O 2. STUDY OF SNOW DEPTH AND BIOCLIMATIC IMPACT

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ABSTRACT: One of the most important climatic elements in a certain area is snow. The amount and depth of snow matter, as they have an impact on the lives of plants and animals, as well as the components of the climate. The scientific techniques used at NOAA provide accuracy and estimates for large climatic zones. The impact of snow depth is related to the water balance, the passage of plant stages, the adaptability of living things, climate change, etc. Climate warming can reduce snowfall and cause earlier spring melts and shorter snow cover seasons. For instance, warmer air in Alaska has caused the snow to melt earlier each spring, lengthening the snow-free summer season. Seasonal snow is an important part of Earth's climate system. Snow cover helps regulate the temperature of the Earth's surface, and once that snow melts, the water helps Fill Rivers and reservoirs in many regions of the world, especially the western United States. In terms of area, snow cover is the largest single component of the cryosphere, covering an average of about 46 million square kilometres (about 17.8 million square miles) of Earth's surface each year. About 98 percent of the Earth's snow cover is located in the Northern Hemisphere. This study was conducted within the project: Evaluation of JPSS satellite and blended snow products, project NOAA, USA.

Keywords: Study of snow depth, bioclimatic impact, ecosystems

Acknowledge: Evaluation of JPSS satellite and blended snow products, project NOAA, USA

INTRODUCTION

This study describes the application of the 2D-OI method over No1the1n Hemisphere using NOAA's operational Global Forecast System (GFS) modelled snow depth as first guess, and the station-measured snow depth obse1vations during the winter season of 2016-2017. The layout of the paper is as follows: The next section describes the input/output and evaluation data and the specific application of the scheme, followed by a discussion of main results and conclusive remarks.

MATERIAL AND METHODS

Bias Collection of Satellite-derived Snow Depth

Snow depth at a grid point is estimated from updating a first guess snow depth, in this case the forecast from NOAA's Unified Forecast System (UFS), with an analysis snow depth increment, the latter computed as the weighted average of snow depth data increments at the surrounding station s. Weights are calculated using spatial co1Telation function s of snow depth with respect to horizontal distance and elevation difference between pairs of station data. E-folding scales for horizontal distance and elevation functions are fixed at 120 km and 800 m, respectively. For a detailed description of the method the reader is refe1Ted to Brasnett, 1999; Brown et al., 2010, de Rosnay et al, 2015, and Kongoli et al., 2009.

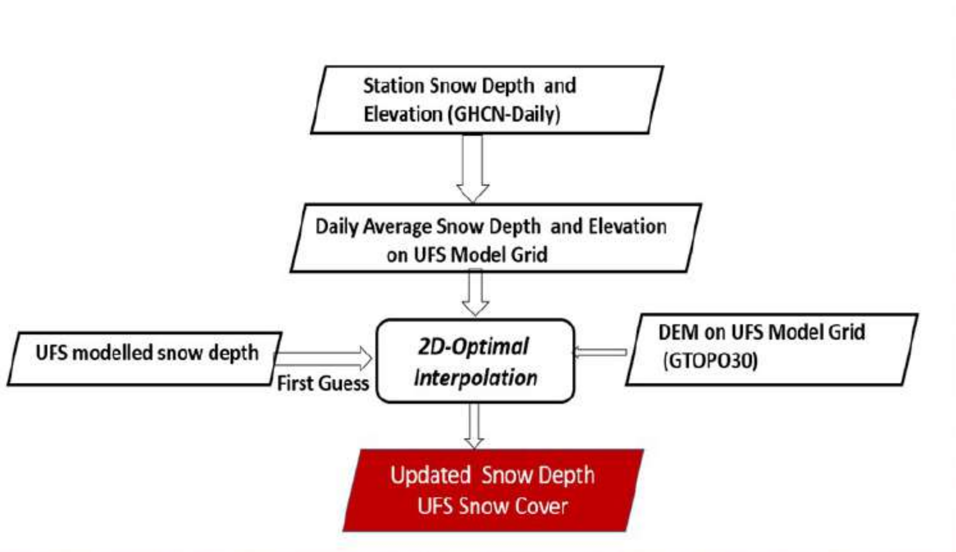

Figure 1. 2-Dimensional Optimal Interpolation (2D-OI) implementation scheme applied to NOAA's (by C. Congoli).

