

## The Relationship of Weather Salience with the Perceptions and Uses of Weather Information in a Nationwide Sample of the United States

ALAN E. STEWART

*University of Georgia, Athens, Georgia*

JEFFREY K. LAZO, REBECCA E. MORSS, AND JULIE L. DEMUTH

*National Center for Atmospheric Research, Boulder, Colorado*

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### ABSTRACT

The authors used data from a sample of 1465 adults living in the United States to perform a confirmatory factor analysis on the Weather Salience Questionnaire (WxSQ), a 29-item instrument designed to measure the ways in which weather is psychologically significant for people. The original measurement model of the WxSQ was confirmed in the present sample. Additional work also was performed to create a WxSQ short form consisting of seven items. The authors then examined the relationship of weather salience with the respondents' climate zones of residence and several other weather-related attitudes and behaviors that were assessed in the national sample. People residing in continental and temperate climates expressed significantly more weather salience than those living in dry climates. Further, weather salience was significantly and positively related to the following: 1) the frequency with which people sought weather information and forecasts, 2) the frequency of seeking weather information during the day, 3) the frequency of using forecasts to plan daily activities, 4) seeking weather information for wider geographic areas, and 5) the use of precipitation and temperature forecasts. Weather salience also was significantly and positively related to the confidence people expressed about National Weather Service forecasts and to the perceived importance of these forecasts. The results imply that peoples' level of weather salience, at least in part, affects their uses of weather information and their confidence in it. These results support the validity of the WxSQ and also reveal some of the psychological bases of people's perceptions and uses of weather information.

### 1. Introduction

People exhibit a large amount of variability in their chosen sources for obtaining weather information, in their uses of this information, and in their perceptions and values of the available forecast products in the United States (Lazo et al. 2009; Demuth et al. 2011). Similarly, for ostensibly the same forecast scenario, different people make different decisions and exhibit different thresholds for taking protective measures for common weather hazards (Morss et al. 2008a; Morss et al. 2010). There could be many reasons for this interindividual variability in people's sources, perceptions, uses, and

values of weather-related information. For example, people have different attitudes and behaviors toward risk and information in general (Blais and Weber 2006; Weber et al. 2002). One possible reason directly related to weather and weather information is that people experience different weather associated with different climates where they live. A related possible reason is that people have different exposure to weather conditions based on their daily routines associated with their occupations, recreational activities, and personal lives, among other things (Meyer 2000; Strauss and Orlove 2003).

Another source of variability, which we focus on in this paper, stems from differences in the extent to which people find the weather to be psychologically significant for them. Stewart (2009) used the term *weather salience* to convey the degree to which people are psychologically attuned to and affected by weather and weather changes. Weather salience pertains to the degree of importance or

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Corresponding author address: Alan E. Stewart, Department of Counseling & Human Development, University of Georgia, 402 Aderhold Hall, Athens, GA 30677.  
E-mail: aeswx@uga.edu

significance stemming from psychological sources that people have or exhibit for the weather. Stewart's conceptual and quantitative work in developing a measure of weather salience reflects the fact that people's psychological relationship with weather and weather information may be as important as the actual weather that occurs. It is part of an emerging consensus that a more complete understanding of individuals' orientations, perceptions, and attitudes toward weather and weather-related information is needed to facilitate improved utilization of weather products (Dash and Gladwin 2007; Gladwin et al. 2007; Morss et al. 2008b; Morss et al. 2011; National Research Council 2010; National Weather Service (2010).

The focus of this article is to build upon Stewart's (2009) initial work by examining weather salience in a nationwide sample of the United States population. Several research questions guided this examination, the first of which concerned the extent to which Stewart's (2009) original measurement model of weather salience, the Weather Salience Questionnaire (WxSQ), could be generalized to a geographically broader and demographically more variable sample of respondents than the sample of undergraduates in the southeastern United States on which the measure was developed. Specifically, do the WxSQ items perform in the same manner and relate to the same dimensions of weather salience in a new and broader sample? Beyond measurement considerations, subsequent questions concerned the extent to which weather salience covaried with the perceptions, use, and the importance of weather information reported by the sample. In other words, to what extent does the variability in a person's reported psychological significance of weather account for variability in the perceptions and use of weather information? Addressing these questions will help to further examine the external validity of the WxSQ as a research tool for the study of weather-related attitudes and behavior in people. Second, examining the relationships of weather salience with the sources, perceptions, and uses of weather information that people reported may further the field's understanding of how people think of and interact with available weather products. Section 2 describes the nature of weather salience and Stewart's (2009) approach to its measurement. The next section describes the study methodology. Subsequent sections present results on the relationships of weather salience with peoples' perceptions and uses of weather information.

## 2. Nature and measurement of weather salience

The environmental psychology literature provided the theoretical and conceptual framework that guided

the construction of a weather salience measure (Campbell 1983; Stokols 1979). *Weather salience* is conceptualized here as a multifaceted and primarily individually based construct that encompasses the general psychological significance of the weather. The different facets of weather salience stem from the various psychological processes, such as attention, cognitions, attitudes, emotions, and behavior that are affected by the weather or involved in responding to some aspect of the weather. A brief review of these processes follows.

People will attend to the weather to the extent that its nature or magnitude makes it *perceptually salient* given their sensory and perceptual characteristics (Stokols 1979). That is, people will pay attention to the weather or changes in the weather when it becomes noticeable to them. People also differ with respect to their natural and typical levels of perceptual (i.e., sensing, experiential) and epistemic (informational) curiosity levels (Berlyne 1954; Collins et al. 2004; Litman and Spielberger 2003). Some people have greater levels of cognitive or experiential curiosities about the environment while others possess lower levels of such curiosities.

The weather may be psychologically significant for the *emotional* and *motivational salience* that can arise in so far as weather can be broadly experienced as *good* or *bad*. Such valence (i.e., good or bad) will have implications for the emotions that may arise in the person as a result of the weather (Campbell 1983; Denissen et al. 2008; Keller et al. 2005). Daily weather fluctuations can affect the emotions that people experience and people thus pay attention to the weather for this reason (Denissen et al. 2008). Potentially dangerous or destructive weather may give rise to motivations to protect oneself (Ortony 2009; Rogers and Prentice-Dunn 1997). Similarly, the weather can be psychologically salient in that people become emotionally attached to particular types of weather or weather regimes much in the same way that people can be attached to geographical places (Altman and Low 1992; Knez 2005). Another characteristic that can affect the attention or significance of the weather concerns its duration and periodicity (Evans and Cohen 1987). Weather is significant for people because of its variable and somewhat predictable patterns and because weather events of different magnitudes unfold over varying time-frames. The degree of predictability or control of the weather and of one's responses to it as daily life plans, projects, and tasks (e.g., work, recreation) are affected also bears upon weather salience (Campbell 1983; Little 1983).

Stewart (2009) developed the WxSQ, using a sample of university undergraduate students, to reflect the

various ways that weather could be psychologically significant or important for people. An initial pool of 53 statements addressing the different facets of weather salience was created. These statements were designed so that respondents to the measure could use a five-point numerical rating scale to indicate their level of agreement with each statement (1 = Strongly Disagree to 5 = Strongly Agree) or the frequency of occurrence of what the item described (1 = Never to 5 = Always). A factor analysis of the original 53 items resulted in a final, 29-item measure that demonstrated a good fit to the data and that assessed seven components of weather salience. These components were consistent with the environmental psychology theories that informed the WxSQ's development: 1) Attention to weather and weather information (e.g., "If a friend or family member asked me what the weather forecast was for today I could not tell him or her what to expect."); 2) sensing, observing, and experiencing the weather directly (e.g., "I can tell when there seems to be a lot of moisture in the air"); 3) effects of weather on daily plans, work, and activities [e.g., "During certain seasons of the year, the weather conditions routinely (i.e., at least once per week) affect my ability to perform tasks at school or work."]; 4) effects of weather on moods (e.g., "The weather affects my mood from day to day"); 5) attachment to weather of certain places (e.g., "I am attached to the climate of the place where I live or used to live"); 6) need for weather variability and interest in weather changes (e.g., "I like to experience variety in the weather from day to day."); and 7) attention to weather when it may create interruptions, cancellations, or holidays, for example, "I become interested in the weather when there is a possibility that I may have a weather-related holiday (e.g., snow day from school or work)." Detailed information regarding the development of the WxSQ and other psychometric information appears in Stewart (2009). On the basis of Stewart (2009) the WxSQ demonstrated promise as a measure of people's psychological orientation and valuing of weather and weather-related experiences. The extent to which the measure functions similarly in a new and more diverse sample of respondents will now be examined.

