Development of the new Conformal-Cubic Atmospheric Model (CCAM) in capturing the past season's major rain events

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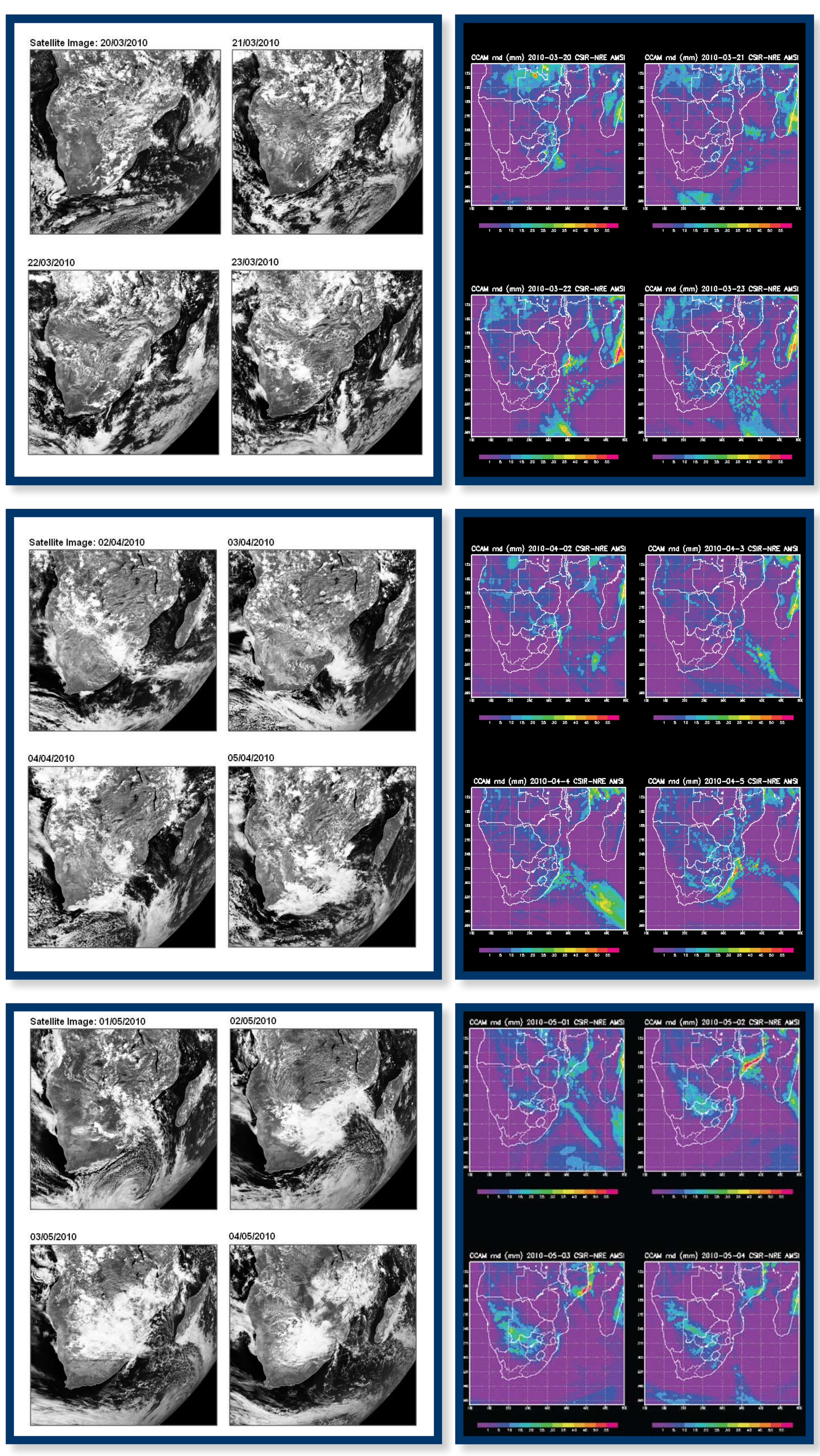
INTRODUCTION

The Atmospheric Modelling Strategic Initiative is a new initiative at the CSIR, and has only begun producing daily forecasts for southern Africa (and the Southern Africa Development Community – SADC) as of January 2010. These forecasts are currently being made for rainfall, maximum and minimum temperatures, and wind fields using the new Conformal-Cubic Atmospheric Model (CCAM). This model has been adapted and developed since its initialisation, increasing its weather prediction capability in order to produce more reliable forecasts.

