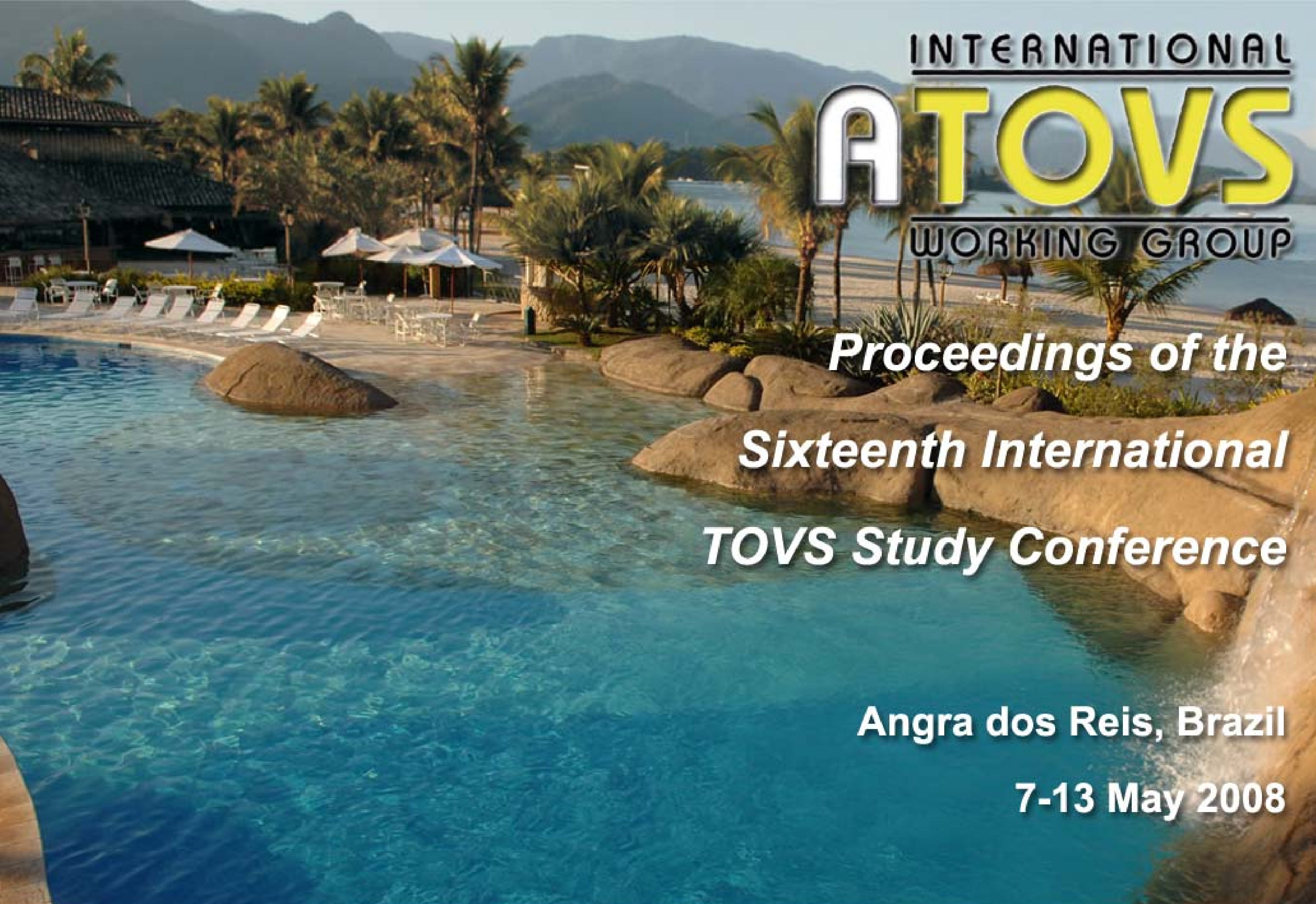
Implementing Radiance Assimilation in NAVDAS-AR: Lessons Learned

Nancy Baker, Ben Ruston and Tim Hogan and Tom Rosmond

NAVDAS – the NRL Atmospheric Variational Data Assimilation System – is an observation space 3dvar system and provides the initial conditions for the U.S. Navy's global NWP model (NOGAPS) and mesoscale model (COAMPS®). NAVDAS was designed to be the precursor for the 4dvar assimilation system NAVDAS-AR (Accelerated Representer). Because NAVDAS was designed to accommodate variable grid dimensions and map projections, the observation pre-processing is separate from the 3D-Var solution, which in turn is separate from the final mapping of correction vector into model space. The observations types are pre-processed independently, then combined into single file containing the observation and ancillary information needed for the 3D-Var solution. For satellite radiances, the pre-processor routine includes the quality control, observation selection and thinning, bias correction, radiance monitoring and Jacobian calculation using a fast radiative transfer model. One advantage to this approach is that it easily allows radiance observations to be passively monitored, rather than assimilated, by the operational assimilation/forecast model without appreciably affecting the total run time of the system. For example, with NOAA-18 AMSUA-A, we were able to move from passive monitoring to active assimilation within three weeks of the data becoming operationally available (and without operational code changes). While this approach provides flexibility for the development of new observation pre-processors, it has contributed to unexpected difficulties during the implementation of radiance assimilation with NAVDAS-AR. The initial NAVDAS-AR implementation followed the operational NAVDAS configuration. The NOGAPS fields are output on 30 fixed pressure levels at 0.5o resolution, and the 3-, 6-, 9-hour forecast fields from the previous update cycle are interpolated in space and time to the observation location. Within NAVDAS-AR, the observations are binned within 30 minute windows, and the background values are interpolated from the model Gaussian grid/sigma level fields. Differences between background fields used in the observation pre-processors and the NOGAPS trajectory lead to systematic differences in the computed brightness temperatures, inconsistencies with bias corrections and degraded forecast skill. We will present our diagnostic results and solutions, which have involved a re-examination of the role of observation pre-processors for data monitoring and selection, quality control, and bias correction. We have also encountered various difficulties upgrading our radiative transfer model from RTTOV-6, and results from assimilation tests using the JCSDA Community Radiative Transfer Model and RTTOV-8.7 will be presented. Finally, the

differences in observation impact (computed using adjoint methods) between NAVDAS and NAVDAS-AR will be presented and discussed.

INTERNATIONAL ATOVS WORKING GROUP



Proceedings of the Sixteenth International TOVS Study Conference

Angra dos Reis, Brazil

7-13 May 2008

Sharing ideas, plans and techniques to study the earth's weather and climate using space-based observations