### 3. Method

#### a. Survey

The authors designed an online survey to assess people's sources, uses, and values of weather information and forecasts; perceptions and interpretations of forecasts, use of uncertainty information, and

demographic information of the respondents. The survey was developed and pilot tested using the standard principles for designing and implementing survey research (Dillman 2000; Schuman and Presser 1996; Tourangeau et al. 2000). Multiple questions on the survey assessed people's sources, uses, and perceptions of forecast information. These questions included the following: inquiries about the respondent's frequency of obtaining forecasts and weather information, the type(s) of information that were preferred and used, confidence in the accuracy of weather forecasts over various timeframes (e.g., 1–14 days), perceptions of precipitation probability forecasts, and perceptions of the importance of weather and forecast information to the respondent. Where appropriate, the items inquiring about this information were presented in a randomized order for each respondent. Latter portions of the survey inquired about people's weather-related exposure and included items that solicited information about the following: the annual percent of on-the-job time people spend outdoors, the average weekly number of hours people spend commuting from work or school, the average annual percent of leisure time spent outdoors, among other questions. The final section of the survey collected respondent demographic information. The full survey is available from the authors. The survey also included the full 29 items of the WxSQ; please see Stewart (2009) for a description of the process by which the WxSQ subscales were developed. A listing of the WxSQ items is provided in appendix A, along with the frequencies for response to each alternative. Further descriptions of the survey's other questions (i.e., sources and perceptions) and a listing of them are provided in Morss et al. (2008a), Lazo et al. (2009), Morss et al. (2010), and Demuth et al. (2011).

#### b. Participants

The participants completed the online survey in 2006. A survey research company (ResearchExec) programmed the survey and collected the data. The sample was provided by a second company (Survey Sampling International). Only people invited from the sample could access the survey. People were allowed to complete the survey only once. We confirmed the survey's functionality and data quality after approximately 100 responses. Data collection then continued until 1200 responses were collected. Because Caucasians were overrepresented in this group, we purposively sampled approximately an additional 300 non-Caucasians. Given the sampling strategy and the sampling error inherent in Internet-based surveys, the survey was not intended to

obtain a truly representative sample or to provide results that could be generalized to the U.S. public. Nevertheless, the methodology does provide results that are more indicative of the views of members of the U.S. public at large than other commonly used methodologies, such as questionnaires given to students or posted on weather-related websites (Demuth et al. 2011).

There were 1520 completed responses to the online survey, however, 55 (3.6%) of the respondents indicated that they never used weather forecast information. Beyond an initial comparison between users and nonusers of weather information, all of the analyses were performed on the remaining 1465 respondents who reported using weather information. The sample included people from every U.S. state and the District of Columbia.

The sample consisted of 51% women, 75% Caucasian American, 12% African American, and 4% each of Asian and Hispanic American, and 2% Native American. Respondent gender was balanced for each type of ethnicity. The mean respondent age was 50.6 yr [standard deviation (SD) = 13.4 yr]. People reported living at their current residence for a mean of 25.1 yr (SD = 19.3 yr). The sample's sociodemographic characteristics generally reflected that of the U.S. population with the exception that it was somewhat older and more educated and underrepresented people with either very low or very high incomes. Hispanic Americans also were slightly undersampled. Although the sample does not represent a true random, stratified sampling of the U.S. population, it is more diverse and representative than the university-based sample in which weather salience was studied previously (Stewart 2009).

### c. Respondent climate zones

To assess the relationships of geographically consistent weather patterns with perceptions and uses of weather information and with weather salience, we classified each respondent into one of three major climate zones using the Köppen classification (Peel et al. 2007). This classification was accomplished by using Geographical Information System (GIS) software to determine the Köppen classification of each U.S. zip code on the North American continent. We then used the respondent's zip code to determine the climate zone in which they resided. Although there are 44 distinct climate zones in six major climate classifications, the majority of the survey respondents fell into 22 zones that were subtypes of the following: (i) dry (arid and semiarid,  $n = 183$  respondents, 12.5%), (ii) temperate (mesothermal,  $n = 503$ , 34.3%), and (iii) continental (microthermal,  $n = 694$ ,

47.4%) climates.<sup>1</sup> Less than one percent of the respondents lived in regions classified as tropical, hence these 12 respondents and 73 others for whom zip code information was not available were not included in the analyses involving climate zone. Although there are climate subtypes within each of the three major climate zones used in this study and although people within each zone do not all experience the same kinds of weather, the use of this division may provide one way to begin examining people's attitudes and behaviors according to the weather that they experience. Another reason for using climate zones in this analysis stemmed from the results of Demuth et al. (2011). The authors of that project developed and used measures of daily variability in temperature and precipitation for each respondent's location; they subsequently examined whether such variability metrics were related to peoples' sources, perceptions, and uses of weather information using the same sample as the present paper. Because the variability metrics did not seem regularly or robustly related to other variables, the first author chose to use an alternative approach to characterize the climatic regions where people resided (i.e., the Köppen classification).

It is important to keep in mind that climatic classifications like the Köppen system are rather coarse and general. Although people may become psychologically oriented to the weather that typically occurs in a region, shorter-term events like tornadoes, hurricanes, or floods can have a large impact on peoples' psychological relationship with the weather. Such "short fused," and extreme events like tornadoes, however, may not be reflected in climate classifications. Therefore while we expected some relationships between the project measures and the respondents' climatic zones, we also recognized that such zones only reflect the broad temperature and precipitation characteristics of a region.

### d. Data analyses

We employed a structural equation modeling approach to perform a confirmatory model fit analysis of the WxSQ items using the national sample. In other analyses we calculated descriptive statistics to summarize

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<sup>1</sup> From the Köppen classification system, a "B" climate is predominantly *dry* in which evapotranspiration regularly exceeds precipitation. A "C" climate is a midlatitude climate with moist, subtropical characteristics that underlie a mild winter and warm to hot and humid summers. We refer to these climates as *temperate*. A "D" climate is a moist midlatitude *continental* type of climate with mild summers and cold winters. Further specific information about these major climate types and their subtypes (i.e., distribution of precipitation and seasonal variability) can be found in many standard climatology texts (e.g., Robinson & Henderson-Sellers 1999).

the central tendencies and dispersion of variables. We also calculated Pearson (zero order) correlation coefficients to examine the relationships of variables with weather salience.

The survey contained items that inquired about the sources that people consulted to obtain weather information, the geographic areas for which they sought the information, the times during the day in which they normally obtained weather information, the intended uses of weather information, and the types of weather information that they sought. To analyze these data in conjunction with weather salience, we calculated Cronbach's coefficient alpha ( $\alpha$ ) to examine the extent to which the respective subsets of items taken together assessed a unidimensional construct. If the alpha was sufficiently high (i.e., generally above 0.60) we then summed the survey items pertaining to each of the above topics and then used the resulting scores as dependent variables in hierarchical linear regression analyses. We performed hierarchical regression because this allows the researcher to enter blocks of independent variables according to substantive or theoretical considerations. Here, hierarchical regression allowed for a comparison of the relative contributions of the respondent's climate region (dry, continental, or temperate) along with the contribution of weather salience. In each of the regressions that we conducted, the two variables used to dummy code the three levels of climate region were entered as a block first. We entered the climatic variables first because they are pre-existing background elements of the environment. Climate and the weather created by the climate dynamics of a region are the basis for the psychological responses people develop by way of weather salience or perceptions of available weather products. Then, one weather salience variable (e.g., attention to weather and weather information, WxSQ total, or WxSQ short form) was entered as a second block. We then observed the variance accounted for by the full model (adjusted  $R^2$ ) and the change in the  $R^2$  value after adding the contributions of weather salience. The choice of which weather salience subscales (or WxSQ total) to use as an independent variable in the analysis was guided by the magnitudes and statistical significance of the Pearson (zero order) correlations of the weather salience variables with each dependent variable. The weather salience variables demonstrating the highest zero-order correlations with the source or use variable was entered into the regression analyses. Because the weather salience subscales are intercorrelated, we did not enter all of them into the regression analyses. In all analyses we also entered the WxSQ short form variable separately to evaluate the functionality of this variable in its relation to sources and

uses of weather information. Typically, only one weather salience scale emerged as a statistically significant predictor of the dependent variables.