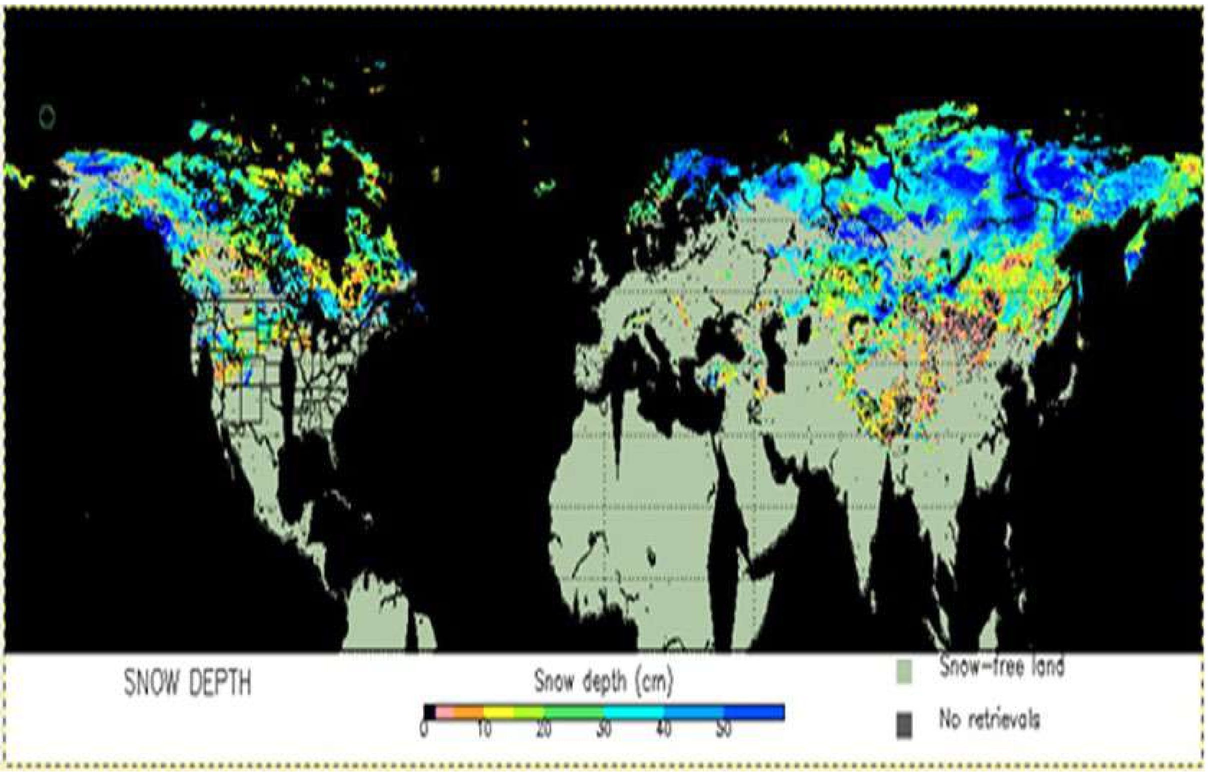

Figure 2. AMSR-2 Snow Depth before (top) ru1d after (bottom) bias collection applied to in-situ data from GHCN-Daily using optimal interpolation (by C. Congoli)

RESULTS

Visual inspection of the maps shows that the largest differences between the Global Forecast System-derived snow depth and the optimal interpolation-based snow depth are concentrated over Weste1n US and Canada, in high mountain terrain. Blue coded areas denote high snow accumulations co1Tectly estimated by the optimal interpolation-based snow depth analysis, whereas the forecast (UFS) makes large and consistent underestimations that increase as the snow season progresses. More importantly, as the season progresses from January to February GFS area coverage of snow accumulations decreases, which is not realistic, whereas the snow depth analysis co1Tectly estimates increased accumulations in Weste1n

US and Canada. Average bias for the forecast snow depth over areas above 1000 m was - 22.0 cm, whereas the bias for the optimal interpolation-based analysis was relatively small (4.4 cm).

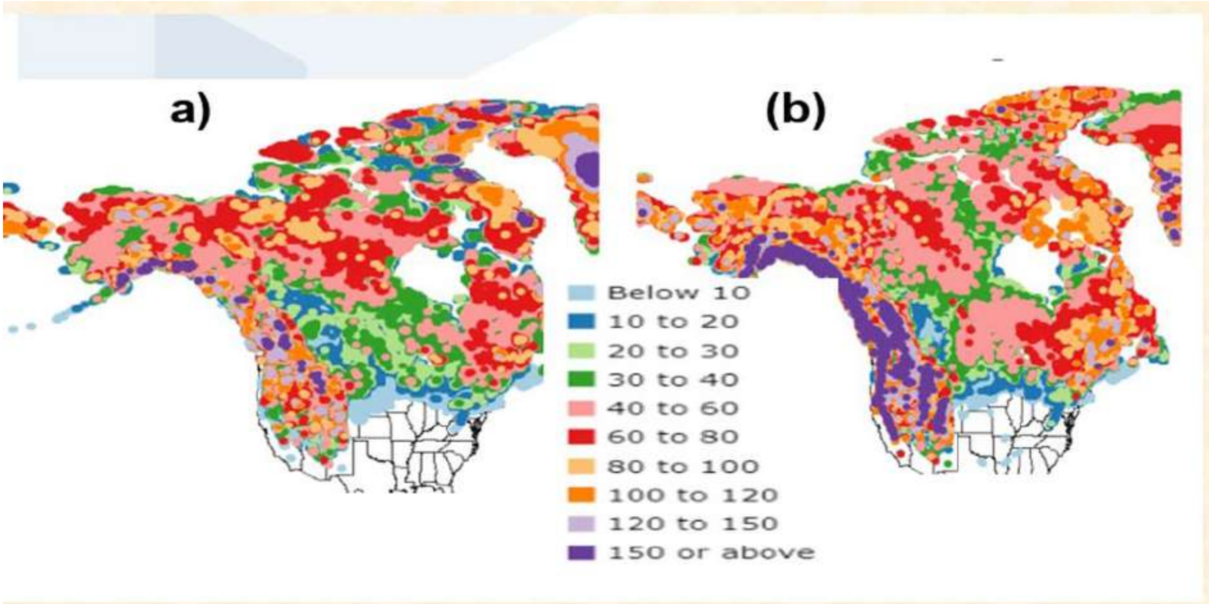

Figure 3. Map of Snow Depth Distribution (in cm) from the NCEP Global Forecast System (a) and from the 2-Dimensoi nalOptimallnte1polation on February 1, 2017.

CONCLUSIONS

The distribution of snow depth over No1the1n Hemisphere is investigated by 2-Dimensional Optimal Interpolation applied to synoptic station snow depth measurements. The scheme uses snow depth derived from NOAA's Global Forecast System (GFS) as a fist guess. The main finding of the study was tl1at the technique significantly improves forecast snow depth, especially over mountain terrain, making it suitable for reliable snow assessments over these regions. The technique also improves estimations over remote poorly monitored areas due to the successful application of a large radius (600 km) and number of in-situ stations for interpolation (50).

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