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Surface temperature forecast skill comparison for the west coast of Saudi Arabia

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RESUMEN

Debido al interés creciente del público general por acceder a servicios comerciales de pronóstico meteorológico a través de diversos medios de comunicación, y al impulso que ha cobrado la promoción del turismo en Arabia Saudita (AS), se hace un primer intento de comparar aptitudes para el pronóstico de la temperatura superficial en cuatro ciudades situadas en la costa oeste de AS (Wejh, Yenbo, Jeddah, y Giza), centrado en la fase de transición de 61 días (del 16 de enero al 16 de marzo) entre los periodos diciembre-enero-febrero y marzo-abril-mayo. Se utiliza un método sencillo de comparación de puntajes para evaluar los pronósticos de temperatura superficial de 24 h realizados por seis proveedores comerciales de pronósticos del tiempo basados en un modelo numérico. Todos los proveedores que utilizaron el modelo numérico de predicción del tiempo obtuvieron mejores resultados que la climatología diaria para la estación correspondiente. Dependiendo del proveedor y la estación, la diferencia absoluta en los promedios de temperatura máxima entre los pronósticos y las observaciones fue menor a 2 ºC. Los pronósticos diarios de temperatura superficial obtenidos a partir de dos versiones de un modelo de circulación general océano-atmósfera también se comparan para evaluar su desempeño en estas localidades costeras.

ABSTRACT

Given the growing interest of the general public in accessing commercial weather forecasts through various media outlets and the available impetuses for promoting tourism in Saudi Arabia (SA), a first attempt is made to present a forecast skill comparison for surface temperature in four cities (Wejh, Yenbo, Jeddah, and Gizan) along the west coast of SA, for the 61-day transitional period (from January 16 to March 16) between the December-January-February (DJF) and the March-April-May (MAM) seasons. A simple skill score comparison method is used to assess the next-day city forecasts for surface temperature from six commercial weather forecast providers based on the operational numerical weather prediction (NWP) model outputs. All the NWP model forecast providers performed better than the respective daily climatology (Clm) for each station. Depending upon the station and the provider, the absolute average maximum daily surface temperature difference between the forecasts and the observations was less than 2 ºC. Daily surface temperature forecasts from two versions of an atmospheric-ocean general circulation model are also compared to assess their performance for these coastal locations.

Keywords: Saudi Arabia, surface temperature, forecast skill comparison, transitional season period.

1. Introduction

The uncertainty in temperature forecast is deep-rooted theoretically; the temperature forecast is inherently related to the preciseness of the initial conditions (see, for instance, Palmer, 2000; Slingo and Palmer, 2011, and references therein). A possible way to address/reduce this uncertainty is to compare various temperature forecasts based on a skill comparison metric, preferably all under the same spatiotemporal conditions, and to attempt to identify and rectify the sources of impreciseness (Casati *et al.*, 2008). The temperature forecast verification analysis is beneficial not only from the research point of view but also from the socio-economic point of view (for a recent review, see, for instance, Jolliffe and Stephenson, 2003, and references therein; Curtis *et al.*, 2011). Thus, a purpose for a forecast verification study is to provide information that may be relevant for the modelers, forecasters, and the general public, provided a well judged objective forecast comparison is performed. The continual temperature forecast verification comparisons could also indicate a trend in temperature forecast quality (Sanders, 1986; Maglaras, 1998, 1999). Furthermore, the range of issues associated with accurate forecasts is large enough: from improved communication to dissemination of information geared towards specific cultural values and user needs (see, for instance, Keller *et al.*, 2007; Pennesi, 2007; Morss *et al.*, 2008).

There is growing evidence of general public interest in Saudi Arabia (SA) to check for weather updates using the Internet (see, instance, Saudi Gazette, 2012). In particular, this includes personnel from the growing sector of tourism in SA (see, for instance, Arab News, 2012a, b). The successful verification of the weather forecast has thus direct implications for regional economics (Casati *et al.*, 2008). Surface temperature is a key weather variable affecting daily life in SA; it determines many regional socio-economic factors including the energy and tourism sectors (see, for instance, Bigano *et al.*, 2006). In particular, transitional periods are considered as one of the best times of the year to visit the coastal SA for tourism, because of less extreme temperatures (Arab News, 2012c, d).

The regional stormy weather forecast comparisons have been reported extensively; these include short-lived tornados, and/or rain/hail/snow bringing storms (see, for instance, Evans and Grumm, 2000; Czarnetzki, 2001). The analyses of relatively recent long-lived heat waves/cold spells are also presented (e.g., Karl and Knight, 1997; Thornes and Stephenson, 2001; Athar and Lupo, 2010; Lupo *et al.*, 2012). On the other hand, the non-extreme events forecasts and their skill comparisons also have considerable socio-economic implications (Casati *et al.*, 2008).

Numerous deterministic forecast skill comparison metrics exist and have been applied to compare the skill of forecasts (see, for instance, Mailier *et al.*, 2008). The selection of a particular metric is essentially an open question, mainly determined by the addressed implication (see, for instance, Roebber and Bosart, 1996). Although various aspects of temperature forecast verification geared towards assessing responses of widely varying interest sectors of general public are discussed for different locations (Brooks *et al.*, 1997), there is no such study available for SA. Also, unlike the customary tradition in North America, of having city forecast competition/game as a part of under graduate/graduate course work (see, for instance, Driscoll, 1988; Athar and Sara, 2013), there is no such established custom in SA universities. The present analysis may thus serve as a reference document to possibly initiate such a practice in university education in SA and/or at general public level (for the quality assessment of commercial weather forecast, see, for instance, Mailier *et al.*, 2008). In particular, as of now, King Abdulaziz University is the only educational institute in the region offering a formal education in meteorology.

A relevant question may be why such a study needs to be carried out when automated statistical analysis software packages and large weather information based dataset archives already exist. Since efforts for forecasting weather have essentially the single aim of informing the general public with the latest state of the lower atmosphere, so that they may prepare in advance for any weather change, one might wonder which commercial weather forecast provider is comparatively better. The commercial weather forecast providers do not provide an archive of the displayed daily weather information to the general public (which is the topic addressed in this paper). A short (and first) archived study is thus welcome, to initiate and to possibly promote intercultural response. Furthermore, with the rapid growth of the tourism sector in the region, the utility of such comparative studies is and will be enormous (Arab News, 2012e, f).