#### 4. WxSQ confirmatory factory analysis

We used the Mplus statistical software (Muthén and Muthén 2007) to evaluate the extent to which the WxSQ measurement model reported using Stewart's (2009) sample would fit the data generated when the current sample responded to the WxSQ items. The primary interest in performing such a confirmatory factor analysis is to assess the extent to which the WxSQ items align with the same latent variables (or WxSQ subscales) in the new sample as in the original sample. Observing a good fit between the data generated by the present sample and the existing measurement model would support the external validity of the measure and also would support the construct validity of weather salience.

Overall, when the new sample of United States residents responded to the WxSQ items, the items exhibited relationships with each other and with the subscales of the WxSQ that did not statistically differ from the original measurement model reported by Stewart (2009). With respect to model fit, the relatively large sample size likely contributed to the statistically significant chi-square statistic assessing overall fit of the WxSQ measurement model,  $\chi^2 (N = 1465, df = 347) = 1592.35$ . Otherwise, the original measurement model demonstrated a good fit to the data of the present sample: standardized root mean residual (SRMR) = 0.047, root-mean-square error of approximation (RMSEA) = 0.049, comparative fit index (CFI) = 0.92, and Tucker-Lewis index (TLI) = 0.91. For an explanation of these fit statistics, please see appendix B. The measurement model did not differ significantly according to gender. Model fit statistics were improved slightly by allowing the residual variances of several items with the same WxSQ subscales to be correlated. This is an acceptable constraint to allow in a confirmatory model assessment and does not alter the scoring, interpretation, or use of the measure (Byrne 2001).

#### *Descriptive statistics*

Table 1 shows the descriptive statistics for the WxSQ subscales and the total scale. The total scores on the WxSQ can range from a minimum of 29 to a maximum of 145. The mean total weather salience score for women (116.36) was approximately four points greater than the mean value for men (112.29); this difference was statistically significant and was of the same approximate magnitude as differences between women and men in Stewart's (2009) undergraduate sample. Women also



TABLE 1. Descriptive statistics for the weather salience questionnaire sub scales. The authors used the Student's  $t$  test for comparing the means for two different (independent) groups to assess WxSQ score differences for men and women. Scales marked by the \* were significantly different for men and women at  $p < 0.02$ . The total and short-form weather salience scores for men and women were approximately normally distributed in shape.

| Scale  | Men ( $N = 712$ ) |         | Women ( $N = 753$ ) |         |
|--|-------------------|---------|---------------------|---------|
|  | Mean              | Std dev | Mean                | Std dev |
| 1) Attention to weather and weather information                          | 30.95             | 5.54    | 30.91               | 5.66    |
| 2) Sensing and observing weather directly*                               | 17.66             | 3.77    | 18.30               | 3.73    |
| 3) Effects of weather on daily activities*                               | 8.05              | 2.74    | 7.59                | 2.52    |
| 4) Effects of weather on daily mood*                                     | 21.62             | 5.23    | 23.60               | 5.11    |
| 5) Attachment to weather patterns  | 10.14             | 2.35    | 10.22               | 2.62    |
| 6) Need to experience weather variability*                               | 15.72             | 3.58    | 16.21               | 3.91    |
| 7) Attention to weather when it may result in a holiday or cancellation* | 8.15              | 2.91    | 9.53                | 3.20    |
| Total Weather Salience Score*  | 112.29            | 18.02   | 116.36              | 18.07   |
| Weather Salience Questionnaire—Short form*                               | 22.81             | 4.25    | 23.74               | 4.40    |

exhibited significantly greater salience with respect to effects of weather on daily mood, sensing and observing the weather directly, desiring variety in the weather, and attending to the weather when it may result in a holiday or cancellation (see Table 1). Men reported significantly greater salience than women with respect to the effects of weather on daily life activities. The present sample, perhaps because it consisted of a more geographically and demographically diverse group, reported significantly greater total mean weather salience scores than Stewart's (2009) undergraduate sample by approximately three points. This difference was statistically significant for men,  $t(993) = 2.15$ ,  $p = 0.03$ , and for women,  $t(1414) = 3.21$ ,  $p = 0.001$ . In examining the WxSQ subscales to identify the facets of weather salience that might underlie the differences between the student and national samples, it appeared that the national sample reported greater effects of weather on mood and the needs to experience weather variability.

With respect to weather salience, to what extent are the *statistically significant* differences between men and women of *practical significance*? Anecdotally, the first authors' discussions about the psychological significance (salience) of weather with both men and women (but not participants from this study) typically revealed ready acknowledgment by women that the weather affects them psychologically more so than is the case for men, especially when this involves weather and mood relationships.

Cronbach's (1951) coefficient alpha ( $\alpha$ ) was calculated for the items in each subscale and for the entire measure to assess the item homogeneity. Theoretically, Cronbach's  $\alpha$  ranges from 0 to 1 with higher values indicating greater internal consistency of the items constituting a scale. For this project, the observed values of

Cronbach's  $\alpha$  ranged from 0.60 (effects of weather on daily activities) to 0.87 (for the effects of weather on daily mood). Taking all the items together as a measure of overall salience it was observed that  $\alpha = 0.87$ . This value was slightly higher than the level of internal consistency reported in Stewart (2009,  $\alpha = 0.83$ ). This difference, though slight, was a statistically significant one, using the Fisher-Bonnet test,  $Z(2407) = 4.47$ ,  $p < 0.001$  (Kim and Feldt 2008). Overall, it appears that the WxSQ possesses an acceptable level of internal consistency in measuring weather salience and its facets.

## 5. A WxSQ short form

We next created a brief measure of overall weather salience using selected items from each of the seven WxSQ subscales. The rationale for distilling such a short form was that there may be occasions or applications where researchers may need only a general indication of overall weather salience and not the information provided by the individual weather salience subscales. Further, researchers may need or want a brief measure of weather salience because use of the full-length measure, along with other measures or questions, may make a measurement packet too lengthy for practical administration.

We created the WxSQ short form by selecting items from each WxSQ subscale that demonstrated the highest item-to-total correlations with the full-length measure. Thus, the WxSQ short-form consists of seven items that most highly related to the core weather salience construct (see Table 2). The WxSQ short form was found to be internally consistent (Cronbach's  $\alpha = 0.70$ ). In addition, a one-factor model (general weather salience) demonstrated a good fit to the data when examined with the Mplus software: Cumulative Fit index = 0.96,

TABLE 2. Items for the Weather Salience Questionnaire—Short form.

| Item  | Correlation with total scale |
|---|------------------------------|
| 1) I take notice of changes that occur in the weather.  | 0.63                         |
| 2) I notice how the clouds look during various kinds of weather.  | 0.58                         |
| 3) I plan my daily routine around what the weather may bring.   | 0.48                         |
| 4) The weather or changes in the weather really do not matter to me.*   | 0.58                         |
| 5) I am attached to the weather and climate of my hometown<br>(or the place of where my family of origin lives or lived).   | 0.27                         |
| 6) It is important to me to live in a place that offers a variety<br>of different weather conditions throughout the year.   | 0.41                         |
| 7) In the past I have wished for weather that would result in a weather-related holiday.  | 0.43                         |
| Scoring: *Item 4 is reverse-scored. Items 5 and 6 have the response format of:<br>Strongly Disagree (coded 1 for scoring)<br>Disagree (coded 2 for scoring)<br>Neither (coded 3 for scoring)<br>Agree (coded 4 for scoring)<br>Strongly Agree (coded 5 for scoring) |                              |
| All remaining items have the response format of:<br>Never (coded 1 for scoring)<br>Seldom (coded 2 for scoring)<br>Sometimes (coded 3 for scoring)<br>Usually (coded 4 for scoring)<br>Always (coded 5 for scoring)   |                              |

Tucker–Lewis index = 0.94, RMSEA = 0.06, and SRMR = 0.04. The WxSQ short form was highly correlated with the remaining items of the full, original WxSQ that were not chosen for the brief measure,  $r = 0.84$ ,  $p < 0.0001$ . These results suggest that a WxSQ short form possesses acceptable psychometric properties for use in the present study. The descriptive statistics for the short form appear in the last row of Table 1. Subsequent sections of this paper will include the WxSQ short form so that its relationships with sources and perceptions of weather information can be examined and evaluated.

