APPENDIX: Discussion Session Outcomes / Suggested Future Research

a) Research activities

- Cross comparison of Heat Flux (HF) results, e.g.
    - HF inferred from point measurements
    - HF inferred from ice observations/water
    - HF inferred from magnetic data
    - HF inferred from electrical admittance
    - HF inferred from seismic tomography
    - HF inferred from geology
- Plan for understanding/reconciling discrepancies in the above and which methods are most reliable under what circumstances
- Understand the strengths/weaknesses of each form of data
- Understand of the best way to interpolate/extrapolate HF values to create continent or plate-scale HF maps
- Establish the basis for prioritising locations for new HF measurements, optimised for benefit in terms of variable density of future measurements

b) Research products

Everything below to have quantified uncertainty, and alternate models and probabilistic models encouraged

- Geomap (ongoing)
- Rock Heat Production values database
- HF measurements database
- Ice temperature profiles database
- 3D lithosphere + crust reference model (including lithospheric thickness for GIA, crust for HF) from which to generate 2D HF maps
- 2D HF maps derived from alternate methods
- 2D gridded HF maps with spot points and uncertainties
- Guide to HF products
- Rheology model of Antarctica

c) Modelling

- A small Model Intercomparison Project (MIP)
- A MIP of ice sheet models in inverse mode designed to infer geothermal flux
- To understand what situations would lead to the biggest contribution to sea level rise from HF
- To understand how big an HF anomaly would have to be to have an impact
- To understand how much laterally varying HF influences ice sheet behaviour
- To understand what spatial scale of lateral variability in HF matters
- To understand what accuracy/resolution of HF measurement is needed
- To find the locations in new HF measurements are most significant to improve modelling
- To find conditions where melt rate can be upper/lower bounded
- To assess equilibrium vs non-equilibrium modelling in full 3D Stokes

d) New observations

- HF measurements
    - In ice
    - In rock (e.g. RAID) including sediment or bedrock, avoiding hydrothermal
    - Focussed on West Antarctica
    - Marine measurements on the continental margin
- Samples of bedrock
    - Geochronology
    - Geochemistry
    - For petrophysics to correlate with airborne geophysics
- Sub ice observations where the bed isn't frozen
    - Better understanding of accuracy near pressure-melting point
- Ground observations
    - Seismic in East Antarctica, Aurora and Wilkes Basins
    - Active source seismology in the interior
    - UAV hyperspectral
    - UAV radiometrics
    - Gamma ray surveying
- Airborne observations
    - Geomagnetic
    - Ice radar mapping of internal ice structure, englacial layers
    - Phase sensitive radar

e) Other comments / required knowledge

- Note also importance to ice sheet modeller of other factors, e.g. physics of ice, ocean forcing, basal topography inc. coast, atmospheric forcing, HF, GIA and feedback
- Map connections between subglacial lakes
- Better knowledge of basal hydrology
- Better knowledge of permeable nature of ice bed
- Better knowledge of groundwater
- Effect of groundwater storage on ice dynamics
- Complications for subglacial lakes away from the ice divide, ice flow, sliding, advection by water flow
- Better knowledge of sedimentary basins, basement distribution, structures therein
- Role, possibly a variable influence, of HF in paleo ice sheet modelling
- Variation in HF over time for paleo ice sheet model inputs
- Possible influence on HF of ice sheet history
- Possible influence on HF of tectonic history
- Variability of HF in different tectonic provinces
- Evolution of thermal topography over the Cenozoic
- Water content and grain size in the mantle beneath Antarctica
- Relation between mantle volatiles, temperatures, viscosity and seismic velocity
- Ambient seismic noise shear velocity structure to estimate crustal heat production
- Other proxies for temp at depth, e.g. Bouguer gravity spectra and crustal thickness
- Advection effects in borehole measurements
- Neutrino detector