Preliminary study of impact based forecast implementation in Pandeglang District

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Abstract. Natural disasters due to bad weather make the need for weather information increase. The impact of severe hydrometeorological events has caused many casualties and significant damage to property and infrastructure, with adverse economic consequences for the people that can last for years even greater for future climate change, because almost all of the bad weather and climate events are projected to change in frequency, intensity, spatial area, duration and time. The availability of weather information so far turned out to be not enough to reduce the impact of bad weather phenomenon, the accuracy of forecasting and early warning information must be followed by public knowledge of what must be done to respond to this information. The implementation of an impact-based weather information dissemination system elaborates on the delivery of the impact of a hazard to individuals or communities at risk. A series of Covariance Analysis analyses were carried out using the SPSS application to investigate differences in intended perceptions and actions between phenomenon-based weather warning recipients and impact-based weather warnings, by controlling several relevant demographic variables, for example, gender, age, education, and domicile/residence. The results of an analysis of the community response assessment of weather forecast information and early warnings showed that respondents who received impact-based warning information felt it was much easier to understand the possible effects of bad weather, more trust that the potential impact would be more threatening, and was more concerned about the effects of bad weather compared when respondents received phenomenon-based warning information. There is no significant difference for the respondents to take further action on the information provided and the higher the level of education and the more vulnerable the region is, the more public the response.

1. Introduction
Indonesia is of a maritime country located in equatorial and has complex atmospheric conditions [1]. Indonesia is located in the tropical region and it is flanked by two continents namely the Asia continent and Australia continent, and two oceans namely the Indian Ocean and Pacific Ocean [2]. The atmospheric circulation in Indonesia is formed by uneven distribution mass flux from ocean and continent so Indonesia becomes the center activity of global circulation [3]. Indonesia is a tropical country where the sun shines all the year makes own characteristics of weather and climate have uncertainty in weather forecasting.
Natural disasters due to weather bad increasing demand for weather information. Disaster events in Indonesia from 2005 to 2015 is more than 78% (±11.648 events) are hydrometeorological disaster [4]. The impact of severe hydrometeorological events on the earth's surface has a significant impact on the victim, damage to infrastructure, and change the economy in society for last year [5]. In the future, we can losses greater than today caused climate change, which is almost bad weather and climate events are projected to change in frequency, intensity, affected area, and time duration [6].

Technology improvements, real-time data collection, and modeling, information dissemination capabilities have led to increasingly sophisticated early warning systems [7]. Improving accuracy and timeliness weather early warning does not guarantee life safety or prevent large economic disruptions [5]. So far, the availability of weather information not enough to reduce the risk of a phenomenon, the accuracy of disaster warning and early warning information must be followed by public knowledge to respond to the information [8]. The society or peoples need to understand that hydrometeorology disaster has life impact in various aspects. From WMO No. 1150, meteorological agencies around the world are given the mandate to build an impact-based forecast system. The implementation of the impact-based forecast to educate society to know to respond if a disaster happens. This system requires an integrated, multidisciplinary and multi-hazard approach [5].

Many studies relating to the impact-based forecast have been carried out by several researchers. In 2018, some researchers examined the effect of impact-based forecast and response recommendations for bad weather in Switzerland and New Zealand [8,9]. They present the study about the effect of segregated and integration information including response recommendations (BR) and impact-based weather (IBW) reach the public using statistical software. The results show that the impact-based forecast may be more effective than a phenomenon-based forecast [8,9]. There are not too many studies on the characteristics of impact-based forecast in Indonesia, especially in Banten Province. This study aims to assess response to early warning information that is needed as an initial step on development and implementation impact-based forecast in Pandeglang District.

2. Data and methods
The initial hypothesis is that respondents will be easier to understand, more trust and more worried if they receive information B than information A (Table 1). Respondents with female gender in the age range of 20-29 years will respond more to the information provided than others. The method used in data collection is to apply a survey method to obtain primary data and conduct secondary data research. Data was collected using a short interview structured questionnaire survey method. Survey questions were developed together with forecaster staff in Banten Province to ensure the correct terminology was used and that the right type of questions was being asked.

| Table 1. Text and warning information is given to respondents |
|---------------------------------------------------------------|
| On Monday at 16.00 WIB. You see information on weather forecasts and early warnings issued by BMKG tomorrow for your area or residence |
| A | B |
| --- | --- |
| Beware of the potential for moderate to heavy rain which can be accompanied by lightning/thunderstorm and strong winds in the afternoon [10]. | Beware of the potential for heavy rain which can be accompanied by lightning/thunderstorm and strong winds are predicted to occur tomorrow. This condition can have an impact on traffic disruption because the main road is flooded, and trees are uprooted. People are encouraged to be careful if they are active outside the home, remain calm and aware. |

The results of this process are short questionnaires, which are designed to complete about five to ten minutes. Statements are given on a Likert scale, ranging from 'strongly disagree' to 'strongly agree'. The
four questions are presented randomly for each respondent. The number of respondents is 38 people, spread across four different sub-districts, namely Carita Sub-District, Labuan Sub-District, Sumur Sub-District, and Pandeglang Sub-District (Figure 1).