## 6. Relationships of climate zones with weather salience

We next explored how weather salience may differ systematically as a function of the weather regimes that people experience in the three major climate zones within the United States (i.e., dry/arid/semiarid, continental, and temperate), again, bearing in mind that the climatic zones represented a very coarse and broad classification of the weather. Generally, we expected that people residing in climate zones that routinely experienced more variable weather conditions (e.g., midlatitude cyclones with precipitation) might report a higher degree of weather salience. We conducted analyses of variance to check for differences in weather salience as a function of both climate zone and gender. The latter variable was included, where statistically significant, and the marginal means were

adjusted according to gender because weather salience scores tend to differ by gender.

Several facets of weather salience statistically differed according to the climate zone in which people resided. Although the effects are small in magnitude, the statistics are useful in describing the nature of the relationship between climate and people's psychological orientation to the weather of their climate region. To begin, people living in the dry/arid climate of the United States reported significantly greater attachment to the relatively stable weather regime of their region compared to those living in the continental climate zone,  $F(2, 1377) = 3.35$ ,  $p = 0.036$ ,  $\eta^2 = 0.005$  (see Table 3).<sup>2</sup> People living in continental and temperate zones

<sup>2</sup> We reported the partial eta-squared statistic ( $\eta^2$ ) to indicate the magnitude of the relationships between the independent and dependent variables in the one-way analyses of variance that we conducted. Using Ferguson's (2009) criteria, a *small effect* is associated with  $\eta^2 \leq 0.04$ . A *medium effect size* involves  $\eta^2 \approx 0.25$  and a *large effect* characterizes  $\eta^2 \geq 0.64$ . Most of the effect sizes reported in this article are *small* in magnitude. Such effect sizes are common in the psychological and behavioral sciences where the variables under investigation involve attitudes, beliefs, and values (i.e., variables that are measured psychologically via surveys rather than physical variables that can be measured directly and with a greater degree of precision, Cohen 1988). We calculated 90% confidence intervals for each effect size and none of the effect sizes contained the zero point. Further all but two analyses did not contain the zero point when we calculated 95% confidence intervals. Therefore, although the effects we observed were small in magnitude, they generally appear to be reliable.

TABLE 3. Weather salience differences according to climate region.

| Scale   | Dry ( $N = 183$ ) |       | Temperate ( $N = 503$ ) |       | Continental ( $N = 604$ ) |       |
|---|-------------------|-------|-------------------------|-------|---------------------------|-------|
|   | Mean <sup>a</sup> | SD    | Mean                    | SD    | Mean                      | SD    |
| Attachment to weather <sup>b</sup>  | 10.53             | 2.49  | 10.29                   | 2.31  | 10.03                     | 2.64  |
| Need to experience weather variability <sup>c</sup>                               | 14.88             | 3.80  | 15.89                   | 3.63  | 16.01                     | 3.80  |
| Attention to weather when it may result in a holiday or cancellation <sup>c</sup> | 7.51              | 3.03  | 9.09                    | 3.16  | 9.08                      | 3.07  |
| Total Weather Salience Score <sup>c</sup>   | 111.15            | 18.55 | 115.12                  | 17.72 | 115.24                    | 18.26 |
| WxSQ Short Form <sup>c</sup>  | 22.30             | 4.37  | 23.50                   | 4.32  | 23.46                     | 4.34  |

<sup>a</sup> Weather salience means in this table represent the marginal means for climate zone collapsed across gender. The effects of gender on weather salience were included in the analysis of variance models where they were statistically significant. There was no statistically significant gender by climate zone interactions.

<sup>b</sup> Statistically significant difference between means for the dry and continental regions only.

<sup>c</sup> The mean weather salience responses of people living in dry regions, using the Köppen system, differed significantly from the mean responses of people living in temperate and continental climatic regions.

reported significantly greater needs for variety in the weather compared to people living in the southwestern, dry zone,  $F(2, 1377) = 12.41, p < .0001, \eta^2 = 0.02$ . People in dry climates also reported less attention to the weather when it may result in a delay, cancellation, or holiday from work or school, compared to people in the other climate zones,  $F(2, 1374) = 19.99, p < 0.0001, \eta^2 = 0.03$ . With regard to total weather salience scores, people who lived in dry climates reported significantly less overall significance of weather for their lives than those living in temperate or continental climates,  $F(2, 1374) = 3.69, p = 0.03, \eta^2 = 0.01$ . A similar result was observed in using the WxSQ short form,  $F(2, 1374) = 6.33, p = 0.002, \eta^2 = 0.01$ .

## 7. Relationships of weather salience with sources and uses of weather information

### a. Frequency of consulting various sources of weather information

Ten survey items inquired about the frequency (1 = Rarely or Never to 6 = Two or more times a day) with which people consulted various weather information sources [e.g., television, Internet, National Oceanic and Atmospheric Administration (NOAA) weather radio, etc]. Following Lazo et al. (2009), responses to each item were converted to a frequency per month scale. Because some sources were used much more often than others, the Cronbach coefficient for these 10 items taken together as a scale was somewhat lower ( $\alpha = 0.64$ ), indicating some degree of heterogeneity in the content of information source items. The items were summed and the resulting score distribution ranged from 0 to 600 and exhibited positive skewness. The results of the regression analyses revealed that climate zone was not significantly related to the

frequency of consulting sources of weather information. Because this left only the WxSQ variables, we chose to report the Pearson correlations of these variables with the frequency of consulting weather sources per month. The frequency of consulting weather sources was significantly related to the WxSQ information subscale ( $r = 0.46, p < 0.0001$ ), to the WxSQ Total Scale ( $r = 0.38, p < 0.0001$ ), and with the WxSQ short form ( $r = 0.36, p < 0.0001$ ).

### b. Frequency of seeking weather information for different locations

Four survey items ( $\alpha = 0.63$ ) inquired about the frequency (1 = Never to 5 = Always) that the respondents obtained weather forecast information for their own city or cities in their state, the United States, and the world. The items were summed to create an indication of the number of different types of locations for which people sought weather information. The scores ranged from 4 to 20 and were approximately normally distributed. These scores were regressed onto weather salience information subscale as in the first regression) and climate zone. None of the climate zone variables was related to the dependent variable. The results of the regression indicated that only the weather salience information subscale was significantly related to the frequency with which the respondents obtained weather information about progressively wider geographic regions (see Table 4a). When the WxSQ short form (total score) was used as the weather salience variable in this model (adjusted  $R^2 = 0.171$ ), slightly less variance was accounted for; however, it was observed that people living in dry climatic regions more frequently obtained weather information about various geographic regions than those living in temperate or continental zones. Overall, with respect to variable importance, these



TABLE 4. Multiple regression analyses of weather salience and climate zone with sources and uses of weather information.

| a. Number of types of geographic areas for which weather information is sought                       |         |         |            |
|--|---------|---------|------------|
| $F(3, 1376) = 44.42, p < 0.0001$   |         |         |            |
| Variables in model   | $\beta$ | $p$     | Adj. $R^2$ |
| Climate zone (dry vs continental and temperate)  | -0.050  | 0.055   |            |
| Climate zone (continental vs temperate)  | 0.038   | 0.144   | 0.003      |
| WxSQ—Weather information subscale  | 0.292   | <0.001  | 0.088      |
| b. Number of time periods during which weather information is obtained over the course of a 24-h day |         |         |            |
| $F(3, 1376) = 43.22, p < 0.0001$   |         |         |            |
| Climate zone (dry vs continental and temperate)  | 0.065   | 0.012   |            |
| Climate zone (continental vs temperate)  | -0.018  | 0.473   | 0.006      |
| WxSQ—Weather Information Subscale  | 0.281   | <0.001  | 0.084      |
| c. Use of weather forecasts for planning daily activities  |         |         |            |
| $F(3, 999) = 119.84, p < 0.0001$   |         |         |            |
| Climate zone (dry vs continental and temperate)  | 0.035   | 0.198   |            |
| Climate zone (continental vs temperate)  | -0.054  | 0.046   | 0.007      |
| WxSQ – Total scale   | 0.507   | <0.0001 | 0.264      |
| d. Rated Importance of Precipitation Information in Forecasts  |         |         |            |
| $F(3, 1376) = 187.72, p < 0.0001$  |         |         |            |
| Climate zone (dry vs continental and temperate)  | 0.086   | <0.001  |            |
| Climate zone (continental vs temperate)  | -0.051  | 0.024   | 0.013      |
| WxSQ—Weather information subscale  | 0.526   | <0.001  | 0.289      |
| e. Rated Importance of temperature, humidity, cloud and wind information in forecasts                |         |         |            |
| $F(3, 1376) = 187.72, p < 0.0001$  |         |         |            |
| Climate zone (dry vs continental and temperate)  | 0.024   | 0.295   |            |
| Climate zone (continental vs temperate)  | -0.011  | 0.604   | 0.003      |
| WxSQ—Weather information subscale  | 0.515   | <0.001  | 0.265      |

analyses suggested that weather salience was more strongly related to the weather information people sought about different areas than was the climatic region in which they resided.

