducci V., Bianchi C., Cardinali M., Fiorucci F., Mondini A.C., Reichenbach P., Salvati P., Santangelo M., Guzzetti F. (2018). TXT-tool 2.039-1.1 Italian national early warning system. In K. Sassa, F. Guzzetti, H. Yamagishi, Ž. Arbanas, N. Casagli, M. McSaveney, K. Dang (Eds.), *Landslide Dynamics: ISDR-ICL Landslide Interactive Teaching Tools*, Springer International Publishing, Cham (2018), pp. 341-349, [10.1007/978-3-319-57774-6_24](https://doi.org/10.1007/978-3-319-57774-6_24)
 - Sassa K, Picarelli L., Yin YP (2009) Monitoring, prediction and early warning. In: *Proceedings of the 1st World Landslide Forum*. Tokyo, pp 351–375
 - Segoni S., Battistini A., Rossi G., Rosi A., Lagomarsino D., Catani F., Moretti S., Casagli N. (2015). Technical note: an operational landslide early warning system at regional scale based on space–time-variable rainfall thresholds. *Nat. Hazards Earth Syst. Sci.*, 15 (2015), pp. 853-861, [10.5194/nhess-15-853-2015](https://doi.org/10.5194/nhess-15-853-2015)
 - Segoni, S., Rosi, A., Fanti, R., Gallucci, A., Monni, A., & Casagli, N. (2018). A regional-scale landslide warning system based on 20 years of operational experience. *Water*, 10(10), 1297.
 - Takeshi T (2011) Evolution of debris-flow monitoring methods on Sakurajima. *Int J Erosion Cont Eng.* 4: 21–31. <https://doi.org/10.13101/ijece.4.21>
 - Tamburini A (2005) EYDENET: A Real Time Decision Support System. In: Conference presentation, “RiskHydrogeo”, Aosta, Italy. Tamburini A, Martelli D (2006) Displacement and rainfall threshold values for large landslide forecast in real time: the example of the “Becca di Nona” Landslide (Aosta). Conference presentation, RiskYdrogeo, Saint Vincent, Italy
 - Thiebes B (2011) Landslide analysis and early warning – Local and regional case study in the Swabian Alb, Germany. PhD dissertation, University of Vienna
 - Thiebes B, Bell R, Glade T et al (2014) Integration of a limit-equilibrium model into a landslide early warning system. *Landslides* 11(5): 859–875. <https://doi.org/10.1007/s10346-013-0416-2>
 - Tiranti D., Rabuffetti D., Salandin A., Tararbra M. (2013). Development of a new translational and rotational slides prediction model in Langhe hills (north-western Italy) and its application to the 2011 March landslide event. *Landslides*, 10 (2013), pp. 121-138, [10.1007/s10346-012-0319-7](https://doi.org/10.1007/s10346-012-0319-7)
 - Tiranti D., Cremonini R., Marco F., Gaeta A.R., Barbero S. (2014). The DEFENSE (debris Flows triggEred by storms - nowcasting system): An early warning system for torrential processes by radar storm tracking using a Geographic Information System (GIS). *Comput. Geosci.*, 70 (2014), pp. 96-109, [10.1016/j.cageo.2014.05.004](https://doi.org/10.1016/j.cageo.2014.05.004)
 - Tiranti D., Rabuffetti D. (2010). Estimation of rainfall thresholds triggering shallow landslides for an operational warning system implementation. *Landslides*, 7 (2010), pp. 471-481, [10.1007/s10346-010-0198-8](https://doi.org/10.1007/s10346-010-0198-8)
 - Tobler D., Kull I., Haehlen N. (2012) Hazard management in a Debris flow affected area—the Spreitgraben in Central Switzerland. Extended abstract, GRF/IDRC, Davos

- USGS (2018)
https://volcanoes.usgs.gov/volcanoes/mount_rainier/mount_rainier_monitoring_99.html.