A series of Covariance Analysis (ANCOVA) analyses were carried out using the SPSS application to investigate differences in intended perceptions and actions between phenomenon-based weather warning recipients (A) and impact-based weather warnings (B), by controlling several relevant demographic variables, for example, gender, age, education, and domicile/residence. The assumption that the Likert scale is linear in that the p-value of 0.05 is statistically significant in the study.

3. Results and discussion

![Survey location map](image)

Figure 1. Survey location map

The total of respondents was 38 people where 68.4% were men, whereas 31.6% others were women. The dominant age of these surveys including the range of age was 20-29 years old and 30-39 years old (both of these ranges were 31.6%), 40-49 years old (23.7%), and 50-59 years old (13.2%). The education level of respondents was dominantly in Bachelor's degree (S1) as many as 5.3%, Senior High School (SMA/SMK) was 57.9%, Junior High School was 21.1%, and Primary School was 15.8%. All of the respondents were spread in Pandeglang Sub-District (15.8%), in Sumur Sub-District (31.6%), in Labuan Sub-District (28.9%), and Carita Sub-District (23.7%).
Based on 3 figures above, there is a significant trend result in a statistic on the effect of giving twice weather alert types. Figure 2. shows that respondents who receive weather warning information based impact, they felt easier to deeply achieve the probably of the effect from a bad weather, also they felt more confident that the potential of its impact will be more threatening, and they felt more worried to the impact of bad weather for respondent conditions than when the respondents achieved weather warning information based phenomenon. These things are corresponding with the initial hypothesis and also supporting the previous research that has been done [9] that respondents tended to support the use of weather warning information-based impact.

| Source                      | Type III Sum of Squares | df | Mean Square | F       | Sig. |
|-----------------------------|-------------------------|----|-------------|---------|------|
| Corrected Model             | 140.728                 | 33 | 4.264       | 3.655   | .107 |
| Intercept                   | 3247.602                | 1  | 3247.602    | 2783.659| .000 |
| Dealing with vehicles       | 6.667                   | 2  | 3.333       | 2.857   | .170 |
| Changing the activity plan  | 10.667                  | 1  | 10.667      | 9.143   | .039 |
| Clothes to use              | .667                    | 1  | .667        | .571    | .492 |
| Attention to luggage        | 2.000                   | 1  | 2.000       | 1.714   | .261 |
| Checking information        | .250                    | 1  | .250        | .214    | .667 |
| Do nothing                  | 6.712                   | 3  | 2.237       | 1.918   | .268 |

The table above shows the possible follow-up actions taken by the respondent when receiving an early warning and prediction information-based impact, including being careful in dealing with vehicles, changing the activity plan, determining the clothes to be used, paying attention to luggage, checking the information received and do nothing. Based on Table 2, there was no significant difference for the respondents to take further action on the information provided, except for the variable changing the activity plan with a significance of less than 0.05. In general, respondents understand, believe and worry.
about the information provided but there is no or no follow-up action to protect themselves from the effects or impacts caused by the weather. This can be a consideration of relevant institutions in making and adjusting information and education regarding the response that must be made by the community when receiving weather information.

Based on Table 3, demographic variables such as gender, age, and experience of respondents who have been no significant affected by bad weather effects on the weather forecast and early warning information-based impact provided. However, other variables such as the level of education and domicile or residence affect the pattern or perception of the respondent in achieving the information provided. The results of the analysis show that the higher the level of education and the more vulnerable the region, the more significant the response. This does not fully support the research conducted before, which shows that demographic variables influence community response and show that differences between individuals such as age, education, gender, residence location have no significant interaction effect on the perceptions or behavioral responses intended [8,9].

Respondents were also asked to comment on the weather information they wanted to achieve. The qualitative analysis of these data shows that some respondents (n = 14) wanted to receive more information about factors such as the detailed and accurate bad weather predictions-based impact, information was conveyed through several local media and gave responses to what the community should do. In addition to improving information, respondents expect the activities of disaster-related agencies to go directly to the field, the dissemination of bad weather information with high likelihood/confidence levels, and improvement of the early warning system.

4. Conclusion
Based on the analysis results, it can be concluded that respondents who received impact-based warning information found it much easier to understand the possible effects of bad weather events, more trust that the potential impact would be more threatening, and were more worried about the effects of bad weather on respondents conditions than when respondents receive phenomenon-based warning information; there was no significant difference for the respondents to take further action on the information provided, except for the variables changing the activity plan; Demographic variables such as gender, age, and experience of respondents who have been affected by bad weather have no significant effect on the impact-based weather forecast and early warning information provided, while the higher the level of education and the more vulnerable the region, the more significant the response; and respondents expect accurate weather information to be disseminated only when the level of confidence in the impact is high.

5. References
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