### c. Number of daily periods for which weather information was sought

The survey inquired about the times during the day that the respondents normally obtained weather forecasts. The survey divided the 24-h day into seven periods, some of which involved different durations. As with previous survey items, peoples' responses (recoded for Yes = 1 and No = 0) for obtaining forecast information within each period were summed to reflect an overall indication of the number of daily periods during which they obtained weather forecasts. Scores ranged from 0 to 7, with higher scores indicating a greater number of periods during the day in which forecast information typically was obtained.

The results from the regression analyses (Table 4b) revealed that both climate zone and the information subscale of weather salience significantly predicted the

number of time periods during which people obtained forecast information. Specifically, people residing in continental and temperate climate zones obtained forecast information for a more time periods than those living in dry regions. Greater weather salience also predicted obtaining information during more time periods. Weather salience explained more variability than did climate zone. A nearly identical pattern of results was obtained in using the WxSQ short form as a predictor variable (adjusted  $R^2 = 0.076$ ).

### d. Use of weather information to plan daily activities

Eight survey items inquired about the frequency with which people used weather forecasts to plan various aspects of daily life activities (e.g., how to dress, travel, how to work outside, social activities, etc.). A five-point rating scale was used (1 = Never to 5 = Always). The items were summed to provide an indication of the use of forecasts for daily planning. This scale was internally consistent ( $\alpha = 0.82$ ) and included scores ranging from 8 to 40. Regression results (Table 4c) indicated that those residing in continental climate regions utilized

weather forecasts for daily planning more frequently than those in the temperate climate zone. Total WxSQ scores were significantly and positively related to the use of forecasts in daily planning. Weather salience accounted for a preponderance of the 26.4% of the variability explained by the regression model. A nearly identical result was obtained when the WxSQ short form was used to assess the contributions of weather salience in peoples' use of weather forecasts for daily planning (adjusted  $R^2 = 0.257$ ).

#### *e. Type of weather information sought*

Fourteen survey items inquired about the importance of types of weather forecast information, which included parameters such as chance and amount of expected precipitation, high and low temperatures, cloud cover, and wind speed and direction. People indicated the importance of each parameter using a five point scale (1 = Not at all important to 5 = Extremely important). Because the 14 items were varied in nature, we factor analyzed them to create fewer, more homogeneous scales. Consistent with Demuth et al. (2011), we used a principal components factor extraction method, followed by an orthogonal factor rotation for interpretability resulted in a scale that included exclusively precipitation items (e.g., how much precipitation, when, where;  $\alpha = 0.90$ ) and a second scale composed of temperature, wind, cloud, and humidity items ( $\alpha = 0.88$ ). The scores on each scale were approximately normally distributed; the precipitation information scale ranged from 6 to 30 and the temperature, humidity, and wind information scale ranged from 8 to 40.

We regressed the precipitation information subscale on the climate zone indicator variables and on the WxSQ attention to weather and weather information subscale. The resulting model was statistically significant and accounted for a noteworthy proportion of variance in the dependent variable (see Table 4d). The results indicate that respondents in temperate and continental climate zones placed more importance on precipitation information in forecasts than people residing in locations with a predominantly dry climate. Further, people in continental zones placed greater emphasis on precipitation information than those residing in the temperate zones. The informational salience of weather, again, accounted for a majority of the explained variability in the full model. Very similar results were obtained when using the WxSQ Total Scale (adjusted  $R^2 = 0.216$ ) and the WxSQ short form (adjusted  $R^2 = 0.226$ ), although because of the more general nature of these scales the overall explained variability was slightly lower than when the WxSQ information subscale was used in the model.

The climate zone indicator variables were not significantly related to peoples' expressed importance of non-precipitation information such as temperature, humidity, cloud, or wind information in forecasts (see Table 4e). Instead, the degree of attention to weather and weather information as indicated by the weather information subscale of the WxSQ was the only variable in the model to exhibit a statistically significant relationship (adjusted  $R^2 = 0.265$ ). Similar results also were obtained when using the WxSQ total and short form scales.

#### **8. Relationships of weather salience with confidence in weather forecasts**

Next we examined the relationship of weather salience with peoples' level of confidence in weather forecasts. With regard to overall confidence in weather forecasts, the survey asked participants to use a five-point rating scale (1 = Very low to 5 = Very high) to indicate their general degree of confidence in weather forecasts in each of six lead times: less than 1 day from now, 1 day from now, 2 days from now, 3 days from now, 5 days from now, and 7–14 days from now. We did not provide any operational definitions of confidence in the questionnaire; rather, people were free to use their subjective meanings of this concept when making their ratings. We were interested in determining how peoples' profiles of forecast confidence differed according to their levels of weather salience. Although weather salience could be correlated with levels of confidence in forecasts over the varying time frames, we believed that a more illustrative analysis could be obtained by contrasting the confidence profiles of people who reported higher versus lower levels of total weather salience. Thus, we created two groups, one of which had total weather salience scores above one standard deviation above the mean (high weather salience) and another group that possessed scores below one standard deviation of the mean (low salience group). The WxSQ score distributions for men and women were examined separately to create the high and low weather salience groups. The low and high weather salience groups each contained approximately 200 people and represented the lowest and highest 13%–14% of scores, respectively. Gender was not entered as an independent variable in this analysis because, after taking into account the effects of weather salience, it was not associated with forecast confidence. The plot of weather forecast confidence over the six time frames for each salience group appears in Fig. 1.

A mixed model analysis of variance was employed to check for statistically significant differences in the means of rated overall forecast confidence over various

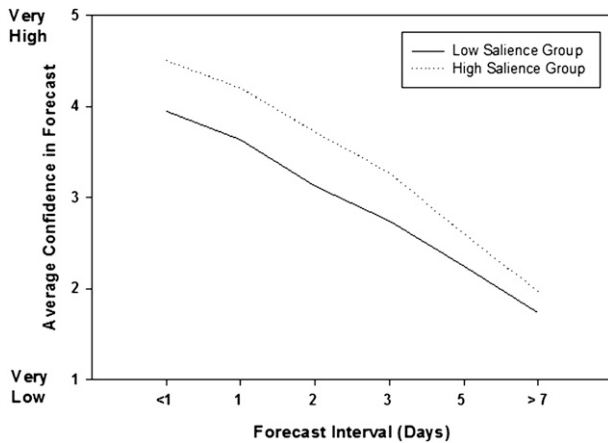


FIG. 1. Relationship of total weather salience with overall forecast confidence.

lead times between those people who had high versus low overall weather salience. The within-subjects component of the analysis consisted of the six ratings of forecast confidence that people in each of the high- and low-salience groups made. Overall, a significant main effect of weather salience group,  $F(1, 408) = 35.73, p < 0.0001, \eta^2 = 0.08$ , was qualified by a significant interaction between salience and forecast lead time,  $F(5, 408) = 5.00, p < 0.005, \eta^2 = 0.012$ . From an inspection of Fig. 1, the main effect of high weather salience is to increase weather forecast confidence by about one-half point compared to the low salience group. Although confidence in forecasts decreases (as would be expected) with longer lead times, the mean differences between the high- versus low-salience group decreases with time as well (this is the interaction). The climate zone of the respondent's location was not related to the expressed forecast confidence. Another mixed model analysis of variance using the WxSQ short form was conducted. A nearly identical pattern of results as

that depicted in Fig. 1 was observed in that people reporting the highest levels of weather salience were significantly more confident than people reporting the lower weather salience,  $F(1, 462) = 35.90, p < 0.0001, \eta^2 = 0.08$ .