The CCAM has been integrated from coarse resolution (200 km) to a much higher resolution (15 km), and this has resulted in considerably more specific and accurate forecasts. In the past March-April-May season there have occurred several major rain events over southern Africa, which the model was able to capture; and depending on how developed the model was (and how high the resolution of the model was at that time), it predicted these events at varying degrees of accuracy.

This poster illustrates the progression of the model's development by analysing its prediction performance from the initial coarse resolution to the current fine resolution. This will be done by comparing the output 4-day rainfall forecasts of the two different resolutions to the real-time satellite images of those four days. The satellite images show the cloud bands of specific rainfall events that took place during March, April and May 2010 – the most recent season. It will be highlighted that the output forecasts have become progressively more specific and defined in area, and more accurate in predicting rainfall and intensity of rainfall, and this improvement is a result of the recent model developments.



WHAT IS THE CONFORMAL-CUBIC ATMOSPHERIC MODEL (CCAM)?

The Conformal-Cubic Atmospheric Model (CCAM) is a variable resolution global model that can be integrated with high resolution over a specific domain (stretched over the globe to focus on a certain area) – the domain chosen for weather prediction purposes by the AMSI is the southern African region . In this way the CCAM can function as a regional climate model (RCM) and avoid boundary problems, since the model is continuous over the entire globe. Therefore the CCAM can also produce forecasts at variable resolutions.

Early in its implementation, the model was running at a resolution of 200 km. But this was integrated to a resolution of 15 km, with the aim of increasing the accuracy and reliability of the forecasts produced. The ability to produce accurate (and therefore useful) short-range weather forecasts is critical, since farming, forestry, mining and other major economic industries can be greatly affected by weather phenomena. Also, short-range weather forecasts are very important for risk and disaster planning, which can affect the lives and livelihoods of many. Therefore, by increasing the resolution of the model, it is hoped that the accuracy of the produced forecasts are also increased, thereby creating more useful predictions.

METHOD

The most recent season has been focused on in this poster, being: March – April – May 2010. The CCAM was integrated to 15 km resolution at the beginning of March. Therefore, in this season, coarse and fine resolution forecasts can be compared to each other, and to satellite images of the specific rainfall events. 4-day rainfall forecasts produced by the CCAM at the two different resolutions of a specific rainfall event during each month will be compared to the real-time satellite images of those four days.

In this way. The accuracy of each forecast that was made can be analysed; also, the forecasts made by the CCAM can be compared to each other, and to the real-life satellite images.

The change in rainfall patterns over southern Africa during this season is also illustrated by this comparison. The the March/early April period has typical end-of-summer rainfall patterns, with rainfall usually occurring in the northern parts of southern Africa, and remaining mostly dry over the cape region. As April shifts into May, more frontal rainfall patterns can be seen in the south, with a significant decrease in rain over the northern parts, with just a few isolated storms systems in these regions.

ANALYSIS

It can be seen in all of these forecast maps that the higher resolution forecasts are exceedingly more detailed and dynamic than the coarse resolution forecasts. When the CCAM was being run at higher resolution, it was able to capture far more specific rainfall patterns and storm systems, as well as a more detailed forecast of rainfall intensity. The rainfall patterns predicted by the high resolution forecasts are more similar to the satellite images of the events, since at high resolution the model was able to imitate real-life weather more accurately. This shows that when the CCAM is being run at a higher resolution [in this case, 15 km], it produces more accurate forecasts and therefore it is possible to make more useful predictions from these forecasts.

The developments made to the CCAM have increased its capacity to produce more reliable and accurate short-range weather forecasts than it was previously able to. And therefore, the usefulness of the predictions that can be made from the output of the CCAM has increased as well.

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The developments made to the CCAM have increased its capacity to produce more reliable and accurate short-range weather forecasts over the southern African region.

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