The International Fujita Scale and its implementation

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Here we report on the development of the International Fujita (IF) scale, developed by ESSL and partners, which provides a globally applicable framework for rating tornado and convective wind damage.

Around the world, tornado damage is rated using the Enhanced Fujita (EF-)scale, the original Fujita scale, the T-scale, or national adaptations of the Enhanced Fujita scale. ESSL started the development of the IF-scale when noted that the original Fujita scale damage description provided insufficient guidance for rating tornadoes in Europe, mostly because of varying sturdiness of damaged buildings, an issue that Fujita himself addressed in his later work. The development of the IF-scale was catalysed by the introduction of the EF-scale in the USA in 2007, which drastically reduced wind speed estimates for higher wind speeds while simultaneously raising it for the F0/F1 boundary compared to the original F-scale: a change apparently motivated by a need to correct for biases in tornado rating practices.

Instead of referring to building types typical for a specific region, the IF-scale instead defines categories of Damage Indicators that are more universal and can be adapted to other regions, using a damage indicator ‘building’ with an attribute ‘sturdiness’. Any building can be a damage indicator after being assigned a level of sturdiness. The IF-scale also retains the original Fujita-scale wind speed estimates, at least until measured data are available that give better estimates. The wind speed that the scale relates to is instantaneous rather than the average wind speed at 10 m above ground, as evidence is accumulating (through high-quality videos and mobile doppler radar measurements) that the wind speeds responsible for tornado damage often have a much shorter duration than the typical averaging periods for wind gust measurements. The IF-scale heavily borrows from experience in regions that have adapted the EF-scale locally, such as the Japanese and Canadian adaptations, and adds additional damage indicators such as for trees, road and rail vehicles, and many other objects.

Recently, ESSL evaluated a preliminary version of the IF-scale by applying it to a violent tornado case in Czechia on 24 June 2021. This application revealed weaknesses that have since been addressed. We will present the latest version of the IF-scale that has become the standard scale used in ESSL’s record of severe weather in Europe, the European Severe Weather Database.