Three additional survey items inquired about the respondents' levels of confidence specifically with regard to temperature, probability of precipitation (PoP), and amount of precipitation over lead times of 1, 3, and 7 days. The respondents used the same five-point rating scale for indicating their level of confidence as employed in the previous question. A mixed model analysis of variance again was used to examine differences in mean levels of confidence as a function of the forecast lead time (within subjects variable) and dichotomized (high versus low) values of weather salience. Generally the mean levels of confidence fell from *High* to *Low* going from day 1, to day 3, and then to day 7. As in the analysis of overall confidence, climate zone was again not a significant contributor to levels of confidence in forecasts of specific temperature or precipitation parameters. Table 5 depicts the mean values of confidence in the forecasts as a function of weather salience and forecast time frame. Respondents' confidence in temperature forecasts differed significantly according to their total weather salience score,  $F(1, 417) = 39.96, p < 0.0001, \eta^2 = 0.09$ . Overall, people highest in weather salience reported approximately one-half point more confidence in forecasts than those lowest in weather salience.

The results for confidence in the PoP and amount of precipitation forecasts over the 7-day period followed a pattern similar to that of temperature. The respondents possessing the highest levels of weather salience expressed systematically more confidence in the PoP forecast compared to those lower in overall salience,  $F(1, 417) = 32.74, p < 0.0001, \eta^2 = 0.07$ . People with the highest weather salience also expressed greater

TABLE 5. Degree of confidence in temperature and precipitation forecasts according to level of weather salience. Note that there were 202 people in the low weather salience group and 217 in the high salience group. These represented the lowest and highest 13%–14% of scores, respectively.

|                              | One-day forecast |      | Three-day forecast |      | Seven-day forecast |      |
|------------------------------|------------------|------|--------------------|------|--------------------|------|
|                              | Mean             | SD   | Mean               | SD   | Mean               | SD   |
| Temperature                  |                  |      |                    |      |                    |      |
| High salience                | 4.41             | 0.68 | 3.57               | 0.88 | 2.59               | 1.09 |
| Low salience                 | 3.85             | 0.90 | 3.12               | 0.94 | 2.20               | 0.94 |
| Probability of precipitation |                  |      |                    |      |                    |      |
| High salience                | 4.16             | 0.82 | 3.23               | 0.91 | 2.25               | 1.07 |
| Low salience                 | 3.56             | 0.98 | 2.85               | 0.93 | 1.92               | 0.87 |
| Amount of precipitation      |                  |      |                    |      |                    |      |
| High salience                | 3.96             | 0.93 | 3.10               | 0.98 | 2.14               | 1.08 |
| Low salience                 | 3.37             | 0.96 | 2.67               | 0.94 | 1.84               | 0.88 |

confidence in the amount of precipitation forecasted,  $F(1, 417) = 31.35, p < 0.0001, \eta^2 = 0.07$ . Consistent with the results of confidence in temperature forecasts, people expressing the highest levels of weather salience were, on average, about one-half point more confident in the precipitation forecasts regardless of lead time (see Table 5). The use of the WxSQ short form to create groups of respondents who were high and low on weather salience resulted in the same conclusions about the confidence in temperature and precipitation forecasts.

### 9. Relationships of weather salience with perceived importance of weather information

One survey item assessed the relative importance and significance of the information and forecast products provided to the public by the National Weather Service (NWS). The item asked the respondents to use a five-point rating scale (1 = Not at all important to 5 = Extremely important) to evaluate the importance of NWS forecasts of severe weather (e.g., tornadoes and hurricanes) along with the forecasts produced for aviation and marine interests. The correlation between this item and weather salience was examined. All of the weather salience subscales and the WxSQ short form exhibited statistically significant correlations with the rated importance of NWS products. The highest correlations included the WxSQ subscale measuring attention to weather and weather information ( $r = 0.35, p < 0.0001$ ) and the sensing and observing weather subscale ( $r = 0.34, p < 0.0001$ ). The WxSQ total score also exhibited a statistically significant degree of association with perceptions of importance of NWS products ( $r = 0.32, p < 0.0001$ ) as did the WxSQ short form ( $r = 0.33, p < 0.0001$ ). These results suggest that increases in the psychological significance that people place on weather, especially as this involves observing or obtaining information about the weather, are associated with increases in the perceived importance of NWS information and forecast products.

### 10. Discussion

The results of this project have provided useful perspectives on both the measurement of weather salience (i.e., the personal degree of significance and importance people place upon the weather) and the relationships of weather salience with peoples' sources, uses, confidence, and importance of weather information and forecasts. With respect to measuring weather salience, the results of the analyses using a national sample of adults in the United States confirmed the measurement model reported by Stewart (2009) using a geographically limited sample of undergraduate students. This successful

confirmation of the WxSQ measurement model suggests that the contribution of WxSQ items to their constituent subscales generalizes to a geographically and demographically more diverse sample. This is an important finding because some researchers have noted that the use of undergraduate samples restricts the generalizability of research results (Sears 1986). Further, the measurement model was invariant with regard to respondent gender (i.e., the same items can be used for both men and women), a result which also was consistent with Stewart (2009). This means that the WxSQ items function similarly in assessing weather salience regardless of gender. The finding that the WxSQ items were internally consistent in the current sample further supports psychometric properties of the instrument (i.e., that the measure performs in a reliable manner given its design and intended use).

As in Stewart's undergraduate sample, women in the current national sample exhibited significantly higher weather salience mean scores than did men. This was due mainly to women reporting greater effects of weather on daily mood and to greater sensing and observing of the weather. This result is consistent with other research on weather-mood relationships that have found women to be more perceptually and emotionally affected by ambient weather conditions (Rosenthal 2006). The sources of such gender differences in weather salience are the subject of ongoing research being conducted by the first author. We observed higher levels of weather salience in the current, national sample compared to Stewart's undergraduate sample, including greater mood-related weather salience and greater needs for weather variability. This result could stem from the geographical diversity of the current sample, which includes people from three different climate zones. In addition, the higher average age of the participants in the present sample also mean that they have had more experience with different kinds of weather and weather-related daily difficulties; one might conjecture that this contributed to an increase in their overall WxSQ scores. Understandably, the more youthful sample in Stewart's (2009) study may have contributed to the higher holiday-related weather salience scores than the older sample.

Finally, with respect to measurement, the current sample was useful in producing a WxSQ short form that assessed general weather salience and that possessed acceptable psychometric properties. Such a brief measure may find uses in research projects where a full examination of weather salience is not wanted or needed. In assessing the relationships of weather salience with the survey items measuring sources, confidence, and importance of weather information, the WxSQ short

form performed very similarly to the full WxSQ total weather salience scores. Therefore, the data from the initial trials with the WxSQ short form were promising.

Before discussing the meanings and implications of the results further, some of the study limitations should be noted. First, the research methodology relied upon the respondents to self-report facts, attitudes, and behaviors regarding their relationship with the weather and with weather information. Sometimes such self-reports can be unreliable in that people do not reliably or accurately evaluate their own behaviors or honestly report their attitudes or values (Nisbett and Wilson 1977). Similarly, what people actually do with respect to their weather-related behaviors may not correspond with their descriptions of their behaviors in a survey such as the one conducted here. A second limitation concerns the generalizability of the results to the population of the United States. Although we used broad stratified sample of adults in the United States, our sample was slightly older than the population. Because younger people may be adopt the information technology through which weather information is disseminated more quickly than older persons, some of our findings may not be as applicable to young adults. A third limitation concerns the classification of respondents into climatic zones. Although the weather within each of the major zones obviously shares important climatic commonalities, the weather within each zone may be quite variable. Thus the use of climatic zone to represent the contributions of the “typical-weather-of-place” is, at best, a coarse and imprecise variable.