- Wang FW, Zhang YM, Huo ZT et al (2008) Movement of the Shuping landslide in the first four years after the initial impoundment of the Three Gorges Dam Reservoir, China. *Landslides* 5: 321–329. <https://doi.org/10.1007/s10346-008-0128-1>
- Wang S (2009) Time prediction of the Xintan landslide in Xiling Gorge, the Yangtze River. In: Wang F, Li T (eds) *Landslide disaster mitigation in Three Gorges Reservoir, China, environmental science and engineering*. Springer, Berlin, pp 411–431
- Wei L.-W. , Huang C.-M. , Chen H., Lee C.-T. , Chi C.-C. , Chiu C.-L. (2018). Adopting the I3-R24 rainfall index and landslide susceptibility for the establishment of an early warning model for rainfall-induced shallow landslides. *Nat. Hazards Earth Syst. Sci.*, 18 (2018), pp. 1717-1733, [10.5194/nhess-18-1717-2018](https://doi.org/10.5194/nhess-18-1717-2018)
- Wieczorek G.F., Morgan B.A., Campbell R.H. (2000). Debris-flow hazards in the blue ridge of central Virginia. *Environ. Eng. Geosci.*, 6 (1) (2000), pp. 3-23, [10.2113/gseegeosci.6.1.3](https://doi.org/10.2113/gseegeosci.6.1.3)
- Wilson R.C. (2012). The rise and fall of a debris-flow warning system for the San Francisco Bay region, California. T. Glade, M. Anderson, M.J. Crozier (Eds.), *Landslide Hazard and Risk.*, John Wiley & Sons, Ltd, Chichester, West Sussex, England (2012), pp. 493-516, [10.1002/9780470012659.ch17](https://doi.org/10.1002/9780470012659.ch17)
- Wong A.C.W., Ting S.M., Shiu Y.K., Ho K.K.S. (2014) . Latest developments of Hong Kong’s landslip warning system. K. Sassa, P. Canuti, Y. Yin (Eds.), *Landslide Science for a Safer Geo environment*, Springer International Publishing, Cham (2014), pp. 613-618, [10.1007/978-3-319-05050-8_95](https://doi.org/10.1007/978-3-319-05050-8_95)
- Yin H.-Y., Lee C.-Y., Jan C.-D. (2015). A web-based decision support system for debris flow disaster management in Taiwan. G. Lollino, M. Arattano, M. Rinaldi, O. Giustolisi, J.-C. Marechal, G.E. Grant (Eds.), *Engineering Geology for Society and Territory* 3, Springer, Cham (2015), pp. 109-113, [10.1007/978-3-319-09054-2_21](https://doi.org/10.1007/978-3-319-09054-2_21)
- Yin H.-Y., Lee C.-Y., Jan C.-D., Lin M.-L. (2016). Practical management of debris-flow-prone torrents in Taiwan. *Proceedings Interpraevent 2016*, Lucerne (2016), pp. 178-185
- Yin HY, Huang CJ, Chen CY et al (2011) The present development of debris flow monitoring technology in Taiwan - a case study presentation. *Ital J Eng Geol Environ*, Special issue: 307–314. <https://doi.org/10.4408/IJEGE.2011-03.B-068>
- Yin K., Chen L., Zhang G. (2007). Regional landslide hazard warning and risk assessment. *Earth Sci. Front.*, 14 (6) (2007), pp. 85-97, [10.1016/S1872-5791\(08\)60005-6](https://doi.org/10.1016/S1872-5791(08)60005-6)
- Yin K., Chen L., Zhang G. (2007). Regional landslide hazard warning and risk assessment. *Earth Sci. Front.*, 14 (6) (2007), pp. 85-97, [10.1016/S1872-5791\(08\)60005-6](https://doi.org/10.1016/S1872-5791(08)60005-6)
- Yin Y, Wang H, Gao Y, Li X (2010) Real-time monitoring and early warning of landslides at relocated Wushan Town, the Three Gorges Reservoir, China. *Landslides* 7: 339– 349. <https://doi.org/10.1007/s10346-010-0220-1>
- Zhang G. , Chen L. , Zhengxing D. (2011). Real-time warning system of regional landslides supported by WEBGIS and its application in Zhejiang Province, China. *Procedia Earth Planet. Sci.*, 2 (2011) (2011), pp. 247-254, [10.1016/j.proeps.2011.09.040](https://doi.org/10.1016/j.proeps.2011.09.040)
- Zhong L. , Xiao S., Zhou Y. (2009). Research on the early warning and forecast system of geologic hazards in Hubei Province based on WEBGIS. *First International Workshop on Education Technology and Computer Science*. Wuhan, Hubei, China (2009), pp. 602-606