The use of a national sample with respondents residing in three climate zones (dry, temperate, and continental) made it possible both to explore weather salience differences according to climate zone and also to include climate zone as a predictor, along with weather salience, in examining responses to survey questions about sources, uses, confidence, and importance of weather information. This inclusion of weather salience as a predictor allowed for an evaluation of the WxSQ's external and concurrent validity and also revealed that peoples' psychological orientation to the weather was associated with their perceptions and uses of weather information. The significantly greater degree of overall weather salience, on both the full and short forms of the WxSQ, for people residing in continental and temperate zones compared to the dry zone, makes sense from the perspective of the literature reviewed earlier. That is, in regions where the atmospheric environment is more uniform and predictable (Campbell 1983; Keller et al. 2005) and involves comparatively fewer weather events that demand attention (Stokols 1979), people may report systematically lower levels of weather

salience. The effect sizes for the relationships of climate zone with weather salience, however, were small in magnitude. This implies that although the climate and weather of one's locality affects the psychological significance that people attach to weather, it does not strongly determine it. The magnitudes of the relationships examined here were similar in size to those reported in Stewart (2009) in which prior evacuation for a hurricane or the experience of weather-related property damages were associated with increases in weather salience.

We observed that weather salience was significantly related to the sources and uses of weather information that people reported. In particular, salience involving attention to weather and weather information along with the respondents' climate zone predicted the following: 1) the overall frequency and 2) the number of time periods during the day in which weather information was sought, 3) the geographic regions for which forecast information was sought, 4) the number of daily activities for which weather information was sought, and 5) the types of information (i.e., precipitation, temperature, winds) that were sought. These results are noteworthy for three reasons, the first of which pertains to validation support they provide for the WxSQ. That is, to the extent that the WxSQ measures the personal importance, psychological significance, and inherent curiosity people possess about the weather (Berlyne 1954; Collins et al. 2004; Litman and Spielberger 2003), then it makes sense that weather salience (i.e., attention to weather and weather information) positively covaried with self-reported information-seeking behaviors. In some respects the survey questions pertaining to sources and uses of weather information reflect similar ways of measuring the significance people place on weather and thus support the concurrent validity of the WxSQ.

The second noteworthy point concerns the result that peoples' sources and uses of weather information and forecasts were consistently related to both the characteristics of their physical environments as this was given by their climate zone and to the psychological significance they attached to the weather (i.e., to their levels of weather salience). Although weather salience was itself related to respondent climate zone, each variable made independent and statistically significant contributions to the analyses we performed to predict source and use-related variables from the survey. Although climate zone information was entered first in all of the regressions, weather salience consistently accounted for more of the variability in the dependent variables than did climate zone. These results suggest weather salience may contribute more to the sources people consult and the uses they make of weather information than do the



long-term physical characteristics of their place (i.e., the climate or climate zone).

Third, these results suggest that weather information and forecasts are not uniformly important or significant to people. Based upon responses to the WxSQ and to survey items, people appear to differ in the extent to which weather and weather information is significant to them (Stewart 2009), to the sources for weather that they consult, the range of activities for which they seek information and the types of weather information that they seek and use. The implication of these results is that different people will consult different sources, kinds, and amounts of weather information and use this information accordingly. Put another way, the results of this project do not provide support for viewing weather consumers as *uniform* or *identical* with regard to their sources and uses of information. Developing a fuller understanding of these multidimensional differences and similarities, will eventually help guide efforts in information provision by different means, for different people, for different uses.

Although the results that *people differ individually* in the degree to which they attach general importance to weather may confirm long-held beliefs or experiences that social and atmospheric scientists have about human responses to the weather, the results of this study along with Stewart (2009), represent the first efforts to assess the nature and extent of such individual differences quantitatively. In this regard those who have researched responses to hurricanes and floods, for example, have noted that communities, neighborhoods, and even households are not homogeneous (King 2002; Morrow 1999; Pfister 2002). The present research represents an effort to understand the heterogeneity of individuals as they are nested within particular locations, social groupings, and their corresponding climatic zones. The addition of an individual-level variable may enhance researchers' abilities to both understand and model peoples' responses to significant weather events.

With regard to types of weather consumers and the weather salience differences that underlie such types, we observed that people differed in their expressed confidence in weather forecasts as a function of their level of weather salience. People who were one or more standard deviations above the mean level of weather salience for their gender expressed significantly and consistently more confidence in weather forecasts than people who were low (one or more standard deviations below the mean) in weather salience. This result is significant because it represents a meeting of the consumer's weather orientation with the available forecast information such that people's levels of confidence in a given forecast vary. In part, the confidence people

have in weather forecasts seems to stem from their attention, interest, and attributed significance to the weather. One also may conjecture that attention and interest in weather are reciprocally related to confidence as people experience weather events. That is attention, interest, and the importance one places on weather may contribute to greater confidence in forecasts. When such confidence is borne out by a match between conditions and one's expectations, this could lead to increased attention and interest in the weather subsequently.

Just as important, peoples' expressed confidence in forecasts does not simply stem from properties of the forecast itself, such as its lead time. Insofar as confidence in a weather forecast leads to its use in making plans or preparations (e.g., for severe or extreme weather), weather salience represents an important personal user characteristic. It is possible that within this context weather salience consists of a kind of sophistication or level of experience with one's atmospheric environment that contributes to a greater confidence in using a given forecast to know what to expect. That is, weather salience helps to explain differences in peoples' attitudes and behaviors.

Finally, we observed that the personal and psychological significance people attach to the weather corresponds to the rated importance of NWS information and forecasts to them. That is, the components of weather salience, especially of attending to weather information, sensing and observing the atmosphere, and incorporating weather into daily planning, may all help people to use forecasts in a way that makes them more important to people who are higher in weather salience. Another implication of this result is that although weather forecasts can be evaluated according to their skill level, the perceived psychological worth and attributed importance of the forecast is a function (at least in part) of the weather salience of the person receiving and using the information.

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## APPENDIX A

## Items for the Weather Salience Questionnaire Subscales with Response Frequencies

| Subscale and Items   | Response Alternatives Frequency (Percent) |               |               |               |               |
|--|---|---------------|---------------|---------------|---------------|
|  | 1   | 2             | 3             | 4             | 5             |
| <b>A. Attention to weather and to weather information</b>  |   |               |               |               |               |
| 1) I use the Internet to obtain weather forecasts or weather information (temperatures, radar images).   | 119<br>(8.1)                              | 233<br>(15.9) | 476<br>(32.5) | 377<br>(25.7) | 260<br>(17.7) |
| 2) I look at the weather radar on television or on the Internet to see where precipitation (i.e., rain, thunderstorms, snow, etc.) may be occurring.                       | 120<br>(8.2)                              | 171<br>(11.7) | 441<br>(30.1) | 470<br>(32.1) | 263<br>(18.0) |
| 3) I seek out more up-to-date weather information than what is provided on the television or radio.  | 177<br>(12.1)                             | 392<br>(26.8) | 494<br>(33.7) | 269<br>(18.4) | 133<br>(9.1)  |
| 4) I watch television or listen to the radio to get a weather forecast so that I can know what to expect.  | 36<br>(2.5)                               | 80<br>(5.5)   | 285<br>(19.5) | 642<br>(43.8) | 422<br>(28.8) |
| 5) I plan my daily routine around what the weather may bring.  | 114<br>(7.8)                              | 313<br>(21.4) | 602<br>(41.1) | 320<br>(21.8) | 116<br>(7.9)  |
| 6) If a friend or family member asked me what the weather forecast was for today I could not tell him or her what to expect.*  | 20<br>(1.4)                               | 93<br>(6.3)   | 298<br>(20.3) | 791<br>(54.0) | 263<br>(18.0) |
| 7) The weather or changes in the weather really do not matter to me.*  | 57<br>(3.9)                               | 173<br>(11.8) | 541<br>(36.9) | 471<br>(32.2) | 223<br>(15.2) |
| 8) I only pay attention to what the weather is doing when the conditions become severe (e.g., flooding, heat wave, hurricane, thunderstorm, tornado, winter storm, etc.).* | 127<br>(8.7)                              | 228<br>(15.6) | 291<br>(19.9) | 539<br>(36.8) | 280<br>(19.1) |
| 9) I take notice of changes that occur in the weather.   | 24<br>(1.6)                               | 76<br>(5.2)   | 399<br>(27.2) | 627<br>(42.8) | 339<br>(23.1) |
| <b>B. Sensing and observing weather directly</b>   |   |               |               |               |               |
| 9) I take notice of changes that occur in the weather.   | 24<br>(1.6)                               | 76<br>(5.2)   | 399<br>(27.2) | 627<br>(42.8) | 339<br>(23.1) |
| 18) I can tell when there seems to be a lot of moisture in the air.  | 49<br>(3.3)                               | 116<br>(7.9)  | 436<br>(29.8) | 610<br>(41.6) | 254<br>(17.3) |
| 19) I take notice of how the air outside sometimes smells differently after it rains.  | 38<br>(2.6)                               | 104<br>(7.1)  | 359<br>(24.5) | 542<br>(37.0) | 422<br>(28.8) |
| 20) I notice how the clouds look during various kinds of weather.  | 64<br>(4.4)                               | 160<br>(10.9) | 474<br>(32.4) | 485<br>(33.1) | 282<br>(19.2) |
| 21) I look forward to what changes the weather may bring.  | 64<br>(4.4)                               | 160<br>(10.9) | 474<br>(32.4) | 485<br>(33.1) | 282<br>(19.2) |
| <b>C. Effects of weather on daily activities</b>   |   |               |               |               |               |
| 5) I plan my daily routine around what the weather may bring.  | 114<br>(7.8)                              | 313<br>(21.4) | 602<br>(41.1) | 320<br>(21.8) | 116<br>(7.9)  |
| 28) During certain seasons of the year, the weather conditions routinely (i.e., at least once per week) affect my ability to perform tasks at school or work.              | 368<br>(25.1)                             | 387<br>(26.4) | 371<br>(25.3) | 248<br>(16.9) | 91<br>(6.2)   |
| 29) The work that I do (or did previously) is affected by the daily weather conditions.  | 543<br>(37.1)                             | 369<br>(25.2) | 292<br>(19.9) | 122<br>(8.3)  | 139<br>(9.5)  |
| <b>D. Effects of weather on daily mood</b>   |   |               |               |               |               |
| 7) The weather or changes in the weather really do not matter to me.*  | 57<br>(3.9)                               | 173<br>(11.8) | 541<br>(36.9) | 471<br>(32.2) | 223<br>(15.2) |
| 10) How the weather makes the outside environment appear tends to affect my mood during that weather.  | 135<br>(9.2)                              | 306<br>(20.9) | 593<br>(40.5) | 300<br>(20.5) | 131<br>(8.9)  |
| 11) The changes in the weather cause my mood to change.  | 167<br>(11.4)                             | 344<br>(23.5) | 591<br>(40.3) | 256<br>(17.5) | 107<br>(7.3)  |
| 12) There is a particular kind of weather that makes me feel good emotionally.   | 48<br>(3.3)                               | 77<br>(5.3)   | 384<br>(26.2) | 620<br>(42.3) | 336<br>(22.9) |
| 13) The weather affects my mood from day to day.   | 126<br>(8.6)                              | 284<br>(19.4) | 516<br>(35.2) | 424<br>(28.9) | 115<br>(7.8)  |
| 14) Certain types of weather make me feel better emotionally than other types of weather.  | 92<br>(6.3)                               | 161<br>(11.0) | 481<br>(32.8) | 451<br>(30.8) | 280<br>(19.1) |

| Subscale and Items   | Response Alternatives Frequency (Percent) |               |               |               |               |
|--|---|---------------|---------------|---------------|---------------|
|  | 1   | 2             | 3             | 4             | 5             |
| <b>E. Attachment to weather patterns</b>   |   |               |               |               |               |
| 15) I am attached to the weather and climate of my hometown (or the place of where my family of origin lives or lived).                            | 53<br>(3.6)                               | 174<br>(11.9) | 430<br>(29.4) | 598<br>(40.8) | 210<br>(14.3) |
| 16) I am attached to the climate of the place where I live or used to live.  | 44<br>(3.0)                               | 150<br>(10.2) | 389<br>(26.6) | 622<br>(42.5) | 260<br>(17.7) |
| 17) I am attached to the climate that exists in the location where I lived as a child or adolescent.   | 173<br>(11.8)                             | 292<br>(19.9) | 424<br>(28.9) | 420<br>(28.7) | 156<br>(10.6) |
| <b>F. Need to experience weather variability</b>   |   |               |               |               |               |
| 21) I look forward to what changes the weather may bring.  | 68<br>(4.6)                               | 203<br>(13.9) | 673<br>(45.9) | 377<br>(25.7) | 144<br>(9.8)  |
| 22) There are some geographical locations where the weather changes so little that it would be boring to live there.                               | 144<br>(9.8)                              | 239<br>(16.3) | 431<br>(29.4) | 435<br>(29.7) | 216<br>(14.7) |
| 23) It is important to me to live in a place that offers a variety of different weather conditions throughout the year.                            | 111<br>(7.6)                              | 227<br>(15.5) | 495<br>(33.8) | 476<br>(32.5) | 156<br>(10.6) |
| 24) I like to experience variety in the weather from day to day.   | 78<br>(5.3)                               | 231<br>(15.8) | 580<br>(39.6) | 449<br>(30.6) | 127<br>(8.7)  |
| <b>G. Attention to weather when it may result in a holiday or cancellation</b>   |   |               |               |               |               |
| 25) I become interested in the weather when there is a possibility that I may have a weather-related holiday (e.g., snow day from school or work). | 321<br>(21.9)                             | 256<br>(17.5) | 362<br>(24.7) | 285<br>(19.5) | 241<br>(16.5) |
| 26) I enjoy having a weather-related holiday (e.g., a holiday stemming from snow or ice).  | 180<br>(12.3)                             | 200<br>(13.7) | 494<br>(33.7) | 383<br>(26.1) | 208<br>(14.2) |
| 27) In the past I have wished for weather that would result in a weather-related holiday.  | 263<br>(18.0)                             | 296<br>(20.2) | 541<br>(36.9) | 216<br>(14.7) | 149<br>(10.2) |

**Scoring:** Items marked with a \* are reverse-scored. Subscales are scored by summing the numerical ratings for the constituent items. The numbering of items in this table corresponds to that in the instrument. The total WxSQ score is the sum of all items. Items 6, 8, 12, 13, 15, 16, 22, 23, 24, 26, & 28) have the response format of:  
 Strongly Disagree (coded 1 for scoring)  
 Disagree (coded 2 for scoring)  
 Neither (coded 3 for scoring)  
 Agree (coded 4 for scoring)  
 Strongly Agree (coded 5 for scoring)

All remaining items have the response format of:  
 Never (coded 1 for scoring)  
 Seldom (coded 2 for scoring)  
 Sometimes (coded 3 for scoring)  
 Usually (coded 4 for scoring)  
 Always (coded 5 for scoring)

## APPENDIX B

### Structural Equation Modeling Fit Statistics

A range of fit indices exist because different indices have been designed to assess different facets of fit or to operationalize assumptions of fit in different ways. A brief interpretation of the fit indices that were used in this article follows based upon standard texts (Byrne 2001; Loehlin 2004). The standardized root mean residual (SRMR) is the average value of all of the standardized residuals that are observed when comparing the model to the actual data. The RMR can range from 0 to 1, with lower values indicating a better fit of the

model. The RMR can be interpreted as an average error between the data and the model. In the present context, an RMR of 0.047 means that the model explains the correlations with an average error of 0.047. The root-mean-square error of approximation (RMSEA) yields an indication of error of the model adjusted for the degrees of freedom of the model. This fit statistic is calculated in such a way to indicate the error of the model in comparison to the population covariation matrix (if it were known) if the model had unknown but optimal parameters (Browne and Cudeck 1993; Byrne 2001). As with the RMR, the smaller the values of the index, the better the fit. Generally, values less than 0.05 signal a very close of the model to the data. In the present case,

the RMSEA of 0.049 indicates a very good fit to the data. The Comparative Fit Index (CFI) provides an indication of the fit of the measurement model to another model in which the items of the measure are assumed to be uncorrelated. Values that are progressively closer to a value of 1.00 indicate a better degree of fit. The observed CFI of 0.92 indicates an acceptable degree of model fit. Finally, the Tucker–Lewis Index (TLI) is similar to the CFI in that it compares an observed model to one in which the items are uncorrelated; the TLI differs, however, in that the calculation of the index takes in to account the number of parameters estimated in the model. In this article, the TLI of 0.91 represented an acceptable degree of model fit (Byrne 